



SCIENTIFIC REPORT 2018 - 2022

Understanding and modeling time-space patterns of psychology-related inequalities and polarization

1. Summary of the expected and achieved objectives.

1.1. Coordinator (The International Institute for the Advanced Studies of Psychotherapy and Applied Mental Health, Babeș-Bolyai University)

The first objective of the Coordinating Team (CO) was to define, with reference to the existing scientific literature, a set of key psychological and cultural constructs that are relevant to the investigation of the cross-cultural variations in political, economic, social, and health (PESH) indicators. The psychological variables included in the project were selected based on the cognitive-behavioral model of human functioning since, according to international guidelines, this model possesses the strongest scientific support. The general model states that emotional responses are determined by the interaction between the presence of activating life events and cognitive evaluations of the event. Accordingly, the proposed psychological variables for the project comprised the frequency and intensity of negative life events, functional and difunctional cognitive evaluative processes, and positive and negative emotions. Several more psychological dimensions were included in the study based on their connection with PESH variables, namely: optimism/pessimism, personality traits, intelligence quotient, generalized trust, life satisfaction, social support, and six categories of cultural dimensions according to Geert Hofstede's model (individualism-collectivism, power distance, masculinity-femininity, uncertainty avoidance, long term orientation, and indulgence). In addition, the teams' aim was to design and develop the psycho-cultural measuring tools utilized in the overall project and to oversee the data gathering procedure. The proposed psychological and cultural variables were subsequently used to collect data on a representative sample of the Romanian population or were estimated at the country-level using secondary data retrieved from international public databases. The second major objective of the CO was to generate psychological maps across the Romanian territory and to employ cluster analysis in order to identify patterns of psychological and cultural attributes throughout the regions of Romania. Accordingly, the team created psychological maps for each psychological and cultural construct included in the data collection process, at four administrative-territorial levels: (1) 41 Romanian counties and Bucharest Municipality, (2) eight development regions (NUTS II), (3) four development macro-regions (NUTS I), and (4) three traditional historical regions (Moldova, Transylvania, and Wallachia). Additionally, we conducted a cluster analysis to capture the natural way in which these traits cluster in the population. Moreover, the team examined whether the regions differ significantly in terms of psychological characteristics. The third key objective of the team was to study the national and regional associations between relevant psychological and cultural factors and cross-national/regional variations in PESH indicators. This objective was carried out through multiple studies and public research reports. Additional objectives of the CO were to develop policy recommendations pertaining to the management of spatial disparities and to disseminate the findings of the project through scientific publications, public reports, and conference presentations. These objectives were also met throughout the implementation period of the project.



1.2. Partner 1 (Research Centre for Sustainable Development, Babeș-Bolyai University)

The contribution of P1 to the overall objectives of the project consisted in the analysis of territorial inequalities and polarization in Romania, at regional and local scale. The theoretical and empirical advancement in this field was consistent and is documented in the list of publications.

1.3. Partner 2 (Faculty of Political, Administrative and Communication Sciences, Babeș-Bolyai University)

The involvement of Partner 2 in the implementation of the project includes: the review of the relevant political science literature prior to data collection and analysis; defining the database for social indicators and the construction of data collection tools with a focus on social indicators; collection of survey data pertaining to social indicators; the analysis of data, formulation of policy recommendations and dissemination of results. All the objectives were achieved as planned.

From the five specific objectives of the project, Partner 2 had a strong involvement in the realization of the following objective: O4-To evaluate the effects of inequalities and polarization on democratic attitudes and norms and O5-To model the spatial inequalities data with different statistical approaches. The transversal objectives were also achieved: O6-To facilitate the development of fundamental research in the fields covered by the project and obtain frontier research results. O7-To disseminate the results that our teams of researchers will produce, and thus, increase the international visibility of the Romanian research results. O8-To increase the capability and competitiveness of the research teams' members in order to apply successfully to common research projects, including Horizon 2020; since 2021, Partner 2 is working a Horizon funded project DEMOTEC - Democratizing Territorial Cohesion: Experimenting with deliberative citizen engagement and participatory budgeting in European regional and urban policies. O9-To involve doctoral and post-doctoral students of the two institutions throughout the research process; both doctoral and post-doctoral students were employed in Partner 2 team.

1.4. Partner 3 (Department of Theoretical and Computational Physics, Babeș-Bolyai University)

The role of Partner 3 (P3) in the project was to apply modeling and data analysis techniques borrowed from statistical thermodynamics, computational physics, and classical econometrics in describing socio-economic inequalities and to understand their relations to the psychological characteristics of the population. The team formed from the physics and economics departments of the BBU engaged in (i) performing data-mining for gathering relevant data [activities 1.2.3, 1.2.5, 2.2.5, 2.3.2]; (ii) data analyses [activity 3.1.2]; (iii) mean-field type master equation based modeling [activity 3.2.1, 3.4.4]; (iv) stochastic and agent-based modeling together with network science approach [activities 4.2.2 and 4.1.4] in order to describe and understand the investigated phenomena. Alongside pure equilibrium models, it was also proposed to perform a study on the dynamics of socio-economic inequalities in view of game-theory inspired evolutionary models [activity 4.2.3]. Visualization of the observed patterns using the data gathered by this group and other partners with user-friendly programs elaborated by the team members was another objective [activity 4.1.3] of P3. Such visualization and correlation studies were considered in order to help the other partners to test current socio-economic theories for the connection between the socio-economic and psychological parameters of the population. For a wide dissemination of the results, we proposed to organize the MECO 2020 conference and a satellite meeting on econophysics focusing on inequalities (activity 3.3.1). Another objective of this team was to synthesize the studied data and elaborated models and disseminate these through high-impact publications



(activities: 5.1.3-5.1.5). The work of Partner 3 was planned for connecting the activities of the other Partners by mathematical modeling and unified data visualization techniques. The above-presented objectives were fully or partially realized, important new methodologies were developed, and large-scale dissemination was done by high-impact publications and conference presentations. As the main results achieved by Partner 3 we mention here the collection of historical data on socio-economic inequalities (focusing on income and wealth), relevant and novel equilibrium and dynamical models synthesized also in review articles, novel visualization techniques for the data gathered in the project, and a novel visual study of the possible correlations. Partial realization is reported for the organization of the satellite meeting at the MECO45 conference. Due to the pandemic situation in 2020, all conferences were canceled. We have organized the MECO45 conference in online format, and the satellite meeting could not be organized. Instead of this satellite meeting, we have focused on invited, keynote talks in the area of econophysics at MECO 45, targeting socio-economic inequalities. The team from the Economics Department formulated also the following objectives: (1) Analysis over time for the regional inequalities in Romania, for the individual and composite well-being indicators; (2) Study of the long-term equilibrium relationship between income inequality and economic growth in Romania; (3) Computing measures for income inequality at the county level, and the analysis of the impact of the urban growth poles policy on inequality.

1.5. Partner 4 (Bucharest University of Economic Studies)

Partner 4 contributes to the project outcomes by reviewing the economic literature as part of documentation and preparation of data collection and analysis methodology, defining the database for economic indicators and developing research tools in the field of economic inequalities, collection of data on economic inequalities, economic and numerical modelling and dissemination of results.

The research activity of Partner 4 followed the realization plan of the project. In Phase 1 ASE research team was involved in the documentation and preparation of the data collection and analysis methodology. It performed the study of economic literature and conceptualized and defined the database for economic indicators. In Phase 2 ASE research team participated in the development of tools and data collection. More specifically, it developed research tools in the field of economic inequalities, performed data collection on economic inequalities and disseminated the results on economic indicators. In Phase 3 ASE research team was involved in data analysis and modelling by performing the economic and numerical modelling and disseminating the results regarding the economic models.

2. Presentation of the achieved results, outcome indicators, and lack of achievements in comparison to the anticipated results outlined in the grant application (where applicable), with justifications.

