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SUSTAINABILITY AND REGIONAL SECURITY IN THE CONTEXT OF LITHUANIA*

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Abstract. The article explores the relationship between sustainable development and the regional security complex. Problems of sustainability are widely analysed since the goals of sustainable development are based on the same principles that are relevant to every country. Implementation of the sustainable development goals contributes to the understanding that the contemporary lifestyle, consumption, globalisation and the use of natural resources may have a significant impact on the quality of life of future generations. Therefore, the state's responsibility is to ensure economic, social, environmental, cultural and political security for the present and future generations in all regions. However, the regional security complex has not been analysed sufficiently. The goal of this article is to analyse the relationship between sustainability and regional security in terms of the situation in Lithuania with regards to its economic, social and military security. The regional security complex and sustainable development may be determined and analysed by way of observing the same factors and indicators. Indicators describing economic, social and political security are analysed to reach the objective of the article. Authors of the article have chosen segmentation and classification methods such as decision making trees to conduct the research. The results of the analysis demonstrate that the economic and social factors are directly related to the political (military) security in the regions of Lithuania. Therefore, further research could focus on clarifying the full regional security complex that is relevant to each region in Lithuania.

Keywords: sustainable development; regional security; migration; economic growth

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1. Introduction

A great number of scientific articles is dedicated to the problems of sustainability or the implementation of sustainable development goals (Šimelytė, Antanavičienė 2013; Gilli et al. 2013; Neag et al. 2017; Tsai, 2018; Feliciano, 2019; Gil, et al. 2019; Savona, & Ciarli, 2019; Kim et al. 2019; Prada, 2020; Vasconcelos, 2021). The publication of the Brundtland Report by the United Nations in October 1987 prompted the interest in sustainable development issues to increase. It declared that human poverty reduces opportunities for sustainability and increases environmental pressures. These findings elicited a demand to balance ecology and economy. In a broader sense, sustainable development is defined as a compromise between environmental and social societal goals that creates possibilities to achieve social welfare for the present and future generations while keeping the environmental impact within the permissible limits (National Sustainable Development Strategy of the Republic of Lithuania 2011). Neag, Halmaghi & Cucuiet (2017) claim that sustainable development as a strategy involves all areas that are significant to achieving harmony and continuity as well as benefiting the quality of life. Furthermore, the implementation of sustainable development goals contributes to the development of every nation's long-term strategies in respect of economic, social, environmental, technological and security issues. In general, it helps to improve the quality of life of present and even future generations. Therefore, the main goal of sustainable development is to ensure security in all respects for present and future generations. It involves complicated decision making, especially when a long political process is required. Consequently, political security has a role in the implementation of sustainable development goals.

However, the scientific literature lacks analysis addressed to the relationship between the implementation of sustainable development and security issues. The relationship between the regional security complex and sustainable development is particularly poorly explored.

The *goal of the article* is to analyse the relationship between sustainability and regional security in terms of the situation in Lithuania with regards to its economic, social and military security.

For *methodological purposes, the article is divided into three parts*. The first part analyses the scientific literature on the concept of security, the regional security complex and the relationship between regional security and sustainable development goals. The second part is dedicated to data sources and the methodology of the research. The third part provides findings and discussion of the research related to the economic, social and military security. The article ends with conclusions and insights about the possibilities of further research.

2. Literature review

Concept of security. Currently, in the scientific context the complex phenomenon of security is understood much wider than military. For example, Belammy & Hunt (2015) propose that security should include four principal elements. The first element defines the object of security, the second identifies the threat and the third identifies the most advantageous means to deal with the threat. Finally, the fourth element determines what actions qualify to deal with the potential threat. Kafol & Bregar (2017) analyse cyber security and propose a methodology to guide organisations on how to create sustainable protection systems of the highest level in order to prevent cyberattacks. Kullenberg (2002) states that security should encompass economic, social and ecological aspects. Additionally, Ajdari & Asgharpour (2011) exclude physical, spiritual, internal, external, individual, social, national, humanistic, moral and defensive security. Therefore, it could be stated that security may vary across different groups based on their social, economic, cultural and political circumstances. Moreover, the security complex can change with time. In general, traditional understanding of security means being free of any threats or dangers, being safe and feeling secure and protected against any forced aggression from other individuals.

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Based on another concept, security is something that provides or ensures safety, tranquillity and certainty (Juneau, 2013; Ajdari & Asgharpour, 2011; Tang, 2009). On the other hand, human security is usually associated with economic and social security rather than other forms of security. Guaranteeing basic human rights and ensuring human security involves removing or reducing poverty, increasing wealth and providing a dignified quality of life. In general, human security refers to the satisfaction of the basic and physical needs of humans, such as food, home, education and public health (Kundhavi, & Khanal, 2018; Kline, et al. 2017) (Table 1).

Table 1. Concepts and various types of security

The meaning of security	Security type	Concept
Lack of fear	Physical	Political
Being safe	Spiritual	Social
Tranquillity	Individual	Economic
Confidence	Social	Military
Elimination of fear	National	Environmental
Freedom from any threat	Human	Cultural
Silence of the soul	Moral	

