# USE OF THE SHANNON WIENER INDEX TO MEASURE LAG DIVERSITY, A MAJOR PLAYER IN REGIONAL RURAL DEVELOPMENT

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**Abstract**: The article presents a new scientific approach to the issue of entropy as a pro-growth and limiting factor in regional development and its practical elaboration. The research goal was to formulate a theoretical definition of entropy in regional development and to verify it in practice, i.e. to diagnose the entropy factor and to effectively analyze it with the possibility of its practical use. The use of the Shannon Wiener index for Local Action Groups in the South Bohemian region has provided valid results in the field of differentiation of territorial units, such as Local Action Groups (LAGs), regions and municipalities, as well as an appropriate basis for prediction of their further development. The research has also confirmed suitability of four main indication pillars (economic, infrastructure, social and environmental) while their indicators should be adjusted to the character of the tested territory.

An appropriate approach seems to be application of the entropy index to a relatively closed unit where the elements mutually affect one another and have mutual relations and ties. Outputs from the solution can be seen as a description of the general status in the individual LAGs; moreover, outputs from the research have been examined by LAG managements and they have seen them as an important source of knowledge and have made some recommendations to strengthen their informative capacity. In conformity with the findings we can conclude that the achieved results should be seen as the first approximation of the solution of the concerned issue and they need to be further verified and completed.

**Key words:** diversification, cluster, Shannon Wiener index, regional development, Local Action Group (LAG)

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## Introduction

Rural areas with their economic, production and also social structures create a potential base for small and medium enterprises. This general statement is applies both in EU countries and in the global business and market space. Many formal and, particularly, informal organizations are operating in rural areas and seek to achieve its stability and development, while local action groups rank among the most important informal ones. Apart from them, a key role is played by local self-

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government bodies of rural municipalities. Rural municipalities face many problems associated with a broad range of local, regional, as well as global forces. There is a wide range of factors affecting the countryside that are connected with development of information technologies, processes of automation and digitalization of manufacturing and services or changes in information technologies and they accelerate transfer of new knowledge from natural and social sciences into the life of the countryside society. All spheres of life in the country experience changes in agendas and processes; some of them are new and they are more diverse and more specialized than those in the past. The changes also lead to different outputs that are currently based on diverse local characteristics. The submitted article presents results of a research of such processes using the South Bohemian region as an example. The research is mapping changes that occurred in the past 20 years in the South Bohemian countryside and shows how the rural regions have changed from the viewpoint of diversification of their activities. Local Action Groups (LAG) were used as diversification units where a high degree of changes can be expected to continually occur.

**Literature review**

One of the natural laws states that stability of ecosystems is conditional on their diversity. This applies to living organisms and naturally also to human society and its living space. That is why many authors, in agreement with the mentioned law, in the past observed that higher diversity, or diversification of social and economic systems, leads to a lower rate of economic fluctuation (Kort, 1981; Malizia and Ke, 1993). A number of scientific studies have proved validity of that observation also for territorial units or respective areas and regions. According to Baldwin and Brown (2004), a high level of fluctuation is associated not only with a high level of regional specialization but also with a high rate of economic growth (Atkočiūnienė and Kiausiene, 2017). A question remains what is more convenient for a region - is it specialization or diversity? According to the neoclassical economic theory, regions should specialize in those areas where they have a comparative advantage over the other regions. With regard to the growing global economic integration of individual regions, also the pressure on the level of specialization increases so that the regions are able to maintain their competitive edge over the other countries and regions (Kurowska-Pysz et al., 2018; Baldwin and Brown, 2004; Howes and Markusen, 1993). Although advantages of specialization are generally well recognized by the professional public dealing with economic specialization and diversity, the same authors have repeatedly pointed to the fact that specialization in a small number of fields or industries might lead to a growing economic fluctuation (Kort, 1981; Malizia and Ke, 1993; Baldwin and Brown, 2004; Brewer, 1985). A high level of economic fluctuation is perceived as negative for two reasons. The first one is that high fluctuation is associated with a high unemployment rate (Bonasia, at al, 2016); the other is that fluctuation of economic performance makes

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it harder for the state to plan investments in public infrastructure, such as roads, schools or hospitals. According to Gilchrist and St. Louis (1991), regions dependent on a small number of industries will be characterized by periods of growing unemployment and emigration and periods of decreasing unemployment and immigration. On the contrary, regions with higher diversification in different sectors will be less prone to impacts of ups and downs of the economic cycle. Higher diversification in different areas (pillars) should lead to lower fluctuation of unemployment and thus to higher stability of the regional economy in connection with the national economy.