2.1. Coordinator (The International Institute for the Advanced Studies of Psychotherapy and Applied Mental Health, Babeș-Bolyai University)

One of the main objectives of the coordinating team was to create psychological maps designed to illustrate regional-level variations of several psychological constructs relevant to the study of spatial inequality and polarization across the Romanian territory. Based on the data collected throughout 2019 in collaboration with Partner 2, several psychological maps of the Romanian regions were elaborated. The grouping of local administrative units was based on the Nomenclature of Territorial Statistical Units (NUTS) defined according to the National Institute

of Statistics. Thus, the data contained in this report are presented at the level of the 41 counties of the country and Bucharest Municipality (NUTS 3), at the level of development regions (NUTS 2), and at the level of macro-regions (NUTS 1). We have also introduced an additional level of analysis consisting of three historical provinces of Romania (Transylvania, Moldova, and Wallachia). The psychological maps were based on a representative sample of the Romanian population, comprising 3025 participants, with a mean age of 44.5 (SD = 0.30), with 52% of the sample represented by female participants, and with 93.8% of the respondents representing individuals of Romanian ethnicity. Psychological maps were created for the following psychological and cultural constructs: individualism-collectivism, power distance, masculinity-femininity, uncertainty avoidance, long-term orientation, indulgence, interpersonal trust, irrational and rational cognition, negative life events, negative functional and dysfunctional emotions, and positive emotions. Examples of the psychological maps representing the geographical distribution of individualism-collectivism across several levels of analysis can be visualized below (Figure 1).

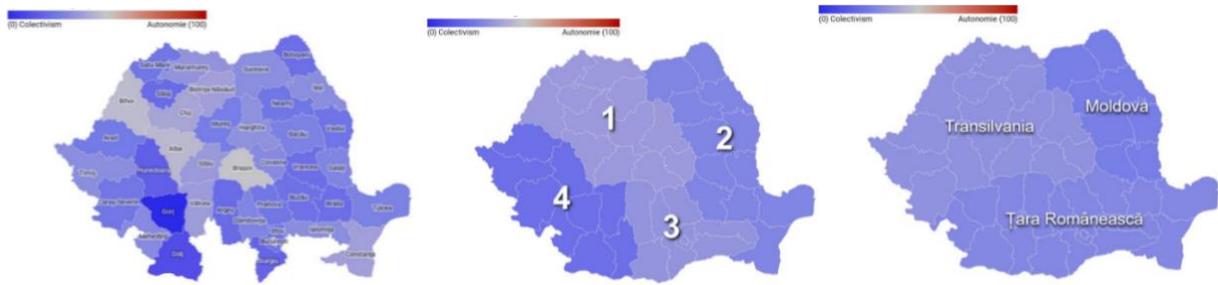


Figure 1. Examples of the psychological maps representing the geographical distribution of individualism-collectivism at the county level, at the macro-regions level, and at the historical provinces level. A shade closer to blue indicates a higher Collectivism score. Theoretical scale scores range from 0 (high Collectivism) to 100 (high Individualism).

Based on the same data, the team created several heat maps, illustrating the concentration of cultural dimensions across Romanian regions. An example of the heatmaps regarding the concentration of the individualism-collectivism dimension can be visualized below (Figure 2).

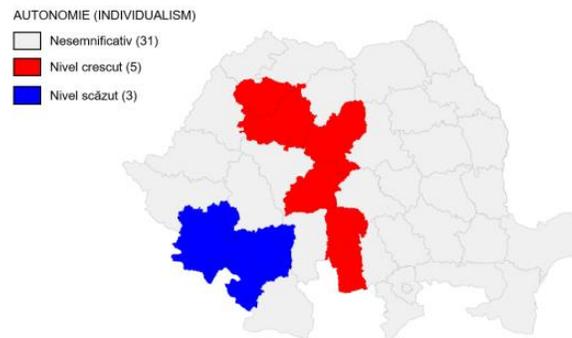




Figure 2. Red areas show areas with a high concentration of Individualism (hot spots). Blue areas show areas with a high concentration of Collectivism (cold spots). Grey areas are areas without a high differentiation (medium).

Next, the team investigated if there are statistically significant differences between different Romanian regions in terms of psychological characteristics. The results did not support any statistically and ecologically significant geographical variations between the psychological factors examined at the macroregional and historical provincial levels. However, at the level of development regions, we identified several statistically and ecologically significant variations between psychological variables: (1) trust in new people (Centre > South-East); (2) trust in people of different nationalities (Bucharest-Ilfov > South-Muntenia; Centre > South-Muntenia; North-West > South-East; North-West > South-Muntenia; West > South-Muntenia); (3) trust in people of different religions (Centre > South-Muntenia; Centre > South-West; North-East > South-Muntenia; North-East > South-West; North-West > South-Muntenia; North-West > South-West), (4) perceived negative experiences (Bucharest-Ilfov > Centre), (5) rational cognitions (North-West > North-East; South-Muntenia > North-East) and (6) positive emotions (North-West > North-East). In accordance with the proposed objective for the project, the team also performed a cluster analysis that highlights a number of multi-faceted psycho-cultural profiles of citizens that were further analyzed in terms of their geographical distribution. The model comprised nine psychological and cultural variables, namely: irrational cognitions, uncertainty avoidance, long-term orientation, individualism-collectivism, indulgence, trust in family, trust in strangers, pro-democratic attitudes, as well as positive emotionality and life satisfaction. The cluster analysis identified two main clusters. Cluster 1 comprised individuals with moderately below-average levels of irrational cognitions and uncertainty avoidance, moderately above-average values of indulgence, trust in family and strangers, and substantially above-average scores for positive emotionality and Life Satisfaction. Cluster 2 comprised individuals recording somewhat higher than average irrationality scores and slightly lower than average individualism, trust in family, and trust in strangers scores. In addition, they exhibit much higher-than-average ratings for uncertainty avoidance and significantly lower values for indulgence, life satisfaction, and positive emotionality.

Another key objective of the team was to examine the association between country and/or regional-level psychological/cultural variables and PESH indicators, using the data collected during the current project and additional international open data sources. Our research team conducted an examination of the link between the psychological and cultural characteristics of the administrative counties of Romania and the mobility of the citizens, during the lockdown period that took place in Romania between the 16th of March and the 14th of May 2020. Data for estimating citizen mobility was retrieved from the Google COVID-19 Community Mobility Reports. The results showed that higher levels of individualism, as well as higher levels of power distance, were both associated with lower levels of mobility in public places and higher levels of mobility at residence. In a consecutive study, we utilized the county-level individualism-collectivism scores in order to examine whether collectivism could act as a protective cultural factor in the relationship between irrational cognitions and depressive symptoms, measured during the lock-down period in Romania, across the 42 counties. The team also tested the hypothesis stating that the protective effect of collectivism in relation to depressive symptoms could be mediated by perceived explicit and implicit support. Our results showed that collectivism



significantly moderated the link between irrational cognitive processes and depression, however social support was not the mechanism explaining the protective effect of collectivism. Moreover, our team found that individuals living in counties characterized by high levels of individualism were more prone to seek explicit social support. Another important contribution of the coordinating team was the computation of a Modernity Index of Romania, and the examination of its growth across generations. The Modernity Index was calculated based on four cultural and psychological dimensions, namely individualism-collectivism, trust-mistrust, duty-joy, and life satisfaction. The results showed that Romania's Modernity Index rose 9 points (from 39 to 48 on a 100-point scale), between the years 1993 and 2018. The evolution of this index points to potential openings for a more seamless integration of Romanian institutions into the geopolitical space occupied by the European Union and NATO in the western hemisphere. Based on these results, our team developed a series of recommendations for the acceleration of the modernization of Romania. Our team created a number of proposals for accelerating Romania's modernization based on these findings. In yet another study, the team investigated the relationship between country-level intelligence, personality traits, individualism-collectivism, and two key economic outcomes related to the project, namely economic wealth and income inequality, across 200 nations. The results showed that country-level intelligence and individualism were significant predictors of national economic wealth and inequality. Moreover, the results highlighted the link between personality traits and income inequality was weaker and that the influence of these aggregated personality traits on inequality was conveyed via economic wealth.