Source: Ajdari and Asgharpour, 2011

Weaver (2008) claims that economic security, political security, military security and environmental security should be studied together because security dynamics direct the interaction of the different forms of security. Furthermore, Weaver (2008) distinguishes significant differences among various forms of security, e.g. military security vs. migration security (when migration is seen as a threat), economic security vs. environmental security. Therefore, the researcher suggests a more systematic approach to the analysis of security as a complex phenomenon by drawing out peculiarities in terms of the main objects of security. For that reason, the definition of security allows further development or evolution of regional security complexes based on the changing considerations (Buzan & Wæver, 2003). Some realist scholars (Juneau, 2013; Wohlforth, 2012; Tang, 2009; Buzan & Wæver, 2003) maintain that military capacity is not possible without economic capacity. Advocates for the dependency theory claim that military expenditures slow down the economic growth (Kentor et al., 2012; Androniceanu A.-M et al., 2020a; Androniceanu A.-M, 2020b). Meanwhile, economic security is based on liberal principles and regulated international trade (Kilroy, Hataley, and Sumano (2013). Therefore, strong economy ensures security by providing a large number of public goods as well as public safety. Military capability depends on the state's expenditures on military and armed procurement and its aggregated production (Juneau, 2013; Bon-El et al., 2020). However, the state's resources and budget are limited. Consequently, higher expenditure on military means lower expenditure on other sectors such as education, the health system, environmental protection or culture. As a result, higher expenditures on military reduce social and environmental security. The cross-national panel study by Tang (2009) confirms that the growing military expenditures formulated as a percentage of GDP increase the level of unemployment in non-OECD and lower middle-income countries. On the other hand, Kentor & Kick (2008) do not find any significant positive correlation between economic growth and expenditures on military per soldier in developed countries from 1990 to 2003. However, their research shows that increased expenditures on military slow down the economies of the less developed countries. The research by Bon-El, Pecht & Tisher (2020) reveals that investing in human capital by way of the state covering higher expenses for the benefit of education results in higher military power, civilian consumption and social welfare in the future. The study by Bildirici (2016) proves that expenditures on defence and energy consumption have had a significant impact on the economic growth in China. On the contrary, despite slowing down the economy, Russia doubled its spending on defence in the decade from 2003 to 2013 and became the third largest in the world in terms of military spending (Oxenstierna, 2016). The results from various studies suggest that there may be significant links between education, military, consumption and economic growth (Androniceanu, Tvaronavičienė,

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2019). In addition, Kilroy, Hataley, and Sumano (2013) state that physical or human security may not be separate from economic security.

Regional trading blocs established since the 1950s, including EEA, EU, NAFTA and OPEC are based on memberships and international agreements. They have established stronger relationships between their members by stimulating their interdependence. Despite these regional economic agreements and memberships benefitting the member states, they can also become a source of insecurity. Trading partners within the region may experience a threat with the opening of borders resulting in an increased flow of weapons, drugs, criminals, illegal migrants and even terrorists. This provides a soil for transnational criminal activities.

Trade and movement of labour have increased within the region since 1st May 2004 that saw fifteen new countries join the European Union. However, this singular, open and free European market has also provided more possibilities for organised crime. Strong and established EU economies have been faced with higher criminal activity rates and an increased flow of legal and illegal migrants. These phenomena have caused human security to decrease in those countries. Furthermore, this insecurity has caused a rise in populist politics across the EU as well as the vote for Brexit in the United Kingdom. Accordingly, as Kilroy, Hataley, & Sumano (2013) state, the economic sector is a two-sided coin. On the one hand, regional trade agreements provide institutionalised arrangements on rules and a framework for solving economic disputes. On the other hand, trade liberalisation opens the borders of new member states and introduces transnational threats, making the partner countries a source of insecurity.

On the regional level, the state develops and secures the social sector. According to this concept, regional social security is based on identity-based policy which impacts security. The measures to ensure social security and to protect the most vulnerable groups may be applied on the international, regional or state level. As Buzan and Waever (2009) state, social security threats unfold from the acts of sharing ideas, regional alliances, and violent and nonviolent cross-border activity. For example, continuing identity-based policy in North America has influences regional social security. The best-known evidence is found in the state of California in the United States. Proposition 187 was introduced in 1994 to limit the access of illegal migrants to public services, education and healthcare (Buzan & Wæver, 2003). As a result, insecure illegal migrants established cooperative relationships with criminal organisations and even well-known terrorist organisations. Terror attacks threaten regional social security and negatively impact economic security. For instance, terrorism and wars cause damage to the economic development by way of losing human lives, destroying property and the natural environment (Blinc et al., 2007). Since terrorist organisations operate and expand across borders, they tend to recruit members from the neighbouring states. Accordingly, both the regional social insecurity and the regional economic insecurity increase.

Regional political security relates to taking actions against threats in order to establish organisational stability. In other words, external and internal actions may cause threats to the legitimacy and stability of the state. External threats may arise from transnational corporations, organisations, alliances, cartels or social movements (Buzan & Wæver, 2009). For instance, new or existing transnational corporations lobby to use their influence on political decisions and can increase the level of corruption. In this regard, transnational corporations create political insecurity. Meanwhile, internal threats emerge from ethnic or religious minorities, illegal migrant communities or groups. Kilroy, Hataley & Sumano (2013) note that the United States, Mexico and Canada are faced with issues and challenges of political insecurity. In particular, Mexico faces problems resulting from the activity of drug cartels. In some regions of Mexico, drug cartels replace the government's role of providing identical public goods. As a result of the movement of illegal migrants and criminals, the United States and Canada experience the impact of drug cartels with regards to social costs and increased violence.

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Relationship between sustainable development and the regional security complex. According to the regional security complex theory (Kline, et al. 2017; Buzan & Weaver, 2009), regional security is a set of units whose processes involve both securitisation and desecuritisation. These processes are closely connected and essential to one another's resolution. On that account, security is a concept that identifies the problems and provides solutions. However, Buzan & Weaver (2009) claim that regional security is a social construct. The other researchers (Kilroy, et al., 2013) state that the regional security complex consists of the following four elements: boundaries dividing neighbouring countries, anarchic structure of two or more autonomous units, polarity defining the distribution of power among units, and a socially constructed understanding of amity and enmity among the units.

The concepts of security and of sustainable development have strong links. All elements of sustainability may be integrated into the regional security concept. Kullenberg (2002) claims that comprehensive regional security demands both the fulfilment of human physical needs and the prevention of armed conflicts (Ciobanu et al., 2019). In other words, 17 sustainable development goals align with the components of the security complex (Table 2).

