Effective and Prospective Regional Leader - Concept Model

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ABSTRACT

Innovation processes emerge in system of network connections, where cooperation between academy, enterprises and the public sector (triple helix - TH) is becoming increasingly important. Expanding TH by society, allows to analyse the dynamics of interaction in network from a wider perspective. The QH model describes economic environment and shows that the entire society is involved in continuous innovation being result of co-creation between network of four helixes of partnerships and symbiotic relationships. The research was focused on:
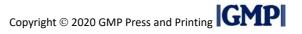
- Diagnosis of awareness of the importance of factors influencing the Regional development;
- Importance of factors to set-up social capital as a driving force for regional development; with emphasis on barriers.
- Importance of managing regional development barriers.
- Decision-makers awareness related to barriers on shaping cooperation in the region.
- Comparative study regions of Poland.

The study group of leaders representing institutions - 103 respondents were selected for final analysis in 2014 then re-tests in 2019. Original tool has been prepared, validated and implemented for the research. The study shows that, the adverse impact on cooperation is due to legal and organizational barriers indicating excessive bureaucratization of relations and competence barrier between entities. The highest indication was obtained by the barrier described as "lack of trust". As a result of the research, the concept of an effective prospective leadership model in Turbulent Market Environment was presented.

Keywords: Effective leadership, Barriers of cooperation, Triple Helix, Regional Development.

1. INTRODUCTION

Contemporary innovative processes in regions take place in a specific system of network connections between academia, enterprises and public sector (triple helix

model) (Leydesdorff & Etzkowitz, 2001). Based on the relationship between these three sectors, many innovative projects are being created and implemented that significantly change development conditions in EU regions. Authors, inspired by the results of the studies of H. Etzkowitz and L. Leydesdorff (1996; 1998; 2000) conducted at the end of the last century and at the beginning of the 21st century, present descriptions of the effectiveness of implementation and functioning of triple, quadruple and quintuple helix models in innovative environments (Lombardi et al., 2012; Carayannis & Campbell, 2011; Carayannis & Rakhmatullin, 2014; Carayannis et al., 2012; Fuerlinger et al., 2015; Abd Razak & White, 2015; Muhyi et al. 2017). The application of these models in the economy allows to rationalise the organization and innovation management in regional projects.

According to research conducted by the European Commission, Poland's innovation indicators are much lower than the European average and are in the group of so-called "Modest Innovators" (European Innovation Scoreboard 2014; 2019). Some thought has to be given on what are the reasons for such low innovativeness, what are the most important barriers that hinder undertaking innovative activities and thus affect competitiveness on both domestic and foreign markets.
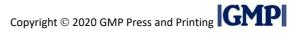
An analysis of trends in the global economy shows that today one of the most important factors affecting the dynamics of regional development are no longer their natural resources, but their social capital, and above all, the ability to use it properly. The level of social capital determines the potential for cooperation in cities and regions, and under this cooperation, it significantly affects the level of innovation of jointly implemented projects or programs (Bojar et al., 2013).

The impact of social capital on the development processes of European regions is marked in particular by the existence and proper functioning of institutions and organizations aimed at cross-sectoral cooperation, such as clusters, scientific and research centres, technopolies, science and technology parks and science and research parks. The implementation of innovative processes requires both innovative resources of all partners in the regional / local environment, as well as building cooperation networks, in which both the flow of information in connection networks and trust between their participants play an important role (Działek, 2011; Cai et al., 2015). In Polish conditions, many of these organizational forms remain unused. This is mainly the result of improperly prepared development programs, but also the lack of staff allowing these centres to be hubs of innovative development.

Changing the approach to understanding the triple helix model, by giving up interpreting it only as a structure, seems to be the way to overcome some of these barriers. It is reasonable to understand this model of cooperation under the triple helix as a special process of social capital management in order to effective implementation of the objectives of both joint ventures and cooperating organizations. The causative entity in this process are contemporary regional leaders - not only those operating in local governments, but also project leaders of regional ventures - leaders with shaped and developed leadership competences.

