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Social protection in Europe, a comparative and correlative research

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Abstract: *The involvement of the state in the market economy through the redistribution of welfare is necessary for moral and economic reasons. The need for a system of social protection is developed in all advanced states to reduce the 'social risks' of the living standards of citizens. Our research aimed to identify the particularities of the governmental social protection policies in the EU states to be able to compare and analyze them correlatively. The main research tools are the cluster method, followed by the visual assessment of cluster tendency (VAT) algorithm for research results validation, and the Hopkins statistic for checking the spatial randomness of the data. The main research variables are public expenditures on social protection and the human development index for the period 2018-2019. The data were collected from Eurostat and Statista. The research results show that the European states are grouped into four clusters. Based on the research analysis results, the European social policies should be better designed and applied with an increased level of public expenditures to raise the population's standard of living and reduce the gaps among European citizens.*

Keywords: social protection, government expenditure, human development index.

JEL: A13, H55, M14

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Introduction

Social protection plays a key role in modern states and is considered a defining pillar of the European Union. The ideological framework of social protection varies historically and geographically in Europe, with different emphasis on compensating for structural disadvantage, social investment, redistribution of resources throughout

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life and between generations, solidarity with risks, empowerment of the most vulnerable citizens, and support respect for human rights. However, there is a clear consensus that governments should ensure the well-being of citizens. Social protection governmental policies set objectives and appropriate ways for real social justice. The citizens benefit from social protection to ensure the increase or maintenance of their well-being. In all countries of the world, some people live in particularly difficult conditions and need special attention given the importance of each person's traditions and cultural values in the protection and development of human personality.

The governments of European states recognize the importance of international cooperation in improving the living conditions of people in all countries (Pimonenko et al., 2021). Researchers (Gonos et al., 2022; Guardiancich and Natali, 2021) show that the socio-economic factor is the one that determines the inequality that starts from the division and redistribution of wealth that has nothing to do with social laws, and then the application of the principles of social justice is required. It is especially important in terms of severe inequality, which can be latent to a great extent due to the informal economy influence (Mishchuk et al., 2018). Besides, social justice ensuring is a touchy domain regarding some vulnerable groups of the population like the elderly and caregivers (Mertl et al., 2019; Witkowska & Kompa, 2020). Therefore, the social policy adopted democratically and promoted within a state should be analyzed from two points of view: political and economic. Politically, throughout history, the function of social protection exercised over citizens has been gradually replaced by the function of assistance, with a shift from civil rights (life, property) to economic and social rights (the right to work), social assistance, in this case, illness or old age, organization and direct provision of social services, etc.). The different forms of social protection for citizens and the variable resources allocated by state governments contribute to ensuring the standard of living.

The standard of living should not be assessed solely by measuring income, social benefits, or capital goods. It must be assessed through a complete list of indicators such as indicators of education, employment, duration of work, working environment, living conditions, transport and telecommunications, criteria for assessing social relations and political, social security, social mobility, etc. Social protection is materialized through social programs that include measures and tools designed to increase the standard of living and improve the quality of life and protect the population from the negative effects that may occur in certain periods determined by different economic and social conditions (Andrei &Luca, 2022).

The main areas and social categories in which social protection measures are applied in different European countries are the protection of the unemployed, protection of the environment, workers, and the public, protection of consumers, protection of public health, protection of people with disabilities, protection of children and youth and others. others. One should underline that besides the governments and local governments that have numerous instruments to conduct such activities (e.g. special

economic zones – see Borowiecki & Makieła, 2019), there are a number of other institutions such as NGOs, and social enterprises (e.g. Urmanavičienė & Čižikienė, 2017; Shpak et al., 2017) that are involved in widely understood social protection tasks. Their engagement is extremely important. Moreover, in all developed countries, insurance, and social protection systems have been progressively established, designed to protect all or part of the population against risks related to health, daily life, and employment. These systems often followed original, administrative, associative, or mutualistic paths to develop. Social protection is just a set of income redistribution mechanisms that contribute in times of crisis to sustaining economic activity and maintaining a certain social cohesion supported by state governments through specific categories of public spending. The research underlying this paper was conducted from this perspective. In this research, we analyzed the main categories of government expenditures for social protection in the period 2018-2019.