Table 2. Sustainable Development Goals and Components of Security Complex

Sustainable Development Goals	Component of the Security Complex
Goal 1. *Zero poverty.* End of poverty in all forms everywhere	Human security, economic security
Goal 2. *Zero hunger.* End of hunger, achieved food security, improved nutrition and promotion of sustainable agriculture	Human security, economic security
Goal 3. *Good health and well-being.* Ensure healthy lives and promote well-being for everyone at all ages.	Economic security, social security
Goal 4. *Quality education.* Ensure inclusive and equitable education and promote lifelong learning opportunities for all.	Social security
Goal 5. *Gender equality.* Achieve gender equality and empower all women and girls.	Social security, cultural security
Goal 6. *Clean water and sanitation.* Ensure availability and sustainable management of water and sanitation for all.	Environmental security
Goal 7. *Affordable and clean energy.* Ensure affordable, reliable and sustainable energy for all.	Environmental security
Goal 8. *Decent work and economic growth.* Promote and sustain inclusive and sustainable economic growth, full and productive employment and decent work for all.	Social security and economic security
Goal 9. *Industry, innovation and infrastructure.* Build a resilient infrastructure, promote sustainability and industrialisation, foster innovation.	Economic security
Goal 10. *Reduced inequalities*. Reduce inequalities within the country and internationally.	Social security, economic security
Goal 11. *Sustainable cities and communities*. Make cities and human settlements inclusive, safe, resilient and sustainable.	Social security
Goal 12. *Responsible consumption and production.* Ensure sustainable consumption and production patterns.	Environmental security, economic security
Goal 13. *Climate action.* Take urgent action to combat climate change and its impact.	Environmental security
Goal 14. *Life below water.* Conserve and sustainable use the oceans, seas and marine resources for sustainable development.	Environmental security

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Goal 15. *Life on land*. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.	Environmental security
Goal 16. *Peace, justice and strong institutions.* Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, build effective, accountable and inclusive institutions at all levels.	Political security
Goal 17. *Partnership for the goals.* Strengthen the means of implementation and revitalise the global partnership for sustainable development.	Political security

Source: created by the authors according to UN (2020)

Perception of links between sustainable development goals and the regional security complex may contribute to the identification of internal and external threats to the state and the region. For instance, threats emerging from outside the region are defined as threats to all actors within the region (Prada, 2020; Gil, et al., 2019; Savona, & Ciarli, 2018; Kline, et al. 2017; Kilroy, et al., 2013). As a result of regional relationships, solutions to all threats should be found to involve collective action from all partnering states, especially when it refers to political and military security. Additionally, sustainable development goals indicate that sustainable development and security are the concern of a globalised world. However, some dangers and threats equally impact both the rich and the poor in any part of the world. Moreover, sustainability is a driving force for internal and external political decisions, economic actions and regional security assurance (Feliciano, 2019; Kline, et al. 2017; Neag et al., 2017). Consequently, the integration of sustainable development into the regional security complex may address the solutions to the economic, social and security problems. Poverty, migration issues, inequality, population growth, environmental problems and external threats are interrelated and interdependent, hence they must be approached concurrently. For example, Prada (2020) finds that indicators of the sustainable development goals have strong links with internal and external migration. Goal 16 may be measured by the number of military units, the number of personnel in the military sector and the percentage of GDP dedicated to the expenditure on the defence.

3. Methodology

Principle indicators describing the economic, social and military security have been selected to analyse regional security and sustainable development in the Lithuanian context. The following sections of the article discuss the economic and demographic indicators and their dependence on the regional security, namely, the deployment of military units in Lithuania. Classification methods are used to demonstrate this dependence. Undoubtedly, economic and demographic changes affect the employment market structure, work relationships, territorial and regional distribution of labour resources as well as the overall supply and demand of workforce in the country.

The following three economic indicators listed in the Lithuanian statistics database describing the situation in the Republic of Lithuania and its districts were selected for the research: gross domestic product (GDP) per capita in Euros, percentage rate of unemployment and gross wages in Euros. Indicators for migration and natural population change were also selected to analyse the demographic situation, where the migration is reflected by the individually observed numbers of immigrants and emigrants as well as the natural population change. Military security indicators are described by the number and distribution of Lithuanian military units as well as the size of Lithuanian military units, i.e. the number of military staff. Military security indicators have been provided by the Ministry of National Defence of Lithuania.

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Every indicator has complex links, i.e. the calculation for the indicators is based on identical methodology and carried out in terms of a specific region in a given year (2010-2019). The following military indicators were also assessed to determine the relationship with the deployment of military units: the number of military units in regions and region ranking based on the number of military staff. K1 ranking is definitive, where 1 means present staff and 0 means no staff. K2 ranking considers the number of staff, where 1 means more than 1000 and 0 means less than 1000.
The following methods were applied in the research: segmentation, classification using the k-means method and decision trees for classification.

The research aims to understand event and behaviour causation by employing diagnostic analytics. The principal methods of diagnostic analytics are segmentation and classification.

Segmentation is heuristic and multidimensional. It is required in the discovery of natural object groupings. Segmentation is a method of data mining designed to classify data, concepts, events, etc. into types of groups termed as clusters. This method is known as market segmentation or client segmentation in economics. It is used successfully in the prevention of fraud. Segmentation aims to gather elements into groups or clusters that exhibit an evident degree of classification among the elements, yet none across the clusters. Segmentation analysis is used to identify a classification scheme, to arrange statistical models for population research, to identify the classification rules, to anticipate the range, size and changes of a broad concept, to locate typical cases that lineate and represent a class, to identify rare cases and to reduce the complexity of an issue. Predictions are not made in segmentation. On the contrary, segmentation methods use object attributes to determine object similarities and to organise similar objects into groups. The segmentation method used in this article is the k-means method.