2.2. Partner 1 (Research Centre for Sustainable Development, Babeș-Bolyai University)

In phase 1 of the project P1 has realised a solid bibliographical documentation of the relevant geographic literature, followed by the building of two large databases for territorial and demographic indicators. The latter were grouped as following: a database containing 90 sustainable development indicators at regional and local scale; a PESH database at local and regional level. In phase 2 of the project P1 has developed new instruments for the analysis of spatial inequalities and polarization, represented by the introduction of Earth Observations based instruments (night lights) for the measurement of local and regional level economic output, and for the measurement of regional inequalities. It was followed by the collection of data from classical sources (National Statistical Institute, Ministry of Finance) as from novel sources (satellite images) as well. The dissemination of the research results was consistent with high quality publications and conference participations. In phase 3 of the project P1 has analysed the territorial and demographical inequalities and polarization, and it has generated territorial models of inequalities and polarization. P1 has developed a novel measurement methodology of the Sustainable Development Goals, developing a 90 indicator, local level database and combining classical (official statistics) and progressive data sources (big data, satellite images) and data analysis techniques (remote sensing, GIS). P1 has organised a workshop as part of the dissemination activity plan. P1 has realised other dissemination activities through publications and conference participations. In phase 4 of the project P1 has measured the spatial concentration of the activities, the economic specialization, the multidimensional convergence process at local and regional level, and the spatial mobility of the population.

On the basis of the previous phases, P1 has mapped the spatial inequalities, the convergence clubs, the spatial patterns of mobility, and has formulated constructive critics and policy recommendations to the management of spatial inequalities. P1 has realized other dissemination activities through publications and conference participation.



2.3. Partner 2 (Faculty of Political, Administrative and Communication Sciences, Babeș-Bolyai University)

The activities of Partner 2 have been consistent with the realization plan of the project. For WP 1-Spatial differentiation of psychological characteristics, P2 was involved in the establishing key psychological variables, both trait and state-like, which could be related to inequalities and polarization. For WP 2 -Spatial inequalities and polarization, P2 was involved in the following activities: Statistical analysis of spatial (local and regional) inequalities; Statistical analysis of social and income inequalities (social stratification and polarization); Measurement of the multidimensional convergence process at local and regional level; The role of spatial mobility in the production and reproduction of inequalities; Mapping of inter-regional and local inequalities, convergence clubs, spatial patterns of mobility, psychological spatial patterns; Policy recommendations related to the management of spatial inequalities. For WP3, the following activities were part of P2 work: Analysis of secondary data of two surveys conducted in 2016 on samples that are representative for the Romanian adults; Conducting a panel survey regarding the key psychological characteristics, on a sample that is representative for the Romanian adults; Evaluation of secondary data from the last rounds of elections (official statistics) at the voting place level for pointing out: turnover differences across the country; Sectorial policy recommendations. For WP 4-Modelling spatial inequalities and polarization, Partner 2 was involved in the discussing all three modeling attempts in the view of the new results obtained in the project and synthesizing the modeling results.

During Phase 1, the P2 research team performed the review of the relevant literature from the field of political science and defined, on the basis of the selected literature, the database for the social indicators to be used in the survey. During Phase 2, the P2 team contributed to the construction of the data collection tools and to the process of data collection. Throughout this step, P2 was responsible for constructing the social indicators for the survey (generalized trust, life satisfaction, financial satisfaction, subjective social status, democratic attitudes), while being, at the same time, involved in the process of survey sampling and tool pretesting. During Phase 3 and Phase 4, the P2 team was involved in the process of data analysis and modeling, with a focus on the social indicators included in the database. The preliminary results of the analysis have been shared with the wider project team within the joint project workshop and became the starting point of a collective article which the team currently works on. In terms of dissemination, during Phases 2, 3 and 4, the P2 team has participated in national and international conferences and workshops, published articles and chapters in collective volumes and submitted works that have been accepted for publication. During Phase 3 and 4, following the collection of survey data, the P2 team began working on a joint paper the aim of which was to test the long term effects of cultural legacies on current cultural attributes of individuals. In doing so, we have analyzed the individual level data collected through the project survey together with historical data from the 1930 census, that includes county-level data on education, ethnicity, religion and the belonging of counties to the Austro-Hungarian Empire prior to 1918. Complex data analyses have provided promising results indicating a positive effect of interwar literacy levels on current levels of social trust and support for democracy.

Taking our analyses into more depth, we have subsequently refined our analysis by shifting the focus on the effects of interwar literacy levels on current levels of human capital. An innovative approach we have used was to incorporate conscientiousness (measured by the data collected through the project survey) into our definition of human capital, and that



conscientiousness has a behavioral operationalization, which is based on the Acquiescence Response Style (ARS). The paper is under review at Europe Asia Studies Journal.

Apart from the general challenges generated in 2020 by the COVID-19 pandemic – successfully managed by transitioning the intra- and inter-team communication online – no other particular difficulties have been encountered.

2.4. Partner 3 (Department of Theoretical and Computational Physics, Babeș-Bolyai University)

The results achieved by Partner 3 can be grouped into the following categories: (i) generating new datasets, (ii) creation of data repository for all partners of the project, (iii) data visualization and applets for detecting relevant correlations, (iv) new modeling paradigms for income and wealth (v) new methodologies for estimating social inequalities by introducing Gintropy and (vi) inequality trends in Romania; (vii) acceleration of socio-economic processes with empirical data and modeling. We will present these results briefly together with the corresponding outcome indicators:

- (i) Large resolution, good quality and uniformly gathered data is a necessary element for validating model results and to compare inequality levels. During this project we have collected and used the following data:
 - Exhaustive wealth data for a commune (Sancrai, Cluj county) in Romania. As it is described in [6] different proxies were used to achieve this, estimating the contribution of different wealth categories to the total wealth of an individual. This data was collected by our group using the agricultural records and local tax archives of the commune.
 - Good quality income data for several countries. The data was obtained either from a previously compiled exhaustive dataset for Cluj county, by collaborations with the Central Statistical Offices of Romania and Hungary and by available data from the Internet. A description of this data can be consulted in our relevant publications [3,7-10]. In order to confirm some hypothesis used in our models, we used also our Cluj county dataset that allowed the study of the income dynamics for anonymized individuals.
 - Good resolution wealth data collected from the Internet. This data was estimated using different proxies. Wealth estimation and their dynamics was done for the top 100 billionaires using the Forbes database. These data are described in detail in our relevant studies: [6] and [Physica A, vol. 581,126194].
 - Long-term data for the top-list data in music and books [5], for studying the dynamics of human preferences in music and reading.
 - County-level data in Romania were collected for the following well-being dimensions: income, jobs, housing, education, health, access to public utilities, environmental quality, safety, and civic engagement. The data set includes the annual evolution of 20 socio-economic indicators, for the period 2006-2017 [9,10]. Composite indicators of well-being are constructed using the adjusted Mazziotta-Pareto methodology, which allows highlighting the trend of overall well-being scores for each county and each dimension. The evolution over time of the disparities between the counties was analyzed for each socio-economic indicator as well as for the composite index of well-being. The empirical results suggest a slight upward trend in socio-economic disparities over time. There is a small group of counties with much more favorable values of economic indicators than most counties. Also, the factor analysis carried out suggests that the level of GDP

could partially represent some of the well-being dimensions, but does not incorporate information regarding education, environmental quality and security.