1. Social protection in the literature

According to the literature, there are differentiated approaches to social protection directly correlated with the level of economic development of a state. Government social policies will accompany any change in the economic system. The opportunity of some objectives will also be different, as both the financial and natural resources of the states are different. An effective social protection system is not only a moral and political requirement but also an economic one. The polarization of society into rich and poor citizens is an organic phenomenon. Between these two categories, there is a diversity of groups included in the category of those with a good level of well-being or those with limited resources and modest possibilities (Pereira & Procopiuck, 2022). Hence the differentiated access of citizens to the goods and services on the market. This aspect makes it necessary to approach the problem of social protection differently. This is also the premise from which our research starts. Allowing citizens with limited means of living to legally procure, independently, the necessities of life without state protection is morally unacceptable and becomes politically dangerous.

Researchers (Androniceanu A-M et al. 2022; Barrientos, Hulme, 2008; Bowen, 2020; Cepiku, 2020) point out that social protection is based on social and economic factors and the efficiency of the measures taken. The provision by the state administration of the necessary resources to cover various general needs is a normal orientation in social policy, contributing to the satisfaction of the citizen's interests.

Social policy is a set of goals and analysis tools, through which state governments collect financial resources and distribute them from a humanistic perspective of social justice (Džupka & Horváth, 2021). Because of this, social policy is an element of regulation of economic, social, and political tensions. The elaboration of an efficient social policy depends on the application of the principle according to which the welfare of the society is decisively influenced by the welfare of each citizen. In this context, Dvorsky et al. (2021) said, that the quality of the business environment

is one of the goals of government because has a positive impact on the welfare of society. The concept of state social policy is materialized through its objectives, areas of action, and the precise nature of the measures and decisions taken. On other hand, Ardielli et al. (2020) said, that social protection is important, but exists further also important goals for governments of countries (Androniceanu & Georgescu, 2021). At the European level, social protection is based on the principles, values, and traditions that govern social relations between individuals, groups, communities, and institutions. Starting from these points, the social policies of the European states contain measures and actions for ensuring aimed at ensuring a certain level of welfare and social security for the whole population and especially for certain social groups. According to the literature (Sabato et al., 2019), social protection has two main and basic components: contributory social security and non-contributory social assistance. Social Protection in the EU states has to support those who are in a difficult situation to break the deadlock and reintegrate them into society, to remain active in the labor market. Social protection takes into account material living conditions and social conditions. Material conditions mean employment, income, housing, etc., and social conditions include health, education, social environment, etc. (Verdun & Zeitlin, 2018; Kudins, 2022). The European Commission (European Commission and Social Protection Committee, 2021) supports and complements Member States' policies in the areas of social protection and social inclusion. The measures established by the European Commission complemented other initiatives: job-generating recovery; strategy for adequate and secured pensions, and employment measures for young people (Mazzanti et al., 2021; Graziano & Polverari, 2019; Hitka et al., 2018). Therefore, social protection has both material objectives and social objectives. Social protection is provided mostly by government institutions, but private or non-governmental organizations also contribute to it in many states. Most social protection expenditures are financed by compulsory taxes levied by state central governments and regional or local authorities. Employers 'and employees' social security contributions allow the financing of social security expenses. Private administrations are funded by donations from individuals and any grants received from the state, local authorities, non-governmental organizations, or even international or regional organizations. For example, the European Union pays subsidies to certain associations dealing with food aid or housing for excluded or marginalized citizens of the Member States (Copeland & Daly, 2018; Darvas & Leandro, 2015).