When considering a set of objects, each with n measurable attributes, the k-means is an analytical method that identifies groups of k-objects at a selected k-value according to the proximity of the objects to the centre of the k-groups (Bansal et al. 2017). The centre is calculated to be the arithmetic mean of the n-dimension attribute vector of each cluster.
K clusterisation algorithm:

- Step 1. Random k points are randomly selected from the scattered data to be the cluster centres;
- Step 2. The distance between each point is calculated;
- Step 3. New centres are calculated;
- Steps 2 and 3 are repeated until the criterion for convergence is met.

Classification. Classifier is presented together with the set of classified samples. The classifier learns to class new samples based on the previous samples. In other words, the primary task of classifiers is to assign class labels to new observations, which is opposite from segmentation that reveals the structure without a learning set and gives the researcher the option to create and assign labels to clusters. Classification methods are as follows: decision trees, random forests, neural networks, k-nearest neighbour, Bayes classifier, genetic algorithms and rough sets.

The *classification decision tree method* with multiple input variables (attributes) that affect classification patterns has been selected for the research. The decision tree has branches and nodes. Based on the classification patterns, a branch describes the output using one attribute. A leaf node describes the final class selection; an internal node between the root and the branch describes selection possibilities using the conditional operator 'if-then'. The break point indicates the selection. The depth of a node is defined as the minimum number of steps from the root to the node. Leaf nodes are at the ends of tree branches. They represent class labels, i.e. the results of all previous decisions. The path from the root to the leaf node includes multiple decisions made at various internal nodes. The algorithm for a decision tree is as follows:

- root node is created and all data in the analysis are noted;
- the best distribution attributes are selected;

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- each attribute is assigned a branch; based on the attributes, data are allocated to each branch;
- steps 2 and 3 are repeated until the required criteria are met.

This method aims to identify the attributes in each node that will serve to obtain the required classification by way of division (Song & Ying, 2015).

3. Findings of the research

The research assesses regional economic, social and military security by analysing the relationship between economic and demographic indicators and the deployment of military units in Lithuania. A large number of immigrants and a large GDP per capita do not exist mutually in Lithuania. The algorithm's selection of segmentation regions was based on the number of immigrants. Where the annual number of immigrants was from 0 to 2 000, GDP per capita ranged from 3 to 24 thousand Euros. The second region covers the annual number of immigrants ranging from 2 000 to 5 000 and the GDP this region produces ranges from 5 to 16 thousand Euros. The largest number of immigrants (from 5 000 to more than 9 000) corresponds to a small range of GDP per capita, i.e. from 7 to 10 thousand Euros, which demonstrates why these areas are attractive to the immigrants.

The decision tree algorithm is used to link the GDP per capita, the number of immigrants and the number of military staff in the area. The K1 ranking of the military staff numbers resulted in a reliable classification into two branches with an error of 0.14. Decision tree branches demonstrate that regardless of the numbers, military staff is present where the annual number of immigrants is less than 5 689. The classification linking the number of immigrants, GDP per capita in given areas and K2 ranking of military staff in given areas is not sufficiently reliable but sufficiently informative (Fig.1). A significant number of military staff can be found where the GDP per capita is more than 12.25 thousand Euros or the GDP per capita ranges from 9.9 to 12.25 thousand Euros and the number of immigrants is between 153 to 694 or both the GDP per capita and the number of immigrants are low (<9.9 and <153 respectively).

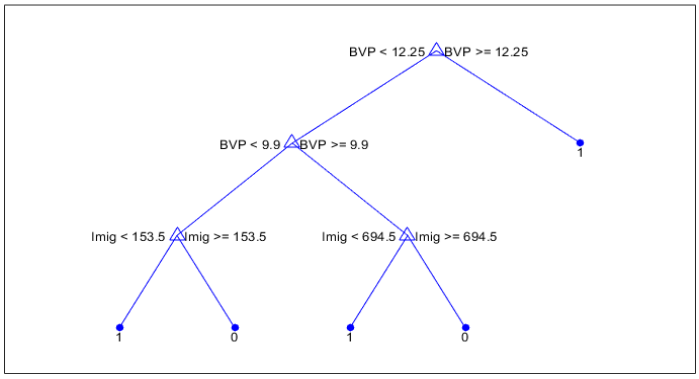

Figure 1. Classification of the number of immigrants (Imig) and GDP per capita (BVP) in given areas using the decision tree algorithm to establish a link with K2 ranking (created by authors)

The scatter plot of the annual number of emigrants and GDP per capita indicators resemble a hyperbola. As the GDP per capita increases, the number of emigrants decreases exponentially. Segmentation using the k-means method allocated the mutual dependence of the number of emigrants and the GDP per capita into three segments based on the number of emigrants. The number of emigrants that ranges from 1 000 to 4 000 is found when observing the entire GDP band (from 5 to 24 thousand Euros). Where the number of emigrants ranges from 4 000 to 9 000, the GDP per capita covers the band of 5 to 15 thousand Euros. High annual emigration rate of 9 000 to 20 000 people only corresponded with the lowest values of GDP per capita, i.e. from 5 to 10 thousand Euros.

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The objective to find a link between the annual indicators of the number of emigrants and GDP per capita and the K1 ranking of military staff in given areas of the Republic of Lithuania was not successful as the results obtained were not sufficiently significant and reliable. The result with regards to the K2 ranking links was not sufficiently reliable. The following four ranges were found to be linked with a significant number of K2 ranking military staff: GDP per capita over 12.25 thousand Euros, regardless of the number of emigrants; GDP per capita between 9.9 and 12.25 thousand Euros and the annual number of emigrants that is more than 6 795; GDP per capita between 9.9 and 12.25 thousand Euros and the annual number of emigrants that is less than 1 469. GDP per capita is between 8.6 and 8.75 thousand Euros.