As in the enterprise, also in the region, a key factor in innovation success is the existence of innovation leaders in the company, i.e. members of the management team, which is constantly stimulated by innovation and gives the direction, and develops other competencies required to develop innovation (Deschamps, 2014; Romanowska, 2016).

Leader should be able to recognise in the external environment the chances and opportunities for doing business not only for themselves, but for all groups declaring

cooperation within triple helix, quadruple helix or even quintuple helix (Carayannis et al., 2012). They should be characterized by: creativity, non-conformism, determination and self-confidence, empathy, the ability to build trust in networks of co-workers, and the skilful fulfilment of the role of an intermediary between subordinates and the environment. These features in strategic managerial activities are ensured by: coherence (coherent behaviour of the strategist - leader with moral and organizational values), creativity of work of decision-making and project groups in which the leader operates, as well as certainty and determination in achieving goals (Stachowicz & Bojar, 2016).

Contemporary regional leaders must be able to perform this function not only within the limits of their organization or community, but also outside of it, even where there is no official function (they should also be informal leaders) (Bojar, et al. 2012). Therefore, it should be agreed with K. Zuk (2017) that the talents of the leader should be used in the widest possible involvement in achieving the goals of all local development stakeholders, by attributing great importance to social participation.

In this context, leadership style focused on group work, cooperation, creating conditions for creative participation, inspiring and encouraging learning, and building space for the creativity of individual people and teams is gaining in significance (Jemielniak & Koźmiński, 2010), This approach should be used to build the position of the leader of leaders integrating the activities of groups operating under the triple, quadruple and quintuple helix regional processes.

As A. Eriksson (2010) emphasizes, nowadays the role of a leader in regional innovative cooperation projects is being transformed towards the role of an "orchestrator" who orchestrates activities that are constantly changing. Orchestration is more than animation or management of a network. To be able to constantly carry out the orchestration process, the leader must reconcile different interest groups and goals. The leader should also be able to function with them and combine their positions. The leader must first sense what individual people need in different situations. What is more, leaders must know how to organize networks, involve new players in the network (Eriksson, 2010).

A contemporary regional leader should not only be a wise and responsible leader of complex regional ventures, but also an initiator, a catalyst for organized and developed cooperation networks of various organizations and entities functioning and cooperating for the rational achievement of goals; (e.g. construction and implementation of a region's development strategy, implementation of projects or ventures, etc.). The progressive building of trust in networks is the driving force behind the organization of groups, teams and systems that, cooperating to achieve specific goals, are increasingly acquiring the characteristics of moral communities. These communities, initiated and sustained by leaders, are a special kind of *regional hubs of entrepreneurship* (Stachowicz & Bojar, 2016). Properly used triple helix technology, thanks to the leader, should ensure the establishment and innovation of relationships. Leader's actions make cooperation subordinate to a self-accelerating spiral of innovation.

2. BARRIERS TO INTRA-REGIONAL COOPERATION - COMPARATIVE RESEARCH ANALYSIS

The assumption that the region's potential is largely determined by the relations/connections between the three types of entities - science, enterprise and government (the arrangement of entities in the triple helix structure) where the lack of

these connections significantly hinders the flow of knowledge in the region - formed the basis for the Faculty of Management of the Lublin University of Technology research aimed at diagnosing the methods, instruments, barriers and opportunities for methodological rationalization of strategic management in the regions.

One of the specific objectives of the research was to identify key barriers to the interface between business - science - regional authorities. It was assumed that barriers that could exist both in the organizational and formal, cognitive, and socio-cultural dimensions may constitute the region's ability to transform into a developed region. At the same time, analysing barriers to intra-regional cooperation should allow to capture the differences in regions with different levels of development. Therefore, as part of the research objective, comparative studies were carried out in two Polish regions: Silesia and Lublin.