- (ii) In order to group all the large scale data for Romania that was used in the project we constructed a unified and user-friendly data bank, that is accessible to all partners involved in the project. This data bank is available at the address: <https://atom.ubbcluj.ro/ropsy-data> by using the following credentials (*user: ropsy-user, Password: PCCFropsy2016*). The database contain both longitudinal and transversal data for relevant economic and psychological indicators on county level.
- (iii) For a complex modeling of the relevant correlation P3 realized a web-based applet that allows the followings:
 - a. Clusterization of the country in regions using the transversal data by an original clusterization method based on nearest-neighborhood relations and correlations.
 - b. Clusterization in regions using 29 years of longitudinal GDP data and Pearson-like correlations.
 - c. Modelling correlations between different indicators, economic, social and geographic ones. These applets are available to access through any web-browser by accessing <https://atom.ubbcluj.ro/RoPsyCorr> (user-name: ropsy-app, Password: RoPsy-ubb-2021)

Spatial clusterization can be visualized as it is shown in Figure 3. By varying the correlation thresholds of the neighbors, clusterization on different length-scales can be achieved. The correlations between relevant socio-economic and psychological measures is indicated in matrix form and by using also a color-code as it is shown in Figure 4. Correlations between wellbeing dimensions and GDP were computed [10].

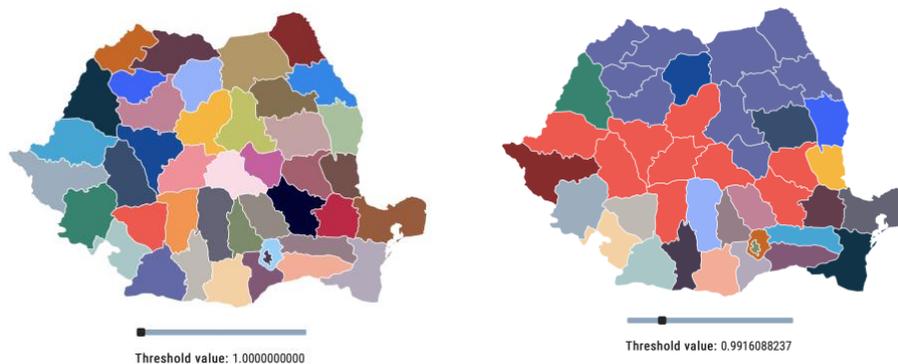


Figure 3. Example for clusterization of countys following socio-economic indicators

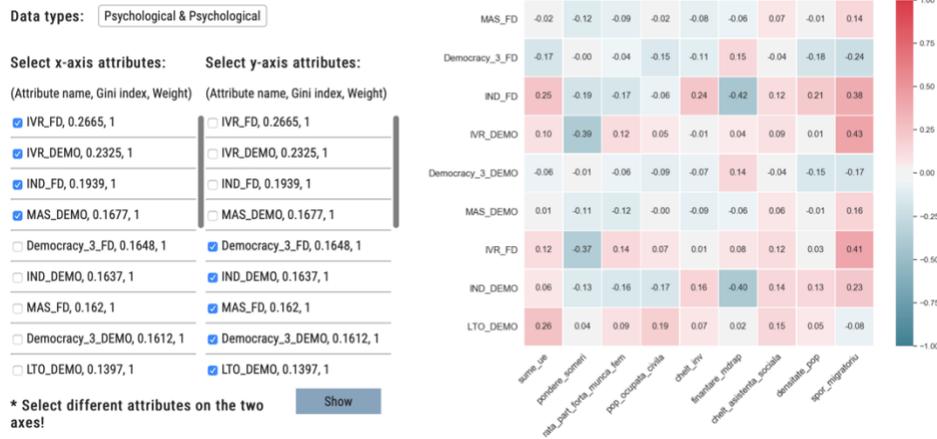


Figure 4. Example for visualization of the correlations between different socio-economic and psychological characteristics

(iv) During the present project we used our LGGR (Local Growth with Global Reset) model [1,3,4,5] (named nowadays as the Biro-Neda model [*Mathematics*, vol. 10, 644]) for describing wealth and income inequalities in modern and past societies. Using the exhaustive and/or good quality data discussed in (i) and this modeling paradigm based on an analytically solvable master-equation in the stationary limit we offered compact forms for the probability density of the distribution function. For income we proved that the LGGR model works fine using a preferential growth and a smart-reset rate that is positive for high income values and negative for lower incomes [3]. Using the exhaustive data for Cluj county on 10 consecutive years, this assumption could be proved on experimental data. This approach leads to probability density function in form of a Beta-Prime distribution, offering an excellent fit to all the experimental data mentioned in (i). It describes in a unitary manner all income intervals and it is in good agreement with all previous stylized facts known in the literature. Apart of the stationary limit of the LGGR model we have studied also the dynamical properties of this model both in the discrete states and continuous states limit [4]. In two practically important cases: constant growth and reset rate and in for constant reset rate and preferential growth rate we derived analytical results for the convergence to equilibrium [4]. For modeling wealth the same modeling method was used with similar growth and reset rates in the case of modern societies. Taking into account that wealth can be also negative (meaning debts), a slight modification had to be considered in both the growth and reset rates. As a consequence of this we obtained for the probability density function a generalized Pareto type distribution [*Physica A*: vol. 581, 126194], resembling the one proposed by Bouchaud and Mezard in their seminal model [*Physica A*: vol. 282, 536]. In order to describe the wealth distribution patterns observed in the exhaustive data compiled for the Sâncraiu commune during the communism time (year 1961 and 1989) a linearly increasing smart reset rate had to be considered along with a constant growth rate. Such growth and reset rates lead to a normal like distribution, which is confirmed by the gathered data [6]. Interestingly we find, that this Gaussian distribution changes very quickly to a Pareto type distribution with the free market economy. A successful LGGR type model should thus incorporate a preferential type growth, which is usually responsible for the formation of the characteristic power-law type tail. By calculating the relevant inequality measures, the Gini index, Lorenz curve and Pareto point



we show the dynamical trends for socio-economic inequalities during more than a 50 year history of the Sâncraiu commune [6].

- (v) Among other inequality measures, the Gini index and Entropy are the ones that are most known and generally used for characterizing socio-economic inequalities. Entropy has the advantage of being directly related to thermodynamic quantities and therefore it offers a clear path for connecting socio-economic modeling to the methods used in statistical physics. In order to further facilitate the dialog between statistical physics modeling and socio-economic theories an entropy like quantity with close connection both to the Gini index and Entropy was introduced by us and named *Gintropy* [2]. This is a function that represents the distance between the Lorentz curve and the total equality line and for the most relevant distributions, uniform, natural and q-exponential distributions its form resembles the form of the characteristic entropies. Many important and useful properties of this quantity were proved and a useful generalization to an *f-Gintropy* was also recently considered [*Entropy*, vol. 24, 407].
- (vi) Since 2007, measures of inequality indicate a flattening or even a slight decrease in income inequality (data source: World Inequality Database WID, Standardized World Income Inequality Database SWIID, TransMonEE, Eurostat). The long-term equilibrium relationship between income inequality and economic growth, in Romania during the period 1990–2020, is analyzed in the framework of the Kuznets curve. The empirical results, provided by the cointegration methodology, suggest the existence of a non-linear relationship. The key mechanism behind the Kuznets model is the relative increase in productivity and employment in the services sector. Regarding the fiscal policy variables, an increase in tax revenue is found to have a positive effect on reducing income inequality. Based on the owned per capita incomes of all cities in a county, the Gini values were computed for each year and for each county; these coefficients measure the "inequality" between cities in a county [7,8]. Similarly, Gini values were determined based on disparities between all localities of a county. Other indicators of inequality were also computed (20:20, 10:10, Theil T index, Theil general entropy index).
- (vii) In the era of big-data, one can find also many relevant hints for dynamics in the socio-cultural trends of our society. Top-lists and social media platforms offer an excellent possibility to study such trends, and carefully gathered data could allow modeling and hopefully will give also predictive tools. Billboard and NY bestseller list were studied and a simple information theory model was used to study this problematics [5]. It was shown that the life-time distribution on top-lists follows a power-law, and this scaling could be nicely explained through the used model. Comparing the results with those from the 80's an acceleration of the selection and survival process is observable. In the future it would be interesting to compare this trends with some documented changes in the psycho-cultural profile of the general population.