Three regions were characterised through segmentation by way of natural population change levels using the k-means method. Natural population change where mortality exceeds the birth-rate substantially (from -1 800 to -2 500) corresponds to a small GDP per capita (from 5 to 9 thousand Euros). Natural population change in the range of -1 800 and -1 100 corresponds with the entire band of GDP per capita (between 5 and 24 thousand Euros). In this segment, the large GDP per capita indicators (>14 thousand Euros) correspond with the capital city. Natural population change where mortality exceeds birth-rate the least (from 0 to -1 100) corresponds with GDP per capita that ranges from 5 to 17 thousand Euros. Decision tree is used to link the natural population change indicator, GDP per capita and the number of military staff based on the K1 ranking. The algorithm provided a reliable classification into 4 classes with an error of 0.11. K1 ranking of military staff regardless of numbers may be linked with natural population change in the interval between -972 and -1 236 or less than -1 236. When the number of military staff in a given area was considered and the K2 ranking was linked with the annual indicators for natural population change and GDP per capita in given areas, the result of a seven-branch classification tree was not sufficiently reliable (Fig. 2). K2 ranking may be linked with the following economic and demographic indicator intervals: GDP per capita of more than 12.25 thousand Euros, regardless of the natural population change indicator; GDP per capita in a range between 9.9 and 12.25 thousand Euros with the natural population change indicator falling below -1 321.5; GDP per capita in a range of 9.9 and 12.25 thousand Euros with the natural population change indicator falling above -679.5; GDP per capita is in a range between 8.6 and 8.75 thousand Euros.

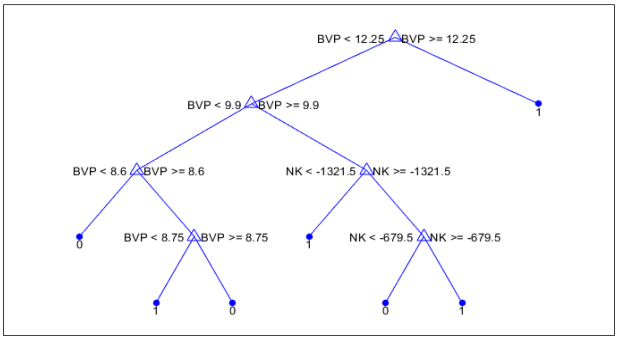

Figure 2. Classification of natural population change (NK) and GDP per capita (BVP) using the decision tree algorithm to establish a link with K2 ranking (created by authors)

Mutual dependence of annual indicators for the unemployment rate and the number of immigrants in given areas. The scatter plot of the indicators does not demonstrate a functional dependence. The first and most suitable cluster covers the indicators that correspond with an annual immigrant number below 2 000 and a full band of unemployment rates ranging from 4% to 24%. The low number of immigrants is completely natural and thus independent of the economic indicators. The unemployment rate allocated to the second cluster is between 4%

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and 15%. Only one indicator marks an exception with an unemployment rate of 23%. The third cluster covers an annual number of immigrants exceeding 5 000, and an unemployment rate that ranges between 9% and 17%.

The decision tree algorithm is used to link the unemployment rate and the number of immigrants with the K1 ranking military staff. The classification provided seven branches, three of which may be linked with the presence of military staff in an area regardless of their numbers; albeit, this classification is not sufficiently reliable. The annual number of immigrants is between 1 366 and 5 689, and the unemployment rate is lower than 18.9%; the annual number of immigrants is between 726 and 1 197, and the unemployment rate is below 18.9%; the annual number of immigrants is lower than 717, and the unemployment rate is lower than 18.9% (Fig. 3).

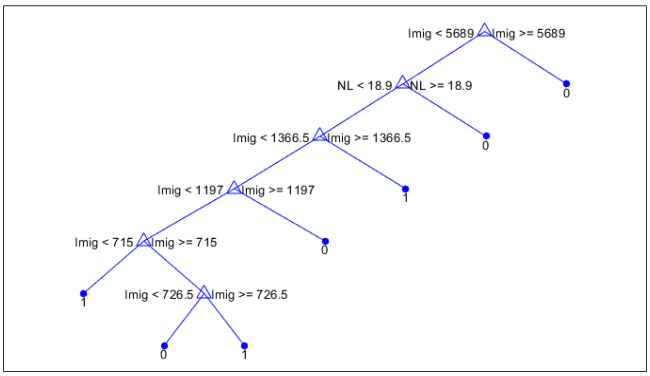

Figure 3. Classification of unemployment rate (NL) and the number of immigrants (Imig) using the decision tree algorithm to establish a link with K1 ranking (created by authors)

Six classification branches were obtained when linking the number of military staff using the K2 ranking with the unemployment rate and the number of immigrants (Fig. 4), albeit with a large error. The following three branches are related to the deployment of military staff in given areas: the unemployment rate is lower than 6.45%, regardless of the number of immigrants; the unemployment rate is between 9.85% and 14.55%, and the number of immigrants is above 763 and below 911; the unemployment rate is between 9.85% and 14.55%, and the number of immigrants is below 763.

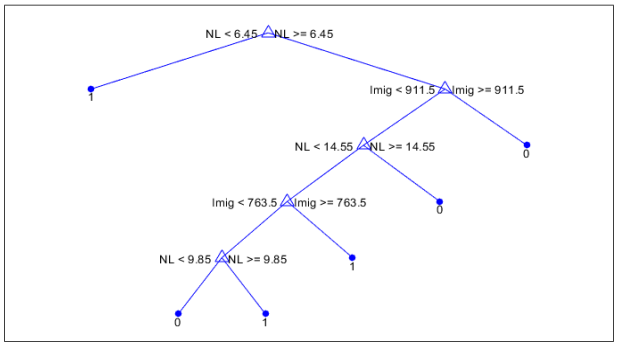

Figure 4. Classification of unemployment rate (NL) and the number of immigrants (Imig) using the decision tree algorithm to establish a link with K2 ranking (created by authors)

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Segmentation of the dependence between the unemployment rate and the number of emigrants characterises three regions based on the number of emigrants. A low emigration rate (less than 4 000 emigrants annually) is characteristic of almost the entire range of the unemployment rate (from 4% to 19%). Many area indicators of the country are concentrated here, which reflects the natural migration of the population. Emigration rate in the range of 4 000 and 9 000 annually is characteristic of approximately the same range of the unemployment rate as above, except that there are fewer indicators here. A high rate of emigration (from 9 000 to 20 000 annually) is linked with a higher rate of unemployment ranging between 8% and 24%.