Social protection is the responsibility of various social security organizations (health insurance, family benefits, old-age insurance, accidents at work, and occupational diseases), or other institutions (supplementary pension schemes, unemployment schemes, optional supplementary health insurance schemes, such as mutual aid and prudential institutions). Organizations of this type vary greatly from country to country. According to researchers (Guidi and Guardiancich, 2018), there are two main approaches to social protection, which vary from state to state. The insurance model is the first model, which aims to cover social risks through horizontal

redistribution, without resource conditions. This model, which materializes in unemployment insurance, pensions, etc., is financed by social contributions from employees and employers. According to this model, the state operates a mandatory national mutualization of social risks. This approach prevailed in France when General de Gaulle created social protection. A second model is the assistance model that covers the social risks of the most disadvantaged (who cannot contribute) by operating a vertical redistribution. The care-focused model aims to reduce inequalities. It is financed by proportionate and progressive taxes and fees such as income tax in France. Social benefits are thus paid subject to the verification of the means. This model is becoming increasingly dominant in current models of social protection in European countries. The two models are complementary, but their place varies by country.

Most social protection institutions are public, non-profit institutions that perform a public service mission under the close control of the state, which oversees them. They are part of a solidarity system and are therefore excluded from free competition. Social protection systems around the world aim both to help citizens and their families, especially poor and vulnerable households, to overcome crises and shocks, to find jobs and invest in health and education, and to protect those who age.

Over time, the concept of universal social protection has developed. Universal social protection aims to ensure that anyone in need of social protection can have access to it at any time. These include child benefits, old-age pensions for the elderly, and benefits for the elderly in the event of maternity, disability, accidents at work, or unemployment. This assistance can be provided through social security and assistance systems that ensure the basic income.

With a well-designed and implemented social protection system, a country will be better prepared to increase human capital and increase productivity, reduce inequality, build resilience and reduce the transmission of poverty from generation to generation (Abramo et al, 2019; Mura et al., 2021; Minárova et al., 2021). The European countries use an average cost of 1.5 - 2% of GDP for employment and social protection. Social protection is linked to sustainable development, as it involves solidarity between human beings, especially between generations.

As in other sectors of activity, social protection raises sustainability issues, very difficult to solve: for old age, for example, we realize today, with current demographic developments, that the high ratio between the number of retirees and the number of active people presents a tax that increases assets so that contributions strike a greater balance between the benefits of pension funds. This phenomenon also affects the branch of social security disease, as the largest consumers of health care are the elderly. This leads to chronic deficits in the branches of illness and old age, which are regularly transferred to debt management organizations, such as the Social Debt Amortization Fund (CADES) in France, or simply included in state debt. However, we can see that this situation is not sustainable, as it leads to the transfer

of the burden of social benefits to future generations, who will have to repay this debt. The research underlying this paper compares and analyzes the correlations between government spending by European state governments for the social protection of citizens in their states. The next section of the paper contains the most important research results using the cluster method.

2. Research methodology, analysis, and main results

The purpose of this research was to analyze comparatively and correlatively the main indicators of public expenditure by which the member states of the European Union finance social protection. One of the main research objectives was to determine the social indicator's implications for the European citizen's well-being as it is reflected by the Human Development Index (HDI). Another research objective was to find out and analyze the inter-relationships between social indicators, the Human Development Index (HDI), and the public expenses of the European states. To achieve the above purpose and research objectives six research variables were selected from the Eurostat and Statista databases and are presented in Table 1. The research was conducted based on social indicators and HDI from 2018 to 2019, for which complete sets of statistical data were identified.