Economic development in recent decades has seen many changes in approaches and interpretation of factors of economic development in space and time. At present, development and competitiveness of regions is associated primarily with theories of knowledge economy, technological innovations and learning regions, where significant driving forces of regional development are not only quantitative factors and processes, but primarily qualitative factors and conditions (Cantner, Meder, 2009, Kaynak, at al, 2017). The knowledge base is not understood only as a static database of knowledge present in a region or country but as a fairly dynamic system affected by a broad range of players with their important capacity and ability not only to process the knowledge but also to create it. Apparently, this is an extraordinarily complex and developmentally conditional source of competitiveness in the economy (Asheim, Coenen, 2005). The way of spreading of knowledge and technologies depends on the ability of regions to process and to produce information flows (Moodysson, 2008). One study of advantages resulting from externalities of various economic bases deals with specific effects of composition of individual territorial characteristics (economic, social, infrastructure and environmental) and their impact on economic competitiveness and growth (Čiegis, at al., 2008, Boschma, Martin, 2010). The authors also conclude that the objective is to understand distribution of economic activities in space and time and to understand mechanisms according to which the distribution takes place.

In general, no knowledge or findings in a certain field can be considered final, comprehensive, complete, constant or unchangeable. It is scientifically correct and objective to say that it is not possible to reach the absolute knowledge and to provide one accurate, final or future picture of the world around us. According to Dudek (1999), data about reality are always incomplete, they change in time, our knowledge always moves within certain limits. Before the 20th century any uncertainty was always strictly excluded <u>from</u> science. A change in the view of entropy came in the early 20th century; thanks to statistical methods and mathematical modeling used in research of statistical physics the use of a measure of uncertainty (entropy) has turned out to be a necessary and indispensable precondition for further scientific experiments and understanding. Entropy as a physical concept was introduced as early as in the 19th century in the field of phenomenological thermodynamics in studies of thermal engines. The statistical

physical interpretation of entropy was formulated in the same century by L. Boltzmann who revealed the relation between the concept of entropy and probability and defined how the category of entropy can be scientifically defined. According to the definition, entropy is a measure of randomness of a system.

Information, as a scientific term, appeared and developed in connection with transmission of messages by telecommunication means. Information as a measure of message was for the first time used probably by Hartley (1928) in his book "Transmission of Information". The concept was further elaborated in connection with telecommunication issues, particularly by the American engineer C. Shannon (1948) who used the concept of entropy to characterize a message or its source. The concept of information defined in this way sees a message as a quantitative side of a piece of information, as a certain sequence of characters, which is detached from the content of the message, i.e. from its relation to the subject described by the message, from its usefulness for the recipient etc. Both the authors set foundations for a quantitative theory of information which is a generalization of mathematical statistics and theory of information. Other important authors who contributed to development of the scientific field were: N. Wiener (1948); W. Weaver (1949) and R. Fisher (1956). The authors of this article, while fully respecting the above described scientific knowledge, have applied the method of determination of the degree of randomness, i.e. entropy, to one of the important territorial structures, specifically to local action groups which play a key role in development of regions.

The following two hypotheses were formulated for the research purposes:

H1: Local action groups in the South Bohemian region will demonstrate presence in all four clusters (economic, social, infrastructure, environmental) with representation of at least one municipality in each cluster.

H2: The dominant cluster (pillar) in the South Bohemian LAGs is the environmental pillar.

**Material and Methods**

Several methods can be used for evaluation of diversification of regions. One of the most frequently used methods is determination of a gross diversification index. The index for an analyzed region is based on shares of employment in individual sectors. However, that calculation method rather investigates distribution of individual industries in the region and it does not directly address regional diversification or specialization. Other methods, e.g. regression method of regional discrepancy or graphical analysis of a growth diagram of regions etc., are very demanding in terms of input data and their processing. Recently, also case studies have been used in the form of narrative evaluation, i.e. structured interviews, conducted also by LAG representatives as direct players in rural areas.