The decision tree algorithm provided 4 classes with an error of 0.16 for the link between the unemployment rate and the number of emigrants and the military staff, regardless of the staff numbers based on the K1 ranking. The presence of military staff in an area may be linked with the annual number of emigrants in the area that is below 8 977, regardless of the unemployment rate; where the number of emigrants was higher than 8 977, the unemployment rate was lower than 13.35%. The relationship between the unemployment rate, the number of emigrants and K2 ranking is described by seven decision tree branches (Fig. 5). A larger concentration of military staff is related to the following four ranges of economic and demographic indicators: the unemployment rate is lower than 6.45%, regardless of the number of emigrants; the unemployment rate is between 6.45% and 14.5%, and the number of emigrants is lower than 1 487; the unemployment rate is between 6.45% and 14.5%, and the number of emigrants is in the range of 1 846 and 1 887; the number of emigrants is higher than 1 887, and the unemployment rate is higher than 14,5%.

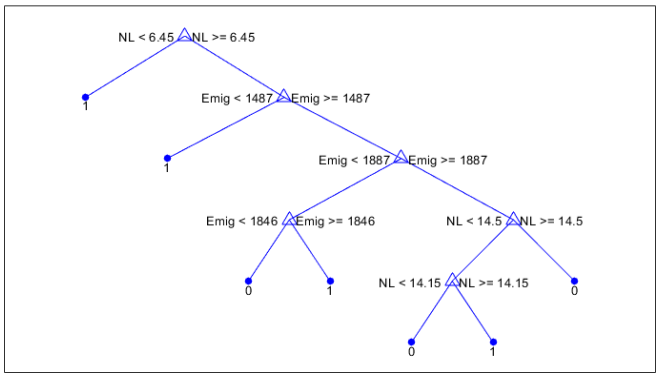

Figure 5. Classification of unemployment rate (NL) and the number of emigrants (Emig) using the decision tree algorithm to establish a link with K2 ranking. (created by authors)

Mutual dependence and scattering of the natural population change and unemployment rate indicators are rather consistent, save for the zones with the highest unemployment rate and the lowest natural population change. A small difference between the annual number of births and deaths in given areas is related to all possible indicators of the unemployment rate. The natural population change indicator ranging between 0 and -1 100 is independent of the unemployment rate. The second segment is defined by the natural population change in the range of -1 800 and -1 100, and the range for the unemployment rate in this case is smaller, i.e. between 4% and 16%. A particularly negative indicator of the natural population change (from -2 500 to -1 800) is found to be characteristic of the unemployment rate in the range of 7% and 13%. The presence of military staff in given areas is related to the unemployment rate below 17.35% and the indicator of natural population change below -1 236 or the natural population change falling between -1 236 and 893 (Fig. 6).

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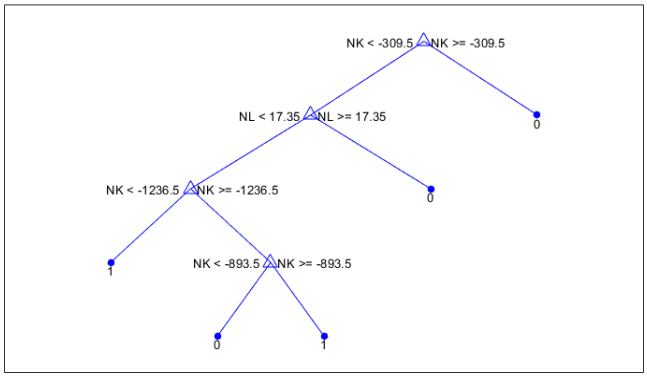

Figure 6. Classification of natural population change (NK) and the unemployment rate (NL) using the decision tree algorithm to establish a link with K1 ranking (created by authors)

The objective to link the annual indicators for natural population control and the unemployment rate in given areas with the number of military staff per K2 ranking resulted in the classification into two classes with an error of 0.2. A large number of military staff is linked to the unemployment rate that is lower that 6.45%. A large number of immigrants is linked with a higher salary. Segmentation of the dependence between the number of immigrants and the salary using the k-means method distributed the indicators into three segments according to the number of immigrants. A small number of immigrants (between 0 and 2 000) is linked to a range covering all monthly wage possibilities from 600 to 1 500 Euros per month. The annual number of immigrants ranging from 2 000 to 5 000 is linked with an average wage in the interval between 600 and 1 300 Euros. A high rate of immigration (between 5 000 and 9 000) is linked to an even smaller range of monthly wages in given areas, i.e. between 600 and 1 100 Euros. The decision tree algorithm created nine branches with regards to the average wage, the number of immigrants and the K1 ranking of military staff. The following four branches describe the link to the K1 ranking: the annual number of immigrants is between 4 825 and 5 689, and the average wage is more than 1 075.35 Euros; the annual number of immigrants is between 4 825 and 5 689, and the average wage is between 852.85 and 1 072.75 Euros; the annual number of immigrants is below 4 825, and the average wage is between 742.3 and 802.6 Euros; the annual number of immigrants is below 4 825, and the average wage is less than 741.15 Euros (Fig. 7).