The research was conducted in three groups of entities: among representatives of authorities in the region, representatives of the scientific community and representatives of business environment institutions as institutions whose task is to facilitate knowledge transfer in the region. The selection of the research sample was targeted. When determining the group of respondents, their function was important, enabling them to make decisions about cooperation with external entities. The group of respondents included official persons representing the institutions covered by the study: business environment institutions, clusters, representatives of local government units in the region, and representatives of the science sector. Total 103 surveys were selected for the final analysis (including 72 from Lubelskie and 31 from Silesia).

The survey questionnaire contained 48 questions on the basis of information obtained from the results of the research (questionnaire interviews) conducted with representatives of groups belonging to the regional authorities sector, science and business environment institutions in the examined regions, and supplemented with data from secondary studies (including reports from research in similar problem areas). The analysis carried out at this stage allowed the identification of key barriers to cooperation. The identified barriers to cooperation were divided into three groups: organizational and legal barriers, competence barriers, and socio-cultural barriers.

2.1 STATISTICAL ANALYSIS

The results of research carried out using the original, dedicated questionnaire tool carried out as part of three separate research projects were subjected to statistical analysis using the Statistica version 13.3 StatSoft Inc. - 2018 package.

The research was conducted in two-time sections covering respectively: in 2013 two geographical areas - in the Lubelskie Voivodeship and in Silesia and 2019 in the Lubelskie Voivodeship.

In terms of the characteristics of the study group, the descriptive statistics module was used, specifying the average or media values, quartile-RQ range, percentile values (10 and 90), minimum and maximum values ranges and mean confidence intervals, respectively.

The following statistical methods were used for statistical analysis:

- χ^2 McNemara test was used to assess the significance of differences in dependent data (Bentler & Bonett 1980),
- Mann-Whitney U test (Hole, 2015), was used to assess the significance of intergroup differences of variables that did not show a parametric distribution, and

in the case of verification of differences in more than 2 groups with the Kruskal-Wallis ANOVA test (McDonald, 2014).

- The analysis of monotonic relationships was carried out using the Spearman rank correlation module (Salkind, 2015).
- Classification methods (cluster analysis algorithms) were used to explore the data structure.
- An attempt was made to construct a regression model (Sarna, 1988; Hazelton, 2015), (a triple helix cooperation model) to capture factors that allow rationalization of development processes in the region.

All calculations were carried out for confidence interval CI = 95%.

2.2 RESULTS AND DISCUSSION

2.2.1 QUESTIONNAIRE SURVEY RESULTS

The results of the respondents' assessments regarding anticipated barriers to cooperation under the triple helix affecting development processes in the Lublin region have been analysed in two trials – year 2013 and 2019 accordingly.

The median of respondents' assessments in relation to 93.75% of the identified barriers was at level 4, which corresponds to the assessment that they significantly hinder cooperation. In the relation to 6.25% of the identified barriers the median value of grades was 3, which corresponded to the assessment that these barriers hinder cooperation to a small extent.

In the survey conducted in 2013, respondents identified as barriers that slightly impeded cooperation:

- differences in performed functions - E1,
- lack of a partner in the region with an appropriate business profile - E10,
- lack of institutions intermediating / supporting cooperation - E46.

In relation to the dominant distribution of grades in the 2013 survey, the respondents identified three barriers (6.25% of the total number of barriers verified in the survey), which they identified as definitely hindering cooperation with the scoring 5. They were respectively:

- excessive formalization and bureaucratization of possible forms of cooperation - E14,
- insufficient financial resources to cooperate - E16,
- mutual competition of partners / unwillingness to share knowledge - E36.

On the other hand, the dominant ratings of the analysed barriers as slightly hindering cooperation (value 3) also concerned 6.25% of all identified barriers, including:
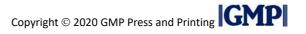
- differences in performed functions - E1,
- lack of institutions intermediating / supporting cooperation - E46,
- and unwillingness to cooperate with persons representing the institution - E33.