An entropy Shannon Wiener index was used to calculate diversity of the regions. The entropy index makes it possible to compare a certain complexity of structure

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of systems, before any attempt to determine the specific condition. Complexity of structures or, in other words, the level of our initial ignorance, can be expressed by a number of possible conditions in which the system may occur. (Marvan 2002; Hejna 2010). The entropy index has been so far used in works of authors who were interested in a relation between diversification of the industry and regional economic performance, e.g. Smith and Gibson (1988); Wundt (1992) and Malizia and Ke (1993). So far, however, it has not been tested for calculation of diversity of individual regions. As we have used data from all the 4 pillars for calculation of the index (economic development and business activities, human resources, infrastructure and environment) our approach can be seen new in research of diversification of regions - see Table 2.

Input data used for the analytical work came from the annually updated database of the Czech Statistical Office; a part of the input data was provided by individual local action groups (LAGs) from the South Bohemian region and a part of the data was provided by Ekotoxa, a company focusing, apart from its other activities, on collection of data and development of data files about individual territorial parts of the Czech Republic. An emphasis was put on good availability of the data, their sufficient informative capacity and future updating.

In the first stage of the research the municipalities were clustered and four basic models were created – the economic cluster, social cluster, infrastructure cluster and environmental cluster. The projection observed four fundamental pillars of LAGs, i.e. four groups of variables – economic, social, infrastructure and environmental. Each municipality was included into a group (pillar) in which it had the highest representation. We determined the average ranking of the municipality in each pillar and then a group was selected (the pillar with the best average ranking).

The calculation of diversity values of regions is able to indicate which LAGs are more diversified and which are more specialized from the viewpoint of the individual clusters of municipalities - economic, social, infrastructure and environmental pillars.

The formula for the entropy index is:

$$Shannon \text{ Wiener } index = -\sum_{j=1}^{k} \frac{E_{ij}}{E_i} * log_2 \left( \frac{E_i}{E_{ij}} \right)$$

Legend:
k = total number of pillars
Eij = number of municipalities in the individual pillars for LAG
Ei = total number of municipalities in LAG
The entropy index equal to 0 means absolute specialization, i.e., the region is highly specialized. Low values mean lower diversity and higher values mean

higher diversity of the region. If the entropy index is 1 it means that all four tested pillars are equally represented.

The next tool applied in clustering of the municipalities is the GIS method to process the outputs (Table 1) into the maps (Figures 1, 2, 3, 4). Based on representation of municipalities in the individual pillars we will be able to evaluate the process, or a degree, of diversification of municipalities in the concerned region.

**Result and Discussion**

Results of the performed analyses with the use of the Shannon Wiener index show that LAG territories with the Shannon index value up to 1.09 are less diversified. That limit has been met by two local action groups: LAG Sdružení Růže and LAG Lužnicko, however the latter no longer exists. Medium diversified LAGs with the index between 1.20 -1.28 include LAG Hlubocko-Lišovsko, LAG Pomalší, LAG Blatenský les – Netolicko, LAG Česká Kanada, LAG Blatensko, LAG Lužnice, LAG Šumavsko, LAG Třeboňsko and LAG Krajina Srdce. The most diversified LAGs with the index higher than 1.3 include the remaining LAGs situated in the South Bohemian region: LAG Vodňanská ryba, LAG Brána Písecká, LAG Strakonicko and LAG Střední Povltaví. LAG Vltava was not included in the analysis due to the low number of municipalities on the territory of the South Bohemian region. Table 1 and the map in Figure 1 indicate which local action groups are highly, medium or little diversified.

Due to the limited scope of this article only selected LAGs from the individual groups will be fully presented in terms of their diversification.

**Table 1. Overview of diversification of LAGs with classification of municipalities based on the significant pillar**

| LAG | Shannon Index | P1 | P2 | P3 | P4 |
|---|---|---|---|---|---|
| LAG Sdružení Růže z.s. | 1.03824001856935 | 7 | 0 | 6 | 13 |
| LAG Lužnicko o.p.s. | 1.06085694715802 | 2 | 4 | 3 | 0 |
| LAG Hlubocko - Lišovsko o.p.s. | 1.20772398183938 | 9 | 1 | 6 | 5 |
| LAG Pomalší o.p.s. | 1.21642957639042 | 11 | 2 | 9 | 4 |
| LAG Blanský les - Netolicko o.p.s. | 1.24118102948399 | 17 | 11 | 8 | 3 |
| LAG Česká Kanada o.p.s. | 1.24379377190395 | 11 | 13 | 5 | 25 |
| LAG Blatensko, o.p.s. | 1.24497915042607 | 5 | 11 | 13 | 3 |
| LAG Lužnice, z.s. | 1.27106625950954 | 8 | 20 | 6 | 9 |
| LAG Šumavsko, z.s. | 1.28475835943806 | 24 | 8 | 13 | 9 |
| LAG Třeboňsko o.p.s. | 1.29555196319234 | 11 | 13 | 10 | 27 |
| LAG Rozkvět, z.s. | 1.30223372268641 | 7 | 3 | 10 | 10 |
| LAG Krajina srdce, z.s. | 1.30570198204386 | 16 | 15 | 5 | 10 |