2.5. Partner 4 (Bucharest University of Economic Studies)

In line with the project's objectives, for the data management, a database was designed and implemented. The data structure and the database design complied with all the principles of relational database design. The structure of the database was configured on the following directions: psychological indicators, social indicators, spatial-temporal indicators, economic indicators and geographical and territorial indicators. The database was installed on a dedicated Oracle server, version 12c, accessible to all project partners. The architecture of the data access



system was adapted to the specific conditions of the project, allowing access to data for all partners, through a dedicated web application. This architecture guarantees immediate access to data, top performance and ensures database scalability. In order to populate the database with data and to ensure interoperability with other data sources, data import functionalities have been implemented from other data sources such as Excel, CSV, MDB files, these facilities will be extended in future, depending on the needs identified.

Regarding the collection of relevant statistical information, statistical information was obtained from the population and housing censuses (RPL) that took place in the last 50 years in Romania (RPL 1977, 1992, 2002 and 2011). The structure of this microdata database is a standardized IPUMS but with the specificity of the questionnaires used by INS in Romania. ADF and PP tests were applied for the time series on the rate of mixed interethnic marriages for the time series. The two tests regarding the unity root show us different behavior for the Romanian ethnic population, and other two ethnic groups. Thus, the two time series defined for the Romanian ethnic group are of DS type, these being integrated of the first order, while the series referring to the two ethnic groups are of TS type.

The Johansen tests for cointegration is applied to the data series considered. By applying this procedure it is established if there is a cointegration relationship between these variables and the long run estimation between them is estimated. The results confirm that, both at the level of the rural environment and at the level of the urban one, there is only one cointegration relationship between the considered variables. Long run estimation for the rate of interethnic marriages to the Romanian ethnic group on the rural and urban environment was made in the following conditions: in the vector model only one delay was retained; in the model a linear deterministic tendency was considered present; in the model were considered three exogenous variables that measure the internal rate of changes of residence for people aged 15-19 years, 20-24 years and 25-29 years.

3. The estimated impact of the obtained results, emphasizing the most important outcomes.

3.1. Coordinator (The International Institute for the Advanced Studies of Psychotherapy and Applied Mental Health, Babeș-Bolyai University)

3.1.1. Conceptual, methodological, and practical implications

3.1.1.1. The collection of large-scale data on a representative sample of the Romanian population regarding psychological and cultural constructs related to spatial and time inequalities and polarization, and other relevant political, economic, social, and health state-level functionality indicators.

3.1.1.2. The elaboration of several psychological maps of Romania, reflecting regional variations in levels of individualism-collectivism, power distance, masculinity-femininity, uncertainty avoidance, long-term orientation, indulgence, interpersonal trust, irrational and rational cognition, negative life events, negative functional and dysfunctional emotions, and positive emotions. The maps were created at several levels of developmental regions: 42 counties, 8 development regions, 4 macro-regions, and 3 historical regions.

3.1.1.3. The identification of two clusters of psychological and cultural profiles on the Romanian territory.

3.1.1.4. The identification of various country-level PESH indicators related to the geographical distribution of psychological and cultural characteristics both within Romania and between several nations. Among the most important findings, we mention the protective role of collectivism against developing depressive symptoms in the presence of irrational



cognitions, and the role of intelligence, personality traits, and individualism on both country-level economic wealth and income inequality.

- 3.1.1.5. The computation of Romania's Modernity Index and the estimation of the index across time along with recommendations for increasing modernity scores over time in the Romanian population.
- 3.1.1.6. The obtained results have major implications for future evidence-based public policy recommendations aimed at reducing special inequalities.
- 3.1.1.7. Academically, the resulting findings address a significant gap in conventional approaches to the study of the relationship between nationally and/or regionally aggregated psychological characteristics and PESH indicators.

3.1.2. Relevant selected publication within the project

- 3.1.2.1. Bartucz, M. B., David, D. O., & Matu, S. A. (2022). Cognitive vulnerabilities and Depression: A Culture-Moderated Meta-Analysis. *Cognitive Therapy and Research*, 1-15. <https://doi.org/10.1007/s10608-022-10299-9>
- 3.1.2.2. Bartucz, M. B., & David, D. O. (2022). Irrational Beliefs as a Cognitive Mechanism Explaining the Link Between Pathogen Prevalence and Individualism-Collectivism. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 1-14. <https://doi.org/10.1007/s10942-021-00441-z>
- 3.1.2.3. Bartucz, M. B., Matu, S. A., & David, D. O. (2022). The Protective Effect of Culture on Depression During Covid-19 Pandemic: A Romanian National Study. *Journal of Cross-Cultural Psychology*, <https://doi.org/10.1177/00220221221109564>
- 3.1.2.4. David, D. O., Matu, S. A., Bartucz, M. B., Comșa, M., Szentagotai, (submitted to). A. The impact of culture, country-level intelligence, and personality on economic development and income inequality.

3.1.3. Public reports

- 3.1.3.1. Bartucz M., Matu S., Comșa M., David, D. (2020) Research report: The impact of the psychological and cultural profile on the mobility of Romanian citizens during the COVID-19 lockdown. (available online: <http://ropsy.granturi.ubbcluj.ro/wp-content/uploads/2020/10/Profilul-psihocultural-in-pandemie-2020-ROPsy.pdf>)
- 3.1.3.2. David, D., Bartucz, M., Matu, S., Szentagotai, A., Comșa, M., (2020) Research report: The psychological and psychocultural profile of Romania's regions. (available online: <http://ropsy.granturi.ubbcluj.ro/wp-content/uploads/2020/11/Raport-Profil-Psihocultural-Romania-ROPsy-2020-Site.pdf>)
- 3.1.3.3. David, D., Comșa, M., (2020). Research report: The Modernity Index of Romania. (available online: <http://ropsy.granturi.ubbcluj.ro/wp-content/uploads/2020/11/Report-The-Modernity-Index-of-Romania-ROPsy-2020.pdf>)

3.1.4. Selected conference presentations

- 3.1.4.1. Bartucz, M. & David, D. (2019). Dysfunctional Thinking in Major Depressive Disorder. A Culture-Moderated Meta-Analysis. In The 9th World Congress of Behavioural & Cognitive Therapies. 17th-20th July 2019, Berlin, Germany.
- 3.1.4.2. Bartucz, M. B. & David, D. (2019). Romania – A cross cultural approach. In The 4th International Congress of Rational Emotive Behavior Therapy. 13-15 September 2019, Cluj-Napoca, Romania.
- 3.1.4.3. Matu, S., Bartucz, M., David, D., Szentagotai, A., Comșa M., (2021). "The impact of aggregated irrational/dysfunctional beliefs on the adherence to the mobility restrictions of



the Romanian citizens during the COVID-19 lockdown”, Annual Congress of the European Association for Behavioural and Cognitive Therapies (EABCT) – CBT: Back to the Future, 8-11 September 2021, Belfast, Northern Ireland.

- 3.1.4.4. Bartucz, M., David, D., Matu, S., (2022) “The Protective Effect of Culture on Depression During Covid-19 Pandemic: A Romanian National Study”. Annual Congress of the European Association for Behavioural and Cognitive Therapies (EABCT) – Re-Thinking CBT: providing strategies for a new way of living, 7-10 September 2022, Barcelona, Spain.