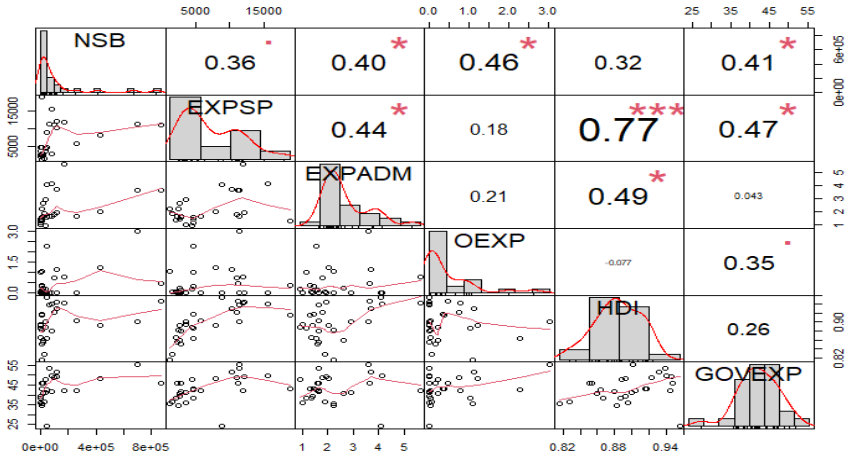
Table 1. The definitions of variables

Variable	Description of the variable	bbreviation symbol of the variable	Range of possible values	Source
Net social protection	Transfers, in cash or kind, are made to relieve households and individuals of the burden of one or more social risks or needs	NSB	Millions Euro	Eurostat
Total expenditure on social protection per head of population. ECU/EUR	Social benefits, administration costs, other expenditure	EXPSP	Euro per inhabitant at constant 2010 prices	Eurostat
Total expenditure on administration costs	The costs charged to the scheme for its management and administration	EXPADM	Percentage of total expenditure	Eurostat
Human Development Index	Statistic ranking countries around the world by the Level of human development	HDI	[0,1]	Statista

Variable	Description of the variable	ɔbreviation symbol of the variable	Range of possible values	Source
Other expenditures on social protection	Miscellaneous expenditure (payment of property income and other).	OEXP	Percentage of total expenditure	Eurostat
General government expenditure by function	Government expenditure according to 10 major functions or purposes	GOVEXP	Percentage of gross domestic product (GDP)	Eurostat

The most important correlations between the main research variables in the analyzed period 2018-2019 and their clustering are found in the Pearson Correlation Matrix (Figure 1).

Figure 1. Pearson Correlation Matrix



The correlation matrix shows positive correlations between all six indicators. The distribution of each variable is represented on the main diagonal. Below the main diagonal, the scatterplots with fitted lines are shown. Above the main diagonal, the correlation coefficients and the symbols of the significance levels (p-values) are shown: (p<.001) "***", (p<0.01) "**", (p<0.05) "*", (p<0.1), "." (Kassambara, 2017). There is a strong positive connection (0.77) between net social protection and HDI, a hypothesis confirmed by Tomassi (2010). The social benefits that citizens receive through social protection provide economic stability and an acceptance to technological changes (Tomassi, 2010), therefore an increase of welfare and human

development. Social protection in long term contributes to economic growth through policies meant to increase income and protect against various shocks (Caminada et al. 2019). The same positive relation exists between government expenditure and HDI (0.26), a hypothesis confirmed by Shafuda and De (2020). Public expenditure, for example on education and the healthcare system, improves human development. An OECD study (Causa and Hermansen, 2017) reveals that redistribution by income taxes and transfers softens the income inequality for the working population in more than a quarter of OECD countries. K-means clustering (MacQueen, 1967) is an unsupervised machine learning technique that partitions the dataset into a predefined number of different non-overlapping clusters, where each point belongs to one cluster. The K-means algorithm assigns each point to its nearest center, making a cluster. The points in the same cluster have similarities different from other clusters. The advantages of the K-means algorithm are that it has an easy implementation, it works faster for large datasets and it produces clusters of different shapes and sizes. In this paper, we decided to apply K-means clustering for K=4 clusters. The software environment R will be used for the statistical processing of data. After data scaling, we obtain the following cluster plot shown in Figure 2.