| LAG Vodňanská ryba, z.s. | 1.31602127359923 | 11 | 8 | 12 | 4 |
|---|---|---|---|---|---|
| LAG BRÁNA PÍSECKA z.s. | 1.31744472222005 | 9 | 8 | 6 | 3 |
| LAG Strakonicko, z.s. | 1.31999298414279 | 16 | 16 | 18 | 6 |
| LAG Střední Povltaví z. s. | 1.32580465417619 | 4 | 10 | 7 | 5 |

Source: Authors' elaboration

**Table 2. Description of individual indicators used for calculation of the Shannon Wiener index**

| | | | |
|---|---|---|---|
| **P1** | **Economic pillar** | K304 | Availability of railway stations |
| K101 | Index of economic structure progressivity | K305 | People living in permanently occupied apartments connected to water supply system, gas line and public sewers |
| K102 | Trend of economic structure progressivity | K306 | Nursery school facilities |
| K103 | Level of business activities | K307 | Elementary school facilities |
| K104 | Recreation potential in the recreation zone | K308 | Availability of secondary schools with final leaving exam |
| **P2** | **Social pillar** | K309 | Availability of senior citizens homes |
| K201 | Population density | K310 | Availability of general practitioner services for adults |
| K202 | Population aging (growing number of seniors) – Old age index trend | K311 | Accessibility of hospitals and outpatient facilities |
| K203 | Economic activity | **P4** | **Environmental pillar** |
| K204 | Share of the original residents | K401 | Production capacity of the land resources |
| K205 | Trend of the growing number of population with a university degree | K402 | Ecological fragmentation |
| K206 | Unemployment trend | K403 | Share of water bodies |
| K207 | Czech citizenship | K404 | Chemical condition of surface water |
| **P3** | **Institutional and infrastructure pillar** | K405 | Arable land percentage trend |
| K301 | Public transportation services in the territory on workdays | K406 | Endangered forest zones |
| K302 | Public transportation services in the territory on Saturday | K407 | Trend of specific territorial emissions from stationary sources |
| K303 | Accessibility of the territory from class I roads and expressways /highways | | |

Source: Authors' elaboration

*Little diversified territory*

The territory of LAG Sdružení Růže (SR) consists of administrative territories of 26 municipalities, 20 of them in the district of České Budějovice and 6 of them in the district of Český Krumlov. The territory is slightly less diversified than the other LAGs in the South Bohemian region. Figure 1 shows that no municipality is significantly represented in the social pillar. This, however, does not mean that no such municipalities exist on the tested territory. The outputs only suggest the other three pillars are more dominant. The map in Figure 1 shows that the dominant pillar is the environmental one. The analyzed LAG is a territory with a high natural and landscape value with a not yet developed tourist infrastructure. The second dominant pillar is the economic one. It is characterized by diversification of business activities, with prevalence of micro- and small enterprises, and by relative stability of major employers. The third pillar is infrastructure. The municipalities with significant representation in this pillar have good accessibility by public transportation, including on weekends.
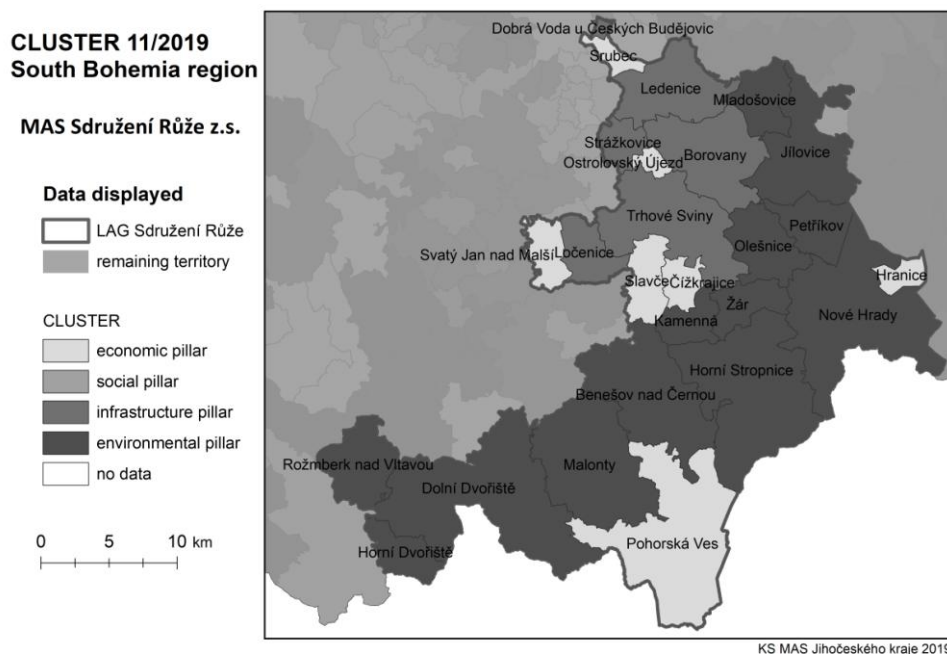