3.2. Partner 1 (Research Centre for Sustainable Development, Babeș-Bolyai University)

P1 has introduced a progressive methodology in the analysis of spatial patterns of inequalities and polarization based on the following elements:

3.2.1. Conceptual, methodological, and practical implications

- 3.2.1.1. P1 has developed a new perspective on the analysis of spatial inequalities and polarization by extending the scale of research to the local level, comprising LAU1 spatial units and by using novel data represented by the local incomes to the budget of all LAU1 units. With this novel methodology and data in background P1 has determined the spatial and temporal patterns of inequalities.
- 3.2.1.2. P1 has developed a new method on delimiting spatial patterns of inequalities based on the spatial autocorrelation calculations at a high level of spatial granulometry.
- 3.2.1.3. P1 has developed a new method in determining spatial polarization based on the calculation of multidimensional convergence and the delimitation of convergence clubs at regional level.
- 3.2.1.4. P1 has developed a new methodology for the measurement of the Sustainable Development Goals.
- 3.2.1.5. P1 has strongly emphasised the geovisualisation of spatial inequalities based in GIS techniques.
- 3.2.1.6. We expect that all these outputs will have a strong impact on the formulation of spatial policies by providing a more precise empirical evidence for a better understanding and management of spatial inequalities at regional level.

3.3. Partner 2 (Faculty of Political, Administrative and Communication Sciences, Babeș-Bolyai University)

3.3.1. Conceptual, methodological, and practical implications

- 3.3.1.1. The development of the research instrument for the main survey, along with the CO and the other project partners.
- 3.3.1.2. Development of the panel study database. The database will be further used to promote policies that can lower social inequalities.
- 3.3.1.3. Development of a database of the panel data along with the data of the census carried out in Romania in 1930, at the grid level, including data on education, ethnicity, religion and membership before 1918 in the Austro-Hungarian Empire. Here is an imagine of the interconnected database, in SPSS:

BazaCompleta_UBB_ValoriCulturale_v3_21feb.sav [DataSet1] - IBM SPSS Statistics Data Editor

	Name	Type	Width	Dec.	Label	Values	Missing	Columns	Align	Measure	Role
1	id_unic	Numeric	8	2		None	None	10	Right	Scale	Input
2	STIME_V	String	999	0	Data incepere chestionar	None	None	21	Left	Nominal	Input
3	FTIME_V	String	999	0	Data finalizare chestionar	None	None	21	Left	Nominal	Input
4	Age	Numeric	3	0	Age	None	None	8	Right	Scale	Input
5	Q1_r1	Numeric	1	0	Q1. Incredere in familie	{1, Foarte m... 5, 6		8	Right	Nominal	Input
6	Q1_r2	Numeric	1	0	Q1. Incredere in oamenii pe care ii intalnitii p...	{1, Foarte m... 5, 6		8	Right	Nominal	Input
7	Q1_r3	Numeric	1	0	Q1. Incredere in oamenii de alta religie	{1, Foarte m... 5, 6		8	Right	Nominal	Input
8	Q1_r4	Numeric	1	0	Q1. Incredere in oamenii de alta nationalitate	{1, Foarte m... 5, 6		8	Right	Nominal	Input
9	Q2	Numeric	1	0	Q2. Situatii stresante ultimele 6 luni	{1, Deloc}...	None	8	Right	Nominal	Input
10	Q3	Numeric	1	0	Q3. Afectat de situatii stresante	{1, Foarte p... None		8	Right	Nominal	Input
11	Q4_r1	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: furie	{1, Deloc}...	None	8	Right	Nominal	Input
12	Q4_r2	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: ne...	{1, Deloc}...	None	8	Right	Nominal	Input
13	Q4_r3	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: an...	{1, Deloc}...	None	8	Right	Nominal	Input
14	Q4_r4	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: ing...	{1, Deloc}...	None	8	Right	Nominal	Input
15	Q4_r5	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: de...	{1, Deloc}...	None	8	Right	Nominal	Input
16	Q4_r6	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: tris...	{1, Deloc}...	None	8	Right	Nominal	Input
17	bucurie	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: bu...	{1, Deloc}...	None	8	Right	Nominal	Input
18	Q4_r8	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: calm	{1, Deloc}...	None	8	Right	Nominal	Input
19	fericire	Numeric	1	0	Q4. Stare de spirit ultimele 2 saptamani: feri...	{1, Deloc}...	None	8	Right	Nominal	Input
20	Q5_r1	Numeric	1	0	Q5. Important in postul ideal: A avea suficien...	{1, Cea mai ... None		8	Right	Nominal	Input
21	Q5_r2	Numeric	1	0	Q5. Important in postul ideal: A avea un sef ...	{1, Cea mai ... None		8	Right	Nominal	Input
22	Q5_r3	Numeric	1	0	Q5. Important in postul ideal: A primi recuno...	{1, Cea mai ... None		8	Right	Nominal	Input

3.3.1.4. Dissemination of the research outcomes.

3.3.1.5. The development of policy briefs on topics that promote the education; Socio-economic development through stimulating economic policies; The emergence of new jobs (eg with increased occupational prestige) through economic policies and stimulating entrepreneurial developments in such fields; Urbanization:

Angi Daniela & Gabriel Bădescu. 2020. "PISA ca instrument pentru politici educaţionale", in PISA 2018: Ce ne spun noile rezultate PISA despre inegalităţile educaţionale din România? (pp. 18-20). Bucharest: Institutul pentru Solidaritate Socială;

3.3.2. Relevant selected publication within the project

3.3.2.1. Angi, Daniela, Gabriel Bădescu, Sorana Constantinescu. 2022. Democratic effects of youth civic engagement: Romania in a comparative perspective. Civil Szemle. Vol. 3. 251-270

3.3.2.2. Chris Foulds, Sarah Royston, Thomas Berker, Efthymia Nakopoulou, Zareen Bharurcha, Rosie Robison, Simone Abram, Branko Ančić, Efsthios Arapostathis, Gabriel Badescu, et. al. 2022. An agenda for future Social Sciences and Humanities research on energy efficiency: 100 priority research questions. Humanities and Social Sciences Communications. (2022) 9:223. <https://doi.org/10.1057/s41599-022-01243-z>

3.3.2.3. Badescu, Gabriel, Sorin Gog, Claudiu Tufis. 2022. Atitudini si valori de tip progresist in Romania. Friedrich Ebert Stiftung Romania. June 2022. DOI: 10.13140/RG.2.2.27806.61763

3.3.2.4. Mihut, Georgiana, Gabriel Badescu. 2022. Învăţământul Post-secundar în România. www.researchgate.net/publication/361174350_Invatamantul_Post-secundar_in_Romania

3.3.2.5. Badescu, Gabriel. 2022. Contextual determinants of Covid-19 vaccination in Romania. Policy Brief. Center for the Study of Democracy. https://democracycenter.ro/application/files/5816/4181/3079/Determinants_of_Covid_vaccination_in_Romania.pdf

3.3.2.6. Angi, Daniela, Burean, Toma, Constantinescu, Sorana, Radu, Bogdan 2022, Scurt ghid pentru identificarea și evaluarea legăturii dintre iliberalism și știri false (lb. rom. & lb. engl) (<https://drive.google.com/file/d/1O40vNL8J1Km2jE3DC4MuuJAx8rAoi-Q-/view>)



3.3.2.7. Constantinescu, Sorana-Alexandra, and Maria-Henriete Pozsar. 2022. "Was This Supposed to Be on the Test? Academic Leadership, Gender and the COVID-19 Pandemic in Denmark, Hungary, Romania, and United Kingdom" Publications 10, no. 2: 16. <https://doi.org/10.3390/publications10020016>

3.3.2.8. Negru-Subțirică, Oana, Gabriel Bădescu. 2021. Social Change and the Dynamic Family Transmission of Youth Vocational Competence. In: Dimitrova R., Wiium N. (eds) Handbook of Positive Youth Development. Springer Series on Child and Family Studies. Springer, Cham. (2022)9:223 https://doi.org/10.1007/978-3-030-70262-5_34

3.3.3. Relevant selected publication accepted for publication

3.3.3.1. Sorana Constantinescu, Lorin Ghiman, Adela Pop-Cîmpean. "Cyberbullying during the pandemic: An exploratory study about on Romanian university students", The Critical Review, 2022

3.3.3.2. Victor Cepoi. Romania: Investing in the European Union economy – a focus on recovery policies. 2022(accepted, upcoming). in Tamara Besednjak Valič, Erika Džajić Uršič, Borut Rončević. Development and implementation the EU long-term policies: sociological, policy, legal and regional considerations. Peter Lang.