Figure 2. Cluster plot

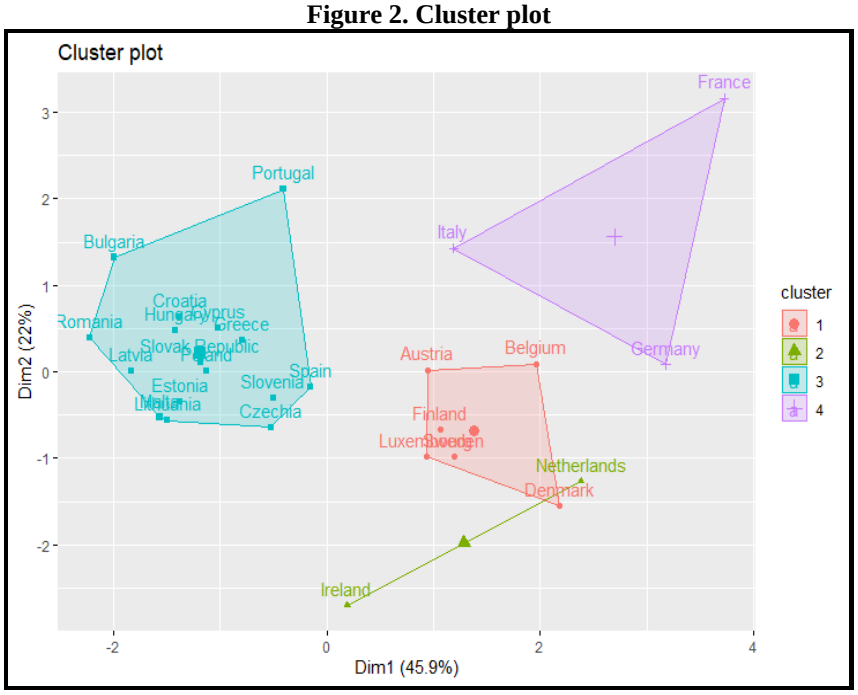


Figure 2 shows good separation of the four clusters, in a plan whose axes are the first two principal components. The first principal component explains 45.9% of the total variability, and the second principal component explains 22.6% of the total variability.

The clusters componence is the following:

Cluster 1: Belgium, Denmark, Luxembourg, Austria, Sweden, Finland

Cluster 2: Ireland, Netherlands

Cluster 3: Bulgaria, Czechia, Estonia, Greece, Spain, Croatia, Cyprus, Latvia, Lithuania, Hungary, Malta, Portugal, Romania, Slovenia, Slovak Republic

Cluster 4: Germany, France, Italy

Table 2 contains the cluster means for each variable after data scaling. One sees from Table 2 that the two countries in cluster 4, Germany and France, have the highest net social benefits and the highest government expenses in the EU. Germany is considered the economic driver of the European Union and has a bountiful social system. In recent years, Germany has paid generous social benefits to its citizens. According to OECD, in 2018-2019, France spent about 31.2% of its GDP on social programs, followed by Belgium (29.8% of GDP) and Finland (28.7% of GDP) (Abeissa, 2019).