It should be noted that the RQ quartile range, for both analysed ranges dominant at the same level of RQ = 1.

Within the range of real barriers (barrier experienced by respondents), the median rated the respondents at a very low level (very low -2) hindering cooperation.

In terms of the dominant categories of rated respondents from the science sector who encountered barriers in their activities - in 2013, the respondents identified four barriers (8.33% divided verified in terms of barriers), respectively:

- complicated and extended decision-making process by the partner - E4,
- too long response time to the changing socio-economic environment - E5,

- legal barriers/complicated / inadequate provisions regarding cooperation - E11,
- and insufficient financial resources for cooperation - E16.

It should be noted that the RQ quartile range was formed for barriers hindering cooperation at the level of RQ = 1 in relation to barriers E4, E11 and E16, while in the case of the E5 barrier the quartile range RQ = 2.

In the assessment of the real barriers (barriers experienced by the respondents), the median of the respondents' opinions in the surveyed subpopulation from the enterprise sector (regional clusters) identified 70.83% of the barriers as barriers to cooperation to a small extent (grade 3), while 14.58% of the barriers classified by these subgroup were as to a very small extent (very weakly - 2) hindering cooperation.

Regarding the dominant distribution of assessments of respondents from the business sector who encountered barriers in their activities - in the 2013 study, the respondents did not identify any barrier that they would define as definitely hindering cooperation with the score of 5.

In assessing the real barriers (barriers experienced by the respondents), the median of the respondents' assessments in the subpopulation of the surveyed sector of regional authorities identified 36.73% of the barriers as barriers to cooperation to a significant extent (grade 4), while 63.27% - barriers classified by this subgroup was as hindering cooperation to a small extent (grade 2).

With regard to the dominant distribution of assessments of respondents from the sector of regional authorities who encountered barriers in their activity - in the 2013 survey, the respondents identified two barriers (4.08% of the total number of barriers verified in the survey), which they identified as definitely hindering cooperation with the scoring 5. They were respectively:

- change of policy/concept regarding cooperation related to the term of office of the authorities - E44,
- the period of political term incompatible with the project implementation time - E45.

It should be noted that the RQ quartile range was shaped for barriers definitely hindering cooperation In the assessment of the real barriers (barriers experienced by respondents), the median of the respondents' assessments in the subpopulation of the business environment sector identified 95.91% of the barriers as barriers to cooperation to a small extent (grade 3) while 2.04% - one barrier classified by this subgroup was as to a very small extent (very weakly - 2) hindering cooperation and also one barrier - 2.04% as hindering cooperation significantly.

With regard to the dominant distribution of assessments of respondents from the business environment institutions sector who encountered barriers in their activity - in the 2013 survey, the respondents identified four barriers (8.16% of the total number of barriers verified in the survey), which they identified as significantly hindering cooperation with the point assessment 4. They were respectively:

- complicated and extended decision-making process by the partner - E4,
- insufficient flow of information between institutions - E31,
- lack of readiness to bear the risk arising from cooperation - E35,
- and others indicated by the respondent - E49.

It should be noted that the RQ quartile range was shaped for barriers significantly hindering cooperation at the level of RQ = 2.

The results of the respondents' assessments regarding anticipated cooperation barriers under the triple helix affecting the development processes of development

processes in Silesia in 2013 allowed to capture the characteristic values of elementary barriers.

The median of respondents' assessments in relation to 75% of the identified barriers was at level 4, which corresponds to the assessment that they significantly hinder cooperation. However, in relation to 25% of the identified barriers, the median value of assessments was at level 3, which corresponded to the assessment that these barriers hinder cooperation to a small extent. As barriers slightly hindering cooperation in the 2013 survey, the respondents identified:

- differences in performed functions - E1,
- lack of institution development strategy - E7,
- lack of ability to analyse the institution's needs - E8,
- lack of / complicated / inadequate internal regulations of the institution regarding cooperation - E13,
- low level of intellectual capital of the institution - E15,
- insufficient staff to undertake cooperation - E19,
- lack of appropriate qualifications to cooperate - E20,
- insufficient technical infrastructure to start cooperation - E21,
- lack of knowledge about strategic management - E26,
- bad past cooperation experience - E32,
- lack of needs and motivation to establish cooperation - E34,
- change of policy / concept regarding cooperation related to the term of office of the authorities - E44,
- lack of institutions intermediating / supporting cooperation - E46.