3.3.4. Relevant selected publication currently under review

3.3.4.1. Angi, Daniela, Jozsef Benedek, Gabriel Bădescu, Sorana Constantinescu, "Historical Legacies and Their Impact on Human Capital: Comparing Regions within Romania", Europe Asia Studies

3.3.4.2. Paul Sum, Gabriel Bădescu. "Collaboration and socio-economic inequality: Estimating the effects of intra-school and inter-school inequality on learning collaborative problem solving skills", Learning and Individual Differences.

3.3.5. Conference presentations

3.3.5.1. Gabriel Bădescu, Daniela Angi, Sorana Constantinescu. When Children Need Protection from Parents: Citizens' Views in Romania and Norway and their Determinants. The International Society for the Prevention of Child Abuse & Neglect (ISPCAN). Tallinn, June 2022

3.3.5.2. Sorana Constantinescu, Sava Alexandru, "Shifting and reinforcing the borders of European identity: East-European xenophobia as an assimilation strategy", the Society for Romanian Studies 2022 Conference: Borders and Transfers, June 15-17, 2022, Universitatea de Vest, Timișoara.

3.3.5.3. Daniela Angi, Gabriel Bădescu. "Values, procedures and the relativity of the 'right thing to do'. A discussion of the Bodnariu case". Bergen Exchanges on Law & Social Transformations. 22-26 August 2022, Bergen, Norvegia.

3.4. Partner 3 (Department of Theoretical and Computational Physics, Babeș-Bolyai University)

3.4.1. Conceptual, methodological, and practical implications

3.4.1.1. The carefully collected data and the unified database will allow further experimentally documented studies on socio-economic inequalities and their general trends.

3.4.1.2. The web-based applet elaborated for studying general correlations between economic, social and psychological data will open new possibilities for researchers that intend to study such problematics. It can trigger many master dissertations, PhD thesis and scientific publications in various fields. It will promote interdisciplinary studies as well.

- 3.4.1.3. The applicability of the LGGR dynamical model to wealth and income dynamics was proved. This modeling paradigm revealed the main mechanism that are controlling socio-economic inequalities. In order to reduce these inequalities, the preferential growth of wealth and income has to be controlled. The Pareto-like tail of income and wealth distribution (giving birth to large income and wealth inequalities) are directly linked to the preferential growth mechanism. Therefore we proved the tight connection of social inequalities with the multiplicative growth present in the free-market economy. Controlling this multiplicative growth has to be the main action-plan in political actions that intend to reduce the inequality levels in our societies.
- 3.4.1.4. Introduction of the new quantity, *Gintropy*, linking Entropy and the Gini index, will open new connections between classical modeling methodologies used in statistical physics. *Gintropy* can well become the missing link in order to generalize rigorously statistical thermodynamic measures and quantities to socio-economic phenomena.
- 3.4.1.5. The obtained quantitative results are useful in the design of cohesion policies, with the main goal of reducing inequalities between counties. The empirical strategy used to construct the composite index of well-being may be a starting point in the development of a multidimensional metric for measuring and monitoring over time of the well-being disparities in Romania. Also, the stylized empirical findings about the structural transformations of the Romanian economy may be seen as premises for outlining a future trend of decreasing income inequality; however, economic growth should be accompanied by fiscal and social policies.
- 3.4.1.6. Training future specialist in interdisciplinary research is also an important impact. Beside the PhD students involved in these research (Istvan Gere and Szabolcs Kelemen) for a wider dissemination we realized an open-access, MOOS lecture series for training students in physics and economics in the area of econophysics. These courses were given by specialists both from physics and economics (www.phys.ubbcluj.ro/~zneda/econophys) and through these we realized an opportunity for continuing such research with new students.

3.4.3. Relevant, selected publication within the project:

- 3.4.3.1. Biró, T. S., Nédá, Z., & Telcs, A. (2019). [Entropic divergence and entropy related to nonlinear master equations](#). *Entropy*, 21(10), 993.
- 3.4.3.2. Biró, T. S., & Nédá, Z. (2020). [Gintropy: Gini index based generalization of Entropy](#). *Entropy*, 22(8), 879.
- 3.4.3.3. Nédá, Z., Gere, I., Biró, T. S., Tóth, G., & Derzsy, N. (2020). [Scaling in income inequalities and its dynamical origin](#). *Physica A: Statistical Mechanics and its Applications*, 549, 124491.
- 3.4.3.4. Biró, T. S., Csillag, L., & Nédá, Z. (2021). Transient Dynamics in the Random Growth and Reset Model. *Entropy*, 23(3), 306. DOI: <https://doi.org/10.3390/e23030306>
- 3.4.3.5. Schneider, L., Scholten, J., Sándor, B., & Gros, C. (2021). Charting closed-loop collective cultural decisions: from book best sellers and music downloads to Twitter hashtags and Reddit comments. *The European Physical Journal B*, 94(8), 1-13. DOI: [10.1140/epjb/s10051-021-00173-0](https://doi.org/10.1140/epjb/s10051-021-00173-0)
- 3.4.3.6. Gere, I., Kelemen S., Biro, T.S., and Neda Z., Wealth distribution in villages. Transition from socialism to capitalism in view of exhaustive wealth data and a master equation approach, *Frontiers in Physics*, vol. 10, 827143 (2022), <https://doi.org/10.3389/fphy.2022.827143>



- 3.4.3.7.Lazar, D. and Litan, C.M. (2022). Regional well-being in Romania: assessment after a decade of EU accession. *International Journal of Social Economics* 49(7), 1009-1028.
- 3.4.3.8.Lazar, D. and Litan, C.M. Inequality, growth and structural transformations: New evidence from a Post-communist economy. *Comparative Economic Studies*. Revise and Resubmit (Second Revision).
- 3.4.3.9.Lazar, D. (2021). The relationship between wellbeing dimensions and GDP: a regional empirical study. *Review of Economic Studies and Research Virgil Madgearu* 14(2), 45-57.
- 3.4.3.10. Benedek, J., Varvari, Ș. and Litan, C.M. (2019). Urban Growth Pole Policy and Regional Development: Old Wine in New Bottles?. In: Lang, T., Görmar, F. (eds) *Regional and Local Development in Times of Polarisation. New Geographies of Europe*. Palgrave Macmillan, Singapore. *Joint publication with Partner 1*.

3.4.4. Databases and visualization

- 3.4.4.1.The data is accessible with copyright restriction (password locked):
<https://atom.ubbcluj.ro/ropsy-data>
- 3.4.4.2.The programs and applet are accessible with copyright restriction (password locked):
<https://atom.ubbcluj.ro/RoPsyCorr>