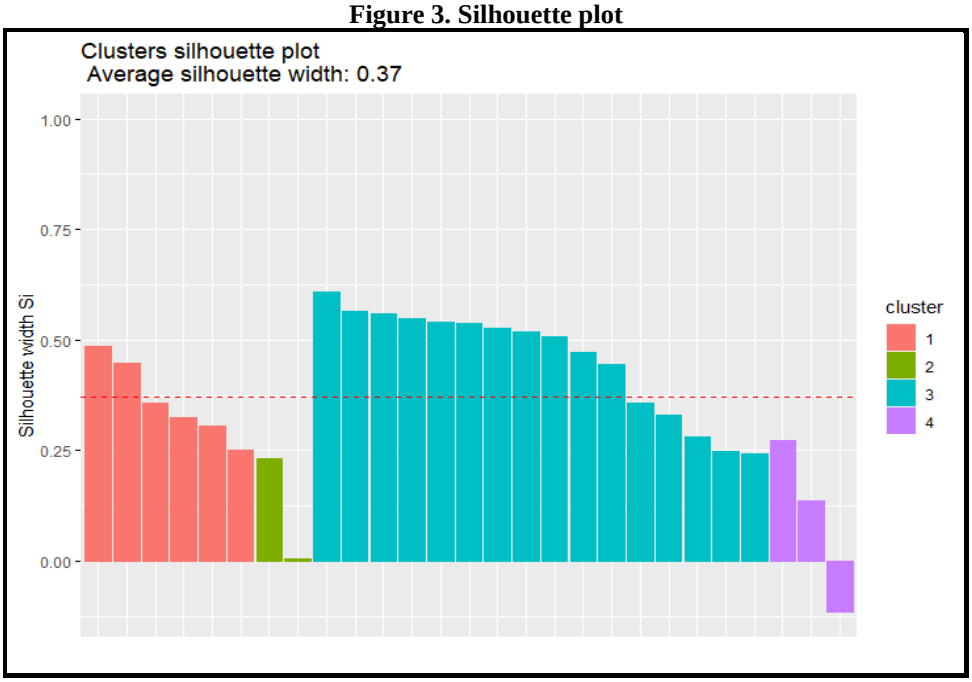
Table 2. Cluster means

No.	NSB	EXPSP	EXPADM	OEXP	HDI	GOVEXP
1	-0.19217760	1.3413478	0.1449681	-0.1455948	0.9448746	0.9265428
2	-0.07459745	0.7501152	2.2492504	-0.1367410	1.4153206	-1.4766085
3	-0.39609553	-0.7302955	-0.4709458	-0.1981638	-0.6143179	-0.3561952
4	2.54659634	0.7121369	0.7222746	1.4392241	0.4430656	1.0310277

The countries in cluster 2 have the highest HDI and the highest expenditure on administration costs. The countries in cluster 1 have the highest total expenditure on social protection per head of population. Cluster 1 contains three Scandinavian countries Denmark, Sweden, and Finland which spend more than 25% of GDP on social services. Cluster 2 can be considered a cluster of outliers. In the set of 17 EU countries, the Netherlands has the highest percent of Total expenditure on administration costs equalling 5.61% of GDP, followed by Ireland with 4.09% of GDP. Cluster 3 contains most of the EU countries.

Silhouette analysis studies the separation distance between the 4 clusters. In Figure 3 the clusters silhouette plot shows how close each point in one cluster is to points in the neighboring clusters (Rousseeuw, 1987). The silhouette width takes values in the interval [-1, +1].

Figure 3. Silhouette plot



The cluster sizes can be measured according to the thickness of the silhouette plots. One can see a negative value of the silhouette width in cluster 4; it belongs to Italy (-0.11), indicating that this country might have been assigned to the wrong cluster. The cluster silhouette widths of clusters 1 and 3 in Tabel 3 have the highest values, 0.36 and 0.46, indicating that those clusters are well determined.