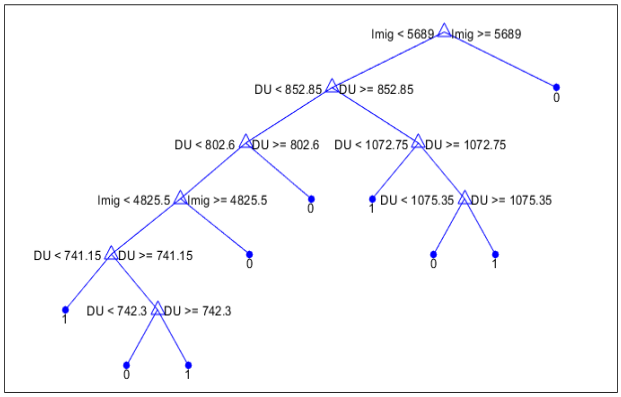

Figure 7. Classification of the number of immigrants (Imig) and the average wage (DU) using the decision tree algorithm to establish a link with K1 ranking (created by authors)

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A decision tree with 6 branches and an error of 0.12 was obtained to link the number of immigrants and the average wage with the number of military staff using the K2 ranking. The larger number of military staff together with the average wage and the number of immigrants are tied to the following 3 classes (Fig. 8): the average wage is more than 1 168 Euros, regardless of the number of immigrants; the average wage is in the rage of 853 and 973 Euros, regardless of the number of immigrants; the number of immigrants is below 1 088, and the average wage is less than 1 036 Euros.

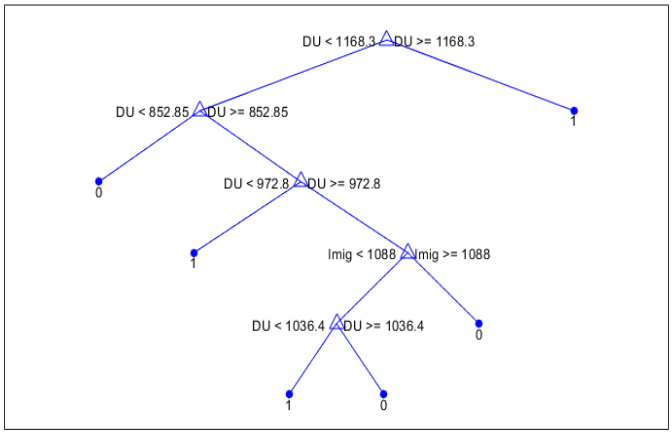

Figure 8. Classification of the number of immigrants (Imig) and the average wage (DU) using the decision tree algorithm to establish a link with K2 ranking (created by authors)

As the gross average wage increases, the number of emigrants decreases. Three segments obtained using the k-means algorithm distribute area indicators according to the number of emigrants. The first region covers the lowest rate of emigration in given areas (from 1 000 to 4 000 emigrants annually); the gross average wage here scatters across the entire band, i.e. from 700 to 1 500 Euros. The second region covers the number of emigrants that ranges between 4 000 and 9 000 annually; the wage ranges from 700 to 1 250 Euros. The third region covers a very high rate of emigration that ranges from 9 000 to 20 000 annually, and the wages within this segment fall into a smaller range between 700 and 1 100 Euros.

The objective to link the number of emigrants and the gross average wage with the military staff ranking, regardless of the number of the military staff per K1 was unsuccessful. A larger number of military staff described by K2 is linked with a classification tree with 4 branches and an error of 0.13. The number of military staff is linked with average wages exceeding 1 168 Euros or falling between 853 and 973 Euros, regardless of the number of emigrants (Fig. 9).

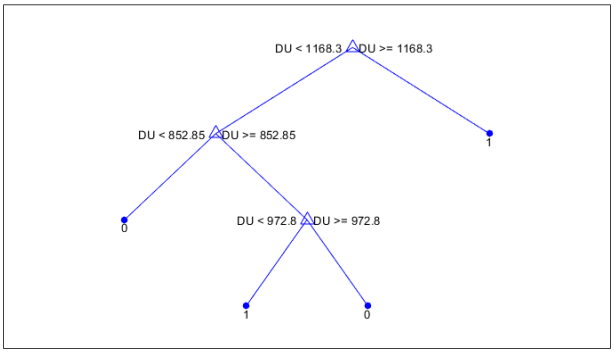

Figure 9. Classification of the number of emigrants (Emig) and the average gross wage (DU) using the decision tree algorithm to establish a link with K2 ranking (created by authors)

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Mutual dependence of the natural population change framed as the annual difference between births and deaths and the average wage. The scatter plot does not demonstrate any functional dependence between these indicators. K-means algorithm allocated the indicators of natural population change and average wage into the following 4 segments: negative natural population change (below -1 800) and an average wage between 700 and 1 050 Euros; natural change approximately between -1 750 and -1 250, and an average wage scattered across the entire range between 700 and 1 050 Euros; natural population change between -1 250 and -700, and a lower average wage (from 700 to 1 200 Euros); the least negative natural population change (from -700 to 0) and an average wage between 700 and 1 350 Euros. The natural population change, average wage and the military staff per K1 ranking are linked in the decision tree with 4 branches and an error of 0.13. The number of military staff may be linked with the natural population change below -1 236 or ranging from -1 236 to -972, regardless of the average gross wage (Fig.10).