Regarding the dominant distribution of grades in the 2013 study, the respondents did not identify any barrier that they would define as definitely hindering cooperation with the scoring grade 5.

On the other hand, the dominant ratings of the analysed barriers as slightly hindering cooperation (value 3) concerned 29.17% of all identified barriers, and the distribution of the three barriers was multimodal at the level of $RQ = 2$.

The results of the respondents' assessments regarding anticipated barriers to cooperation under the triple helix affecting the development processes of development processes in the Lublin region in 2019 showing slight differences to Silesia.

The median of respondents' assessments in relation to 75% of the identified barriers was at level 4, which corresponds to the assessment that they significantly hinder cooperation. In relation to 25% of the identified barriers, the median value of grades was 3, which corresponded to the assessment that these barriers hinder cooperation to a small extent. As barriers slightly hindering cooperation in the 2019 survey, respondents identified:

- differences in performed functions - E1,
- lack of legal stability - E12,
- low competences and knowledge about intellectual property - E25,
- lack of knowledge about strategic management - E26,
- lack of knowledge about project management - E27,
- lack of experience in implementing joint projects - E28,
- insufficient knowledge about possible forms and ways of cooperation - E29,
- reluctance to cooperate with persons representing the institution - E33,

- period of political term incompatible with the duration of the project - E45,
- lack of institutions intermediating / supporting cooperation - E46,
- lack of platforms for exchange of knowledge with institutions in the region - E47,
- lack of formal agreements between partners - E48.

In relation to the dominant distribution of grades in the 2019 survey, the respondents identified four barriers (8.33% of the total barriers verified in the survey), which they identified as definitely hindering cooperation with the 5-point mark. These were, respectively:

- lack of ability to analyse the institution's needs - E8,
- lack of a partner in the region with an appropriate business profile - E10,
- bad past cooperation experience - E32,
- lack of trust in the partner regarding meeting their obligations (also financial ones) - E39.

It should be noted that the RQ quartile range was dominant for the analysed ranges at the same level of RQ = 2.

Analysis of research results allows to capture changes occurring both in individual time sections as well as in relation to regional differences occurring and within the examined subgroup of respondents. In addition, the differences identified regarding the emerging barriers hindering cooperation in the two analysed time sections analysed by the Mann Whitney U test showed statistical significance.

2.2.2 DISCUSSION

The distribution of assessments made by respondents in individual research projects, and the trends of changes in time and regional cross-sections, have become an incentive to attempt to isolate groups of factors and capture the relationships between such groups.

Groups of factors were identified assuming that they are predictors of building inter-regional and intra-regional innovation spaces respectively.

Predictors for the construction of inter-regional space include:

- level of social capital,
- no leader of joint ventures / projects,
- lack of team building skills,
- no institution development strategy,
- lack of ability to analyse the institution's needs,

While the predictors of intra-regional space construction include:

- partners' unjustified ambitions for formal team management,
- lack of ability to analyse the institution's needs,
- lack of ability to observe trends in the economy,
- no leader of joint ventures / projects.

The captured relationships were characterized by statistical significance ($p < 0.05$) for the CI = 95% confidence interval.