**Figure 1: Example of the little diversified territory of LAG Sdružení Růže**
Source: Own

*Medium diversified territory*
LAG Pomalší - The group of medium diversified territories includes LAG Pomalší. Municipalities associated in this LAG are members of three micro-regions: Union of Towns and Municipalities of the Pomalší region (19 municipalities), Voluntary

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Union of Municipalities Poluška (7 municipalities) and Regional Union of Municipalities Vltava (1 municipality). The territory is balanced in terms of the number of municipalities in the economic, infrastructure and environmental pillars. In the social pillar there are only two municipalities (Zvíkov and Věžovaté Pláně), as demonstrated in Figure 2. Those two municipalities have a higher share of natives (i.e. people born in the municipality of their permanent residence) when compared to the other municipalities. In the economic pillar there are 10 municipalities. The territory is also characterized by a higher level of business activities. Most of the municipalities in the economic pillar are in the proximity of big towns, i.e. České Budějovice and Český Krumlov. The environmental pillar includes all municipalities with a high quality, diversity and importance of the environment. All those municipalities demonstrated a higher value of the coefficient of ecological stability. The municipalities are situated in preserved areas with a number of protected elements and they have a higher share of forests. The infrastructure pillar includes municipalities with an advantageous geographical location and transportation links to the axis Prague – České Budějovice – Austria (Linz).
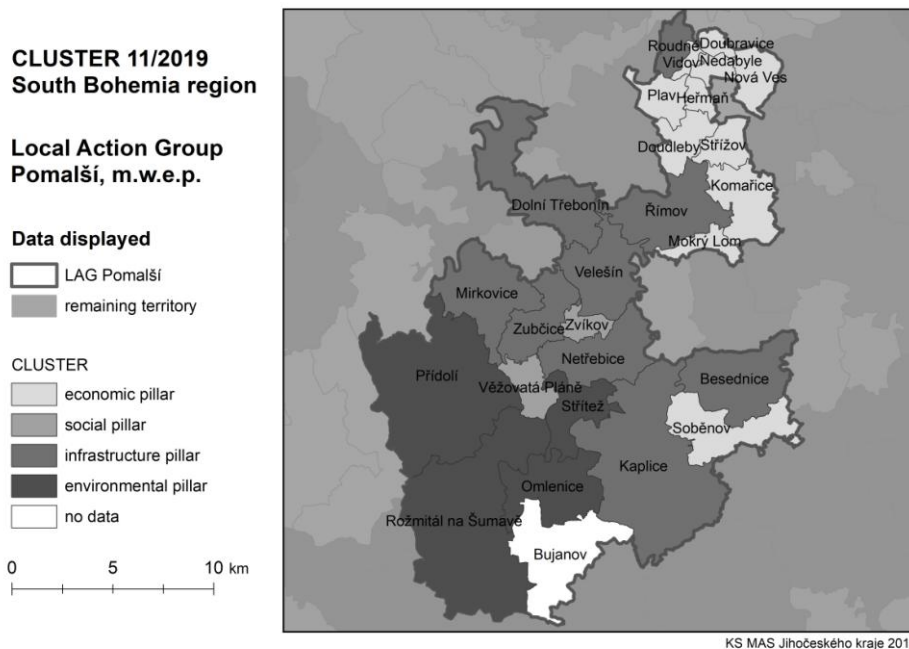