Table 3 Cluster silhouette widths

	cluster	size	ave.sil.width
1	1	6	0.36
2	2	2	0.12
3	3	16	0.46
4	4	3	0.10

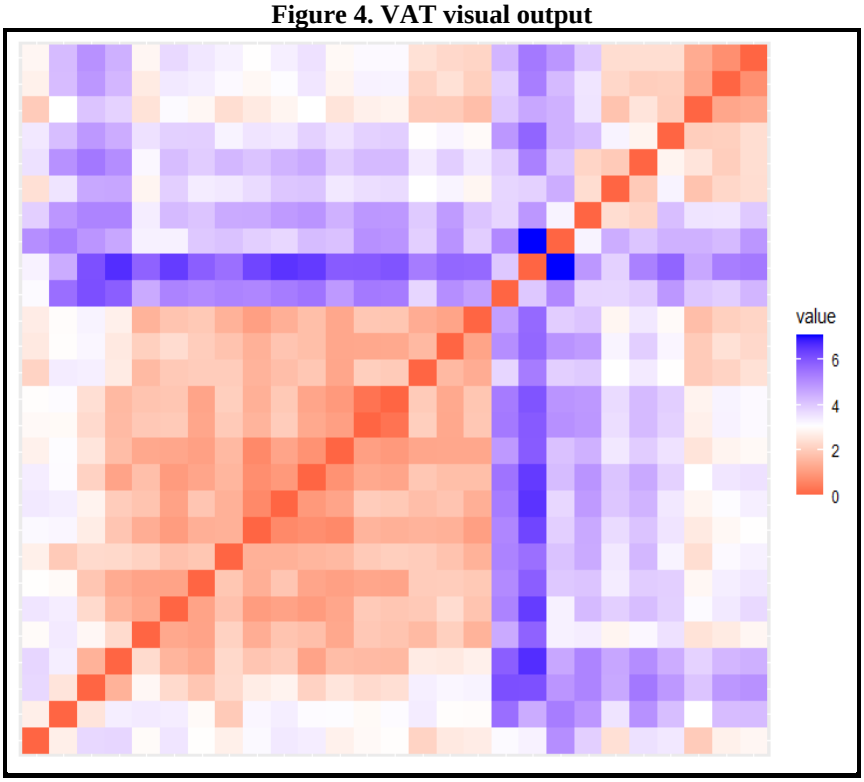
Clusters 2 and 4 have the lowest values of silhouette widths, 0.12 and 0.10, signifying that these clusters are artificial. This can be explained by the reduced number of elements in these clusters, 2 and 3, respectively. Next, we will assess the clustering tendency to check if the clustering structure is meaningful, i.e., non-random structure. The visual assessment of cluster tendency (VAT) algorithm proposed by Bezdek and Hathaway (2002) has the following steps:

1. The dissimilarity matrix between the objects is computed based on the Euclidean distance.

2. The dissimilarity matrix is ordered such that similar objects are close to each other.
3. The ordered dissimilarity matrix is the visual output.

The results of applying it are presented in Figure 4.

Figure 4. VAT visual output



The red color symbolizes high similarity (i.e. low dissimilarity) while the blue color symbolizes low similarity. The colors are pure if dist (x_i, x_j)=0 (pure red=high similarity) and dist(x_i, x_j)=1 (pure blue=low similarity).

Similar objects belong to the same cluster and are shown in consecutive order on the dissimilarity matrix. The dissimilarity matrix in Figure 4 confirms that the clustering structure is not random.

Next, we use Hopkins statistic (Lawson and Jurs 1990) to check the spatial randomness of the data.

The null hypothesis H_0 asserts that the data is uniformly distributed (no statistically significant clusters). The alternative hypothesis H_1 asserts that data is not uniformly distributed (statistically significant clusters). 0.5 is the threshold for rejecting or accepting H_0. If the Hopkins statistic is close to 1 (far above 0.5), then we reject H_0

and decide that the clusters are statistically significant. If the Hopkins statistic is greater than 0.75, then the clustering is valid at a 95% confidence level (Han et al., 2012). In our case, the H-value is 0.75, far above 0.5, therefore we conclude that the data is highly clusterable. A similar study applying the K-means algorithm and checking cluster validity was recently done by Vysochan et al. (2021) for charitable organizations in Ukraine. Beblavỳ et al. (2013) examine the correlation between education and social protection policies in OECD countries by applying different clustering algorithms, such as hierarchical and Gaussian Mixture Model clustering.

3. Conclusions

This paper used the K-means algorithm to cluster the 27 EU countries according to six variables representing social indicators, HDI, and public expenses, extracted for 2018 and 2019. The clustering resulted in 4 clusters, from which cluster 4 contains the outliers Netherlands and Ireland. One reason would be that the Netherlands has the highest percent of Total expenditure on administration costs, namely 5.61% of GDP, followed by Ireland with 4.09% of GDP. The countries in cluster 1, of which three are Scandinavian countries, have the highest total expenditure on social protection per head of population. The Hopkins statistic is 0.75, far above 0.5, therefore we conclude that the clustering is statistically significant.

Conflict of Interest Statement
There is no conflict of interest.

Acknowledgment
Not the case

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