In the sector of business environment institutions, which indirectly characterizes the innovation potential of the studied region, a statistically significant monotonic relationship of the anticipated degree of perception of a partner as unadapted to business reality and real barriers in this cross-section was found $r=0.304$ $p = 0.0202$. Similarly, the significance of dependencies of bad past cooperation experiences and reluctance to cooperate with persons representing the institution was shown $r=0.345$ $p = 0.0122$. A correlation was found between insufficient staff to undertake cooperation and the

experienced lack of a leader in joint ventures / projects r= 0.268 p = 0.0323. The correlation of the lack of appropriate qualifications to cooperate and the experienced lack of the leader of joint ventures/projects in the subpopulation of representatives of business environment institutions was also captured, however the relationship found did not show statistical significance p> 0.05.

In the enterprise sector, it is an integral module of the triple helix model a statistically significant relationship between the anticipated low level of intellectual capital of the institution and the perception of the partner as not adapted to business reality was found r=0,249 p = 0.0431. It should be noted that the partner was perceived as not adapted to business reality even if the dominant assessment of the barrier of the low level of intellectual capital of the institution was above 2, i.e. individually assessed as a barrier with very little impact. A high correlation was found in the enterprise sector in relation to the perception of bad experiences from cooperation in the past in terms of the perception of possible cooperation r= 0.309 p = 0.0099.

In the science sector, there was a relationship of lack of confidence in the partner's keeping confidential information and insufficient staff experienced to cooperate. Similarly, the relationship of lack of trust in meeting a partner's (financial) commitments and insufficient staff experienced to cooperate was captured. However, these relationships did not show statistical significance p> 0.05.

In the sector of regional authorities, a correlation of the lack of skills to analyse the needs of institutions and experienced low competences and knowledge of innovative solutions and modern technologies was found r= 0,239 p = 0.0168.

3. CONCLUSIONS

Based on the analysis carried out, an attempt could be made to formulate the concept of the model of prospective leadership in the structure of a triple helix in an unstable market environment.

The model was created based on the following factors:

Factor A - Leader's entrepreneurship - the ability to discover and take advantage of market opportunities, understood as the ability to overcome barriers within an institution. It consists of the ability to analyse institution's needs and discover opportunities arising from cooperation with other entities in a changing market environment (E2, E5, E8, E9).

Factor B - Leader's competences in establishing cooperation enabling external openness. It is a measure that strengthens social capital in the context of network cooperation (E30, E32, E33, E34).

Factor C - Creative participation - leader's competences in building innovative networks (E35, E41, E42).

Factor D - Leader's personal competences enhanced by the institutional knowledge infrastructure. The knowledge and creativity of the leader supported by the activities of an effectively organized knowledge infrastructure should allow for minimizing the level of risk resulting from cooperation within innovative undertakings (E18-E29).

$$D_M \rightarrow \bigcup \begin{bmatrix} (E_2 \cup E_5 \cup E_8 \cup E_9) \\ \cup (E_{30} \cup E_{32} \cup E_{33} \cup E_{34}) \\ \cup (E_{35} \cup E_{41}) \cup E_{42} \end{bmatrix} \cap \bigcup_{i=18}^{29} E_i$$

Where:

D_M – Determinant of prospective leadership in the structure of a triple helix in an unstable market environment necessary to initiate networking and induce innovation.

E_i – Elementary barrier analysed in previous section.

The verification of the degree of fit of the model was made on the basis of fairly commonly presented in the literature coefficients: GFI - goodness of matching factor, AGFI - corrected goodness of matching and RFI - relative fit factor (Cheung & Rensvold, 2002; Stanley & Edwards 2016; Kenny, 2012). The analysis showed that the obtained values of the coefficients were above the expected values, which means that the presented concept of the model reflects the processes taking place in the space of innovation in relation to the analysed output variables (table 1).

Table 1. Verifying model fit.

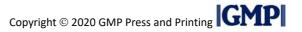| Statistics	Expected value	Level reached
GFI	>0,90	0,92
AGFI	>0,90	0,95
RFI	>0,90	0,93

Where:

GFI - goodness of matching factor,

AGFI - corrected goodness of matching,

RFI - relative fit factor.