**Figure 2: Example of the medium diversified territory LAG Pomalší**
Source: Own

LAG Šumavsko - The territory of LAG Šumavsko ranks among the ones with medium diversification as illustrated in Figure 3. The municipalities are distributed in all the pillars, with the highest concentration in the dominating economic pillar (24 municipalities) – see Figure 3. The municipalities have significant numbers of small and medium business that benefit from proximity of the foreign (cross-border) markets. This means a significant business potential which, unfortunately, has not been fully used. Municipalities identified in the infrastructure cluster (13 municipalities) have both good transport infrastructure and civil amenities. The territory of LAG Šumavsko is well connected to roads of lower classes and there is also the railway track No. 208 Volary – Strakonice which is of regional importance. The social cluster includes municipalities with a lower share of seniors and the so-called natives. The environmental pillar includes municipalities with a superior production potential of soils while in most of the municipalities a change (reduction) has occurred in the share of arable land on the total area of the municipalities in favor of grass (pastureland complexes) and other areas.
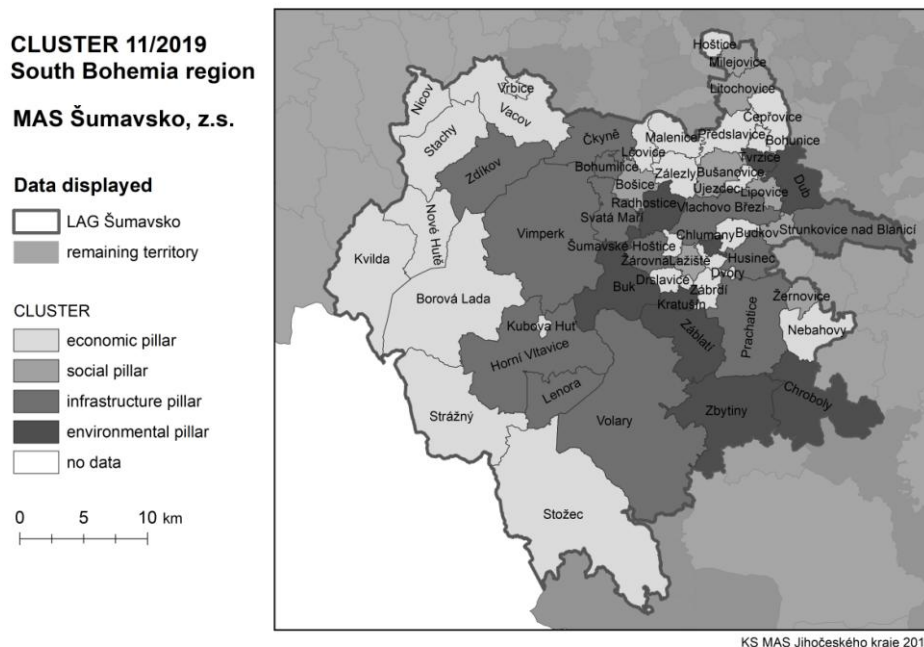


**Figure 3: Example of the medium diversified territory LAG Šumavsko**
Source: Own

*Highly diversified territory*
LAG Strakonicko - The territory of LAG Strakonicko is very well diversified – see Figure 4. There are 53 municipalities on the territory, equally distributed in all the

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pillars; the highest number of municipalities has been identified in the infrastructure, economic and social pillars, and slightly less, 6 municipalities, in the environmental pillar. The social pillar includes municipalities with a positive trend in the age structure of its residents.