3.4.5. Conference presentations

- 3.4.5.1.Z. Neda, I. Gere and T.S. Biro, *Income distribution in a new perspective from empirical data to a novel modeling*, prezentare orală FENS 2019, (10th Polish Symposium on Physics in Economy and Social Sciences) (Warsaw, Poland), 3-5 Iulie, 2019, oral presentation: <https://fens2019.ncbj.gov.pl>
- 3.4.5.2. Z. Neda: *Vagyon és jövedelemeloszlás a társadalmakban - fizikai modellek és a valóság (Distribuții de venituri și averi în societăți - modele fizice și realitatea)* - prezentare orală invitată. Zilele fizicii statistice din Ungaria, organizator: Academia de Științe din Ungaria, Budapesta 26 Aprilie, 2019
- 3.4.5.3.T.S. Biro, A. Telcs and Z. Neda, *Dynamical LGGR Model for Income Distributions*, presentation at MECO 45 (14-16 Sept. 2020) online conference
- 3.4.5.4.Z. Neda, T.S. Biro, G. Toth, I. Gere, Sz. Kelemen, *The growth and reset model for social inequalities*, 11-th Polish Symposium on Physics in Economy and Social Sciences, 01.07-03.07 2021, online webpage: <https://indico.fis.agh.edu.pl/event/69/>
- 3.4.5.5.Z. Neda, MECO47 (Middle European Cooperation in Statistical Physics, 12-14 June 2022, Erice, Italy) *A unified approach to wealth and income inequalities in modern societies*. <https://meco47.sciencesconf.org/resource/page/id/9>
- 3.4.5.6.S. Kelemen, I. Gere, T. Biro and Z. Neda, MECO 47 (Middle European Cooperation in Statistical Physics, 12-14 June 2022, Erice, Italy) *Wealth inequalities in different socio-economic situations, Exhaustive data and a general modelling framework*. <https://meco47.sciencesconf.org/resource/page/id/10>
- 3.4.5.7.Z. Neda, BIODYNAMICS, A transdisciplinary approach -invited talk (Academia Romana și Institutul de Biodinamica, București, 19-21 May, 2022) *The growth and reset dynamics in Complex Systems*. <https://sites.google.com/view/biodynamics2022/home>
- 3.4.5.8.I. Gere, Sz. Kelemen, T.S. Biro and Z. Neda; Econophysics Colloquium 2022 (August 24-26, 2022, Thessaloniki, online) *Wealth inequality patterns based on exhaustive sampling. Data mining and modelling*. <https://ec2022.auth.gr/>
- 3.4.5.9.Sz. Kelemen, M. Jozsa and Z. Neda; Econophysics Colloquium 2022 (August 24-26, 2022, Thessaloniki, online) *Estimation of the Gini coefficient from incomplete datasets*. <https://ec2022.auth.gr/>



3.4.5.10. Litan C. and Lazar D. Workshop: „Understanding and modelling time-space patterns of psychology-related inequalities and polarization”, 1st of June 2020, *Regional well-being in Romania: measures and inequalities*.

3.5. Partner 4 (Bucharest University of Economic Studies)

3.5.3. Relevant selected publication within the project

- 3.5.3.1. Ceptureanu, S. I., & Ceptureanu, E. G. (2019). Community-based healthcare programs sustainability impact on the sustainability of host organizations: A structural equation modeling analysis. *International Journal of Environmental Research and Public Health*, 16(20), 4035.
- 3.5.3.2. ANDREI, T., & MIRICĂ, A. (2019). Key Features of the Internal Migration Process in Romania-An Economic and Historical Perspective. *Romanian Statistical Review*, (2).
- 3.5.3.3. Ceptureanu, S. I., Ceptureanu, E. G., Cristescu, M. P., & Dhesi, G. (2020). Analysis of social media impact on opportunity recognition. A social networks and entrepreneurial alertness mixed approach. *Entropy*, 22(3), 343.
- 3.5.3.4. Lozano, R., Fullman, N., Mumford, J. E., Knight, M., Barthelemy, C. M., Abbafati, C., ... & Cárdenas, R. (2020). Measuring universal health coverage based on an index of effective coverage of health services in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1250-1284.
- 3.5.3.5. Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., ... & Bhutta, Z. A. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1204-1222.
- 3.5.3.6. Murray, C. J., Aravkin, A. Y., Zheng, P., Abbafati, C., Abbas, K. M., Abbasi-Kangevari, M., ... & Borzouei, S. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1223-1249.
- 3.5.3.7. Micah, A. E., Su, Y., Bachmeier, S. D., Chapin, A., Cogswell, I. E., Crosby, S. W., ... & Moghadaszadeh, M. (2020). Health sector spending and spending on HIV/AIDS, tuberculosis, and malaria, and development assistance for health: progress towards Sustainable Development Goal 3. *The Lancet*, 396(10252), 693-724.
- 3.5.3.8. Andrei, T., Bourbonnais, R., Oancea, B., & Mirica, A. (2020). Mixed Marriages in Romania–The Case of the Hungarian Minority. *Economic Computation and Economic Cybernetics Studies and Research*, 54(1).
- 3.5.3.9. Wang, H., Abbas, K. M., Abbasifard, M., Abbasi-Kangevari, M., Abbastabar, H., Abd-Allah, F., ... & Damiani, G. (2020). Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates in 204 countries and territories, 1950–2019: a comprehensive demographic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1160-1203.
- 3.5.3.10. Wiens, K. E., Lindstedt, P. A., Blacker, B. F., Johnson, K. B., Baumann, M. M., Schaeffer, L. E., ... & Das, J. K. (2020). Mapping geographical inequalities in oral rehydration therapy coverage in low-income and middle-income countries, 2000–17. *The Lancet Global Health*, 8(8), e1038-e1060.
- 3.5.3.11. Reiner Jr, R. C., Wiens, K. E., Deshpande, A., Baumann, M. M., Lindstedt, P. A., Blacker, B. F., ... & Denova-Gutiérrez, E. (2020). Mapping geographical inequalities in childhood diarrhoeal morbidity and mortality in low-income and middle-income



- countries, 2000–17: analysis for the Global Burden of Disease Study 2017. *The Lancet*, 395(10239), 1779-1801.
- 3.5.3.12. Deshpande, A., Miller-Petrie, M. K., Lindstedt, P. A., Baumann, M. M., Johnson, K. B., Blacker, B. F., ... & Darwish, A. H. (2020). Mapping geographical inequalities in access to drinking water and sanitation facilities in low-income and middle-income countries, 2000–17. *The Lancet Global Health*, 8(9), e1162-e1185.
- 3.5.3.13. Ceptureanu, E. G., Ceptureanu, S. I., Herteliu, C., & Cerqueti, R. (2020). Sustainable consumption behaviours in P2P accommodation platforms: An exploratory study. *Soft Computing*, 24(18), 13863-13870.
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4. General conclusions

Taking into account the work of each individual partner and the joint activities, we consider that all objectives of the project were attained. The project generated a unique data set containing extensive data on psychological, attitudinal, economic, and developmental indicators, mapped on the administrative organization of the Romanian territory, which has been made publicly available on the project's website. This data set has been the foundation for achieving the other objective of the projects, but will also serve as valuable resource for the partners and the general scientific community for future analyses on the evolution of PESH indicators across Romanian regions, for either research or policy recommendations.

The partners in the project have also generated an extensive set of maps comprising the distribution of psycho-social and socio-economic indicators across Romania. The maps have been organized both on the classical administrative and historical divisions of Romanian territory (NUTS I-III), but also based on clusterization techniques, allowing the regions to group together based on their similarities on the same indicators, or based on the convergence (correlation) of the



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indicators. The depth of the knowledge that has been gained about the geographical distribution of psychological, social, political, and economic indicators across Romania is comparable to the available knowledge for other developed countries where such analysis were performed in the last decade.

Perhaps the most extensive work performed by the partners is reflected in the various methods and the complexity of the analyses that were conducted to understand the relationships between psycho-social and PESH indicators (with special focus on inequalities and polarization indicators). The work conducted includes several innovations, including an aggregated regional-level analysis of the cognitive-behavior model derived from evidence-based clinical psychology, a new methodology for measuring the Sustainable Development Goals, which combines classical and progressive data sources (e.g., satellite images), a complex analysis on the impact of historical literacy and modern days development in the Romanian countries that were part of the Austro-Hungarian Empire prior to 1918, and a complex approach to modeling income inequalities using the Local Growth with Global Reset model (Biro-Neda model).

The project has facilitated the publication of a large number of scientific articles (58 indexed in Web of Sciences) and multiple other international and national publications in respected journals or published by reputed publishing houses. The partners also had an extensive outreach in the scientific community, with several participations at prestigious international conferences in each year of the project.

Based on the work that was conducted in the project, several public policy documents have been elaborated, covering topics such as the development of a modernity index for Romania, fake news and vaccination during COVID-19 pandemic, post-secondary education, and the implications of international standardized tests for the Romanian educational system.