REFERENCES

[1] Abd Razak A., White G. (2015), *The Triple Helix model for innovation: A holistic exploration of barriers and enablers*, "International Journal of Business Performance and Supply Chain Modelling", Vol. 7, issue 3, pp. 278-291.

[2] Bentler, P. M., & Bonett, D. G. (1980), *Significance tests and goodness of fit in the analysis of covariance structures*. "Psychological Bulletin". https://doi.org/10.1037/0033-2909.88.3.588

[3] Bojar, E., Pylak, K., Bojar, M. (2012) *The Process of Management of Development of the Triple Helix for regional Development – The Role of Regional Leader* [in:] *Management science in Kazakhstan and in Poland at the beginning of the 21st Century. Perspectives for Development and Cooperation*. Bula P., Czekaj J., Łuszczarz H., Syzdykbayeva B.U. [Eds], University of Economics, Kraków, s. 89-101.

[4] Bojar E., Stachowicz J., Machnik-Słomka J., Bojar M. (2013), *Zarządzanie strategicznymi projektami w regionie. Zintegrowany system zarządzania unieszkodliwianiem azbestu w ujęciu systemowym*, Towarzystwo Naukowe Organizacji i Kierownictwa „Dom Organizatora", Toruń.

[5]   Cai Y., Pugh P., Liu C., (2015), *Enabling conditions for regional Triple Helix systems*. „Helice", Vol. 4, Issue 4, pp. 19-23, https://www.triplehelixassociation.org/helice/volume-4-2015/helice-issue-4/triple-helix-scientific-news/enabling-conditions-for-regional-triple-helix-systems [access date: 12.10.2019]

[6]   Carayannis E., Campbell D. (2011), *Open Innovation Diplomacy and a 21st Century Fractal Research, Education and Innovation (FREIE) Ecosystem: Building on the Quadruple and Quintuple Helix Innovation Concepts and the "Mode 3" Knowledge Production System*. "Journal of the Knowledge Economy", No 2, pp. 327-372.

[7]   Carayannis E., Rakhmatullin R. (2014), *The Quadruple/Quintuple Innovation Helixes and Smart Specialisation Strategies for Sustainable and Inclusive Growth in Europe and Beyond*, Journal of the Knowledge Economy", Vol. 5, No 2, pp. 212-239.

[8]   Carayannis E.G., Barth T., Campbell D. (2012), *The Quintuple Helix innovation model: global warming as a challenge and driver for innovation*, „Journal of Innovation and Entrepreneurship", Vol. 1, s. 1-12.

[9]   Cheung, G. W., & Rensvold, R. B. (2002), *Evaluating goodness-of-fit indexes for testing measurement invariance.* Structural Equation Modeling. https://doi.org/10.1207/S15328007SEM0902_5

[10] Deschamps J.P. (2014), *Liderzy innowacyjności. Jak rozwijać i utrzymywać innowacyjność w firmie.* Oficyna Wolter Kluwer, Warszawa.

[11] Działek J. (2011), *Kapitał społeczny – ujęcia teoretyczne i praktyka badawcza,* „Studia Regionalne i Lokalne", Nr 3(45), s. 100-118.

[12] Eriksson, A. (2010), Cluster collaboration and glocalised value creation, in: A. Eriksson (Ed.) The Matrix. Post cluster innovation policy, VINNOVA Report VR 2010: 10 (April), VINNOVA – Verket för Innovationssystem/Swedish Govermental Agency for Innovation System. www.vinnova.se [access date: 20.12.2019]

[13] Etzkowitz H., Leydesdorff L. (1996), *Emergence of a Triple Helix of University – Industry – Government Relations*, „Science and Public Policy", 23, pp. 279–286.

[14] Etzkowitz H., Leydesdorff L. (2000), *The Dynamics of Innovation: From National Systems and „Mode 2" to a Triple Helix of University – Industry – Government Relations*, „Research Policy", Vol. 29, pp. 109–123.