The economic pillar includes municipalities with high business activities or municipalities which in the past ten years experienced positive changes in the industrial structure of employment. The infrastructure pillar includes all municipalities with good transport service, primarily from the viewpoint of roads in higher classes, specifically class I ( I/22 and I/4 -R4), connected to the roads in classes II and III. The environmental pillar includes municipalities with a superior or high production capacity of soils; the municipalities of Mutěnice and Přední Zborovice have also a higher share of water bodies.
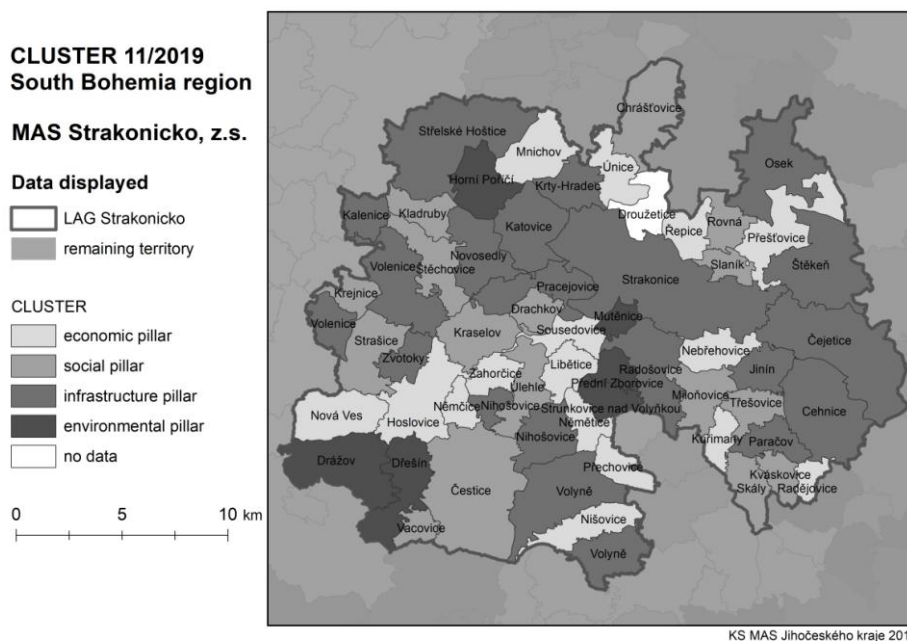


**Figure 4. Example of the highly diversified territory LAG Strakonicko**
Source: Own

The following conclusions may be drawn from the theoretical viewpoint:
The outputs suggest suitability of the four main indication pillars (economic, infrastructure, social and environmental) while their indicators should be adjusted to the character of the tested territory.

The limiting factor for practical use of the newly proposed method is development of a database, its continual updating and specification. A negative phenomenon is infiltration of information technologies and digitalization process into the rural social networks, which may reduce importance of the human factor in the development of rural area, i.e. to its formalization and partial industrialization. This would be in conflict with its natural character and function.

The main practical outputs include:

The entropy index (Shannon Wiener index) has been used for territorial units (LAGs) for the first time and, after the methodology is completed, one can expect that it may be also used in regional development,

the outputs from an analysis of the entropy index make it possible to classify territorial units (LAGs, regions) which may serve as a basis for prediction of their further development,

It seems appropriate to apply the entropy index on a relatively closed unit. It is the so-called top-down approach, where the territory needs to be seen as one organic and living unit, its elements mutually affect one another and have mutual relations and ties.

In case of partial and specific interventions in small regions or municipalities deeper analyses need to be performed, using the so-called bottom up method. For those purposes it is possible to use the newly proposed method for calculation of the economic and development potential as used by the authors of this contribution (Pártlová, et al., 2020).

The achieved diversification analysis has shown that two of the investigated LAGs had no municipality represented in one of the pillars. The pillar dominating in the South Bohemian region is the economic one, followed by equal representation in the social and infrastructure pillars; the least dominant pillar was the environmental one.

The results described above indicate that neither of the proposed hypotheses was confirmed.

Based on the summary evaluation of the outputs for the tested LAGs it is possible to conclude for the South Bohemian region that there are no boundaries which would accurately outline the proposed territories in harmony with the individual pillars. In the course of the research we have noticed a substantial territorial overlapping of the individual pillars, also at the regional level. In this respect the authors believe that the very system of community planning and joint cooperation among LAGs within regions is the only possible and correct way and it will lead to a comprehensive development and stabilization.

**Conclusion**

The issue of diversification of rural area has been researched particularly in connection with its typological definition. The reasons can be especially subsidy policies, i.e. allocation of financial subsidies by the European Union. In recent

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years another type of differentiation started to be used for rural development policies, which is based on case studies with narrative evaluation (the evaluation is based on interviews or events) in combination with quantitative methods. The combination of the two methods has resulted in new categorizations, typologies or models of rural regions. Those topics have been addressed by e.g. Polkinghorne (1988), Hunter (2010), Holstein and Gubrium (2012) or the research project EDORA (ESPON, 2011). Advantages of application of the entropy index as a method for identification and diversification of rural area development consist in the possibility of practical implementation by the users, particularly for assurance of sustainable development of rural areas.