[15] European Commission, *European Innovation Scoreboard 2014*, https://op.europa.eu/en/publication-detail/-/publication/d1cb48d3-4861-41fe-a26d-09850d32487b [access date: 20.11.2019]

[16] European Commission, *European Innovation Scoreboard 2019*, https://ec.europa.eu/docsroom/documents/36281 [access date: 20.11.2019]

[17] Fuerlinger G., Fandl U., Funke T. (2015), T*he Role of the State in the Entrepreneurship Ecosystem: Insights from Germany*, „Triple Helix" Springer Open Journal Vol. 2(3), https://triplehelixjournal.springeropen.com/track/pdf/10.1186/s40604-014-0015-9;

[18] Hazelton, M. L. (2015), *Nonparametric Regression* [in:] *International Encyclopedia of the Social & Behavioral Sciences: Second Edition*. https://doi.org/10.1016/B978-0-08-097086-8.42124-0

[19] Hole, G. (2015). *The Mann-Whitney test*. https://doi.org/10.1007/978-1-4612-4974-0_46

[20] Jemielniak, D., Koźmiński, A. K. (Ed.) (2010) *Zarzadzanie wiedzą*. Wolter Kluwer Polska, Warszawa, pp. 364-365

[21] Kenny, D. A. (2012). Measuring Model Fit. http://davidakenny.net/cm/fit.htm

[22] Leydesdorff L., Etzkowitz H. (1998), *The Triple Helix as a Model for Innovation Studies*, Conference Report, „Science and Public Policy", Vol. 25, No. 3, pp. 195–203;

[23] Leydesdorff L., Etzkowitz H. (2001), *The Transformation of University – industry-government Relations, "Electronic Journal of Sociology"* Vol. 5, http://www.sociology.org/archive.html

[24] Lombardi P., Giordano S., Caragliu A., Del Bo Ch., Deakin M., Nijkamp P., Kourtit K. (2012), *An Advanced Triple-Helix Network Model for Smart Cities Performance*. [in:] O.Y. Erkoskun (Ed.) Green and Ecological Technologies for Urban Planning: Creating Smart Cities. IGI Global, Hershey, USA, pp. 59-73.

[25] McDonald, J. H. (2014), Kruskal–Wallis test. In *Handbook of Biological Statistics*. https://doi.org/10.1002/0470013192.bsa333

[26] Muhyi A.M, Chan A. Sukoco I., Herawaty T., (2017), *The Penta Helix Collaboration Model in Developing Centers of Flags hip Industry in Bandung City*, "Review of Integrative Business and Economics Research", Vol. 6, no. 1, pp.412-417.

[27] Romanowska M. (2016) *Determinanty innowacyjności polskich przedsiębiorstw*, "Przegąd Organizacji" No 2, pp. 29-33.

[28] Salkind, N. J. (2015), *Spearman rank order correlation* [in:] *Encyclopedia of Research Design*, https://doi.org/10.4315/9781412961288.n428

[29] Sarna, S. (1988), *Regression models. Duodecim Laaketieteellinen Aikakauskirja*. https://doi.org/10.1007/978-0-387-92298-0

[30] Stachowicz J., Bojar M. (2016), *Odpowiedzialne przywództwo jako kluczowy czynnik rozwoju współczesnych organizacji i regionów*, "Zarządzanie i Finanse" Vol. 14 No 2, pp. 375-385.

[31] Stanley, L. M., & Edwards, M. C. (2016), Reliability and Model Fit. *Educational and Psychological Measurement*. https://doi.org/10.1177/0013164416638900

[32] Zuk, K. (2017) *Lider XXI wieku w samorządzie. Od modelu menedżerskiego do miasta obywatelskiego i innowacyjnego*, [in:] *Liderzy o liderowaniu w XXI wieku. Refleksje przedstawicieli nauk o zarządzaniu i praktyków*, Bojar E. [Ed.] TNOiK Dom Organizatora, Toruń.