The literary review has shown that this topic has not been frequently addressed by the scientific community and, moreover, the views of its definition and, particularly, of the methodology approach have been significantly diverse within the national, as well international scientific communities.

The study was motivated by two basic research objectives. The first one was a theoretical definition of entropy as a pro-growth and, at the same time, limiting factor in regional development. The second one focused on its practical verification, i.e. to diagnose the entropy factor and to effectively analyze it with a view of its practical use. The outputs presented in the article indicate that the objectives have been achieved. From the viewpoint of practical results, the authors follow the principle of scientific humility; the results require appropriate validation and repeating in other specific natural, economic and social conditions and regions. The authors see the achieved outputs as the first major contribution to the research of this topic; the outputs and, particularly, their scientific value should not be overrated but it is still possible to conclude that some of them are novel and they provide an opportunity for a broad discussion.

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# WYKORZYSTANIE INDEKSU SHANNON WIENER DO POMIARU RÓŻNORODNOŚCI LAGÓW, GŁÓWNEGO GRACZA ROZWOJU OBSZARÓW WIEJSKICH REGIONÓW

**Streszczenie**: W artykule przedstawiono nowe naukowe podejście do zagadnienia entropii jako czynnika prorozwojowego i ograniczającego rozwój regionalny oraz jego praktyczne opracowanie. Celem badań było sformułowanie teoretycznej definicji entropii w rozwoju regionalnym i zweryfikowanie jej w praktyce, tj. Zdiagnozowanie czynnika entropii i efektywna analiza z możliwością jej praktycznego wykorzystania. Zastosowanie indeksu Shannona Wienera dla lokalnych grup działania w regionie południowoczeskim dostarczyło wiarygodnych wyników w zakresie zróżnicowania jednostek terytorialnych, takich jak lokalne grupy działania (LGD), regiony i gminy, a także odpowiednią podstawę do prognozowania ich dalszego rozwoju. Badania potwierdziły również przydatność czterech głównych filarów wskazań (ekonomiczny, infrastrukturalny, społeczny i środowiskowy), a ich wskaźniki powinny być dostosowane do charakteru badanego terenu.
Wydaje się, że właściwym podejściem jest zastosowanie wskaźnika entropii do stosunkowo zamkniętej jednostki, w której elementy wzajemnie na siebie oddziałują i mają wzajemne relacje i więzi. Wyniki rozwiązania można postrzegać jako opis ogólnego stanu poszczególnych LGD; ponadto wyniki badań zostały przeanalizowane przez kierownictwo LGD i uznały je za ważne źródło wiedzy i sformułowały zalecenia w celu wzmocnienia ich zdolności informacyjnej. Zgodnie z ustaleniami można stwierdzić, że uzyskane wyniki należy traktować jako pierwsze przybliżenie rozwiązania rozpatrywanej kwestii i wymagają dalszej weryfikacji i uzupełnienia.

**Słowa kluczowe**: dywersyfikacja, klaster, indeks Shannona Wienera, rozwój regionalny, Lokalna Grupa Działania (LGD)

# 使用Shannon Wiener指数衡量区域农村发展的主要参与者滞后多样性

**摘要**：本文提出了一种新的科学方法来解决熵问题，它是区域发展中的增长和限制因素及其实际阐述。该研究的目的是为区域发展中的熵制定一个理论定义并在实践中加以验证，即诊断熵因素并对其进行有效分析，并有可能被实际使用。在南部波西米亚地区的地方行动小组中使用ShannonWiener指数，在地区单位(例如地方行动小组，地区和市镇)的区分领域提供了有效的结果，并为预测提供了适当的基础他们的进一步发展。该研究还证实了四个主要指标支柱(经济，基础设施，社会和环境)的适用性，同时应根据被测领土的特点调整其指标。适当的方法似乎是将熵指数应用于相对封闭的单元，在该单元中元素相互影响并且具有相互关系和纽带。解决方案的输出可以看作是对各个LAG总体状态的描述。此外，LAG管理层已对研究结果进行了审查，他们将其视为重要的知识来源，并提出了一些建议以增强其信息能力。根据调查结果，我们可以得出结论，所取得的成果应被视为有关问题解决方案的第一近似方案，需要对其进行进一步验证和完善。

**关键词**：多元化，集群，香农维纳指数，区域发展，地方行动小组(LAG)