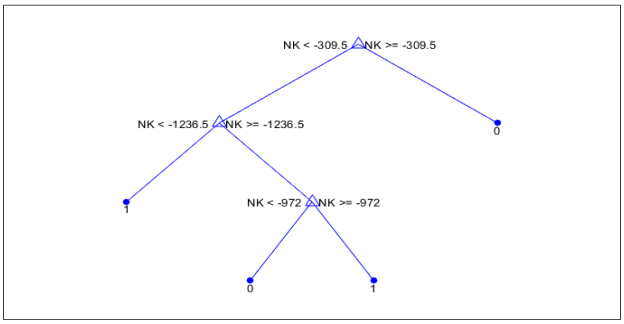

Figure 10. Classification of the natural population change (NK) and the average gross wage (DU) using the decision tree algorithm to establish a link with K1 ranking (created by authors)

The natural population change, average wage and military staff per K2 ranking are linked in the decision tree with 4 branches and an error of 0.1. A bigger number of military staff per K2 ranking is only linked with an average gross wage, regardless of the natural population change. K2 may be linked where the average gross wage is more than 1 168 Euros or ranging from 853 to 973 Euros (Fig. 11).

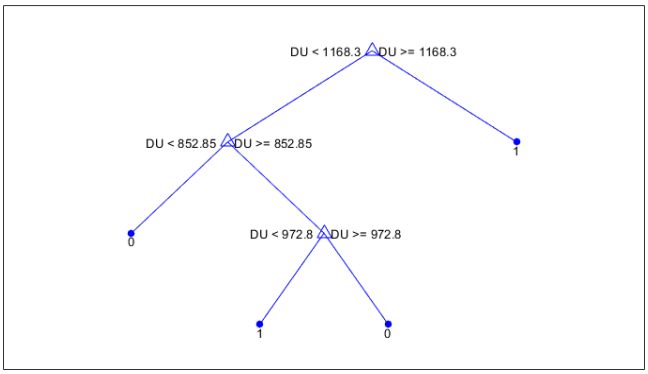

Figure 11. Classification of the natural population change (NK) and the average gross wage (DU) using the decision tree algorithm to establish a link with K2 ranking (created by authors)

Having studied the dependence between economic, demographic and social indicators, the strongest dependence was found to be between the GDP and the rate of emigration as well as a higher levels of GDP and military staff. On the other hand, the dependence between immigration and GDP has been found to be insignificant. Significant links have been identified between military staff and immigration where the unemployment rate is medium or

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high. A higher number of immigrants also means a greater demand for jobs. Such a situation may be advantageous in a competition over workforce, including recruitment of military staff.

Conclusions and discussion

Sustainable development and regional security are tightly connected and often framed by analogous indicators to cover identical grounds for research. Firstly, security is understood as human satisfaction with the surrounding environment and a sense of security within the economic, social, political and cultural context. This understanding of security is closely linked to the seventeen sustainable development goals brought forward by the United Nations. The article concludes that these sustainable development goals correspond with the components of the regional security complex and can be implemented simultaneously, and their results evaluated together. The methods of segmentation and classification selected for the assessment in order to identify the links between the components of sustainable development (e.g. economic and social factors) that are integral to the security concept and the military security in Lithuania by characterising distinct regions.

In summary of the results, it may be concluded that the number of military staff can be linked with the economic and demographic indicators. However, military staff per K1 ranking does not demonstrate the number of military staff and merely assesses the presence or absence of military staff in an area. A large number of immigrants and a large GDP per capita do not mutually exist in Lithuania. A significant number of military staff is found where the GDP per capita is bigger. As the GDP per capita increases, the number of emigrants decreases. The annual indicators of the number of emigrants and the GDP per capita in the Republic of Lithuania areas could not be linked to the military staff K1 ranking.

The natural population change where the mortality substantially exceeds the birth-rate corresponds with a small GDP per capita. The military staff K1, regardless of the number of military staff, may be linked to an average natural population change within an interval. Where the unemployment rate is lower, the number of immigrants was found to be completely natural and independent of economic indicators. However, it was identified that the number of immigrants spans from 1 400 to 5 500 where the unemployment rate is high. The study into the links between the unemployment rate, immigrants and the military staff identified that where military units are deployed, i.e. where the military staff is present, the unemployment rate is low. On the other hand, the links between the unemployment rate, immigrants and the military staff were insignificant. However, there is no dependence on the number of military staff, where the unemployment rate is low and the number of immigrants is average. The number of emigrants does not show a significant dependence, where the unemployment is low or average; however, the rate of emigration is increased in regions that demonstrate a high unemployment rate. Meanwhile, a larger concentration of military staff is linked with a lower rate of unemployment and a low or average number of emigrants, where the unemployment is average or high. Previous research shows that expenditure on military security affects the rate of unemployment in the US, the United Kingdom and 11 OECD countries (Dunne & Smith, 1990). Nonetheless, another study (Abell, 1994) has demonstrated contrary results and identified that expenditure on military security has a positive impact on employment with regards to people who are ethnically white only, and the increase of military security expenses meant an increase of unemployment among African Americans. Meanwhile in China, Quing and Junhua (2015) determined that the increasing expenditures on country security are slowing down the economy. Additionally, where the higher number of military staff should be stabilising the growing unemployment, it promotes it. With regards to the results and by comparing them to previous studies, we can conclude that the number of military staff and/or an increase in the expenditure on military security have little significance in terms of the rate of unemployment in developed areas and in countries with mature economies.

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It was found that a large number of immigrants is linked with higher wages independent of the number of military staff. On the other hand, the link between the number of military staff and immigrants becomes evident where the wage is average. A link between military staff, the number of emigrants and the wages was not found. However, the rate of emigration decreases in areas where the wages increase. Functional dependence also could not be identified between natural population change and average wages. Meanwhile, the number of military staff can be linked with an average or high level of natural population change. A high number of military staff per K2 is linked only with a higher wage, where it does not depend on the natural population change. K2 indicator is linked with a smaller number of immigrants in given regions and a negative natural population change. Whereas Smith (2007) identified a higher dependence between deployed military staff and external immigration in the US in those regions, where migration is considered to be a threat to security. However, the study does not characterise a dependence on wages or unemployment. On the other hand, another study analysing the US situation demonstrated that the internal migration has decreased significantly since 1950, albeit this decrease is linked with a decreasing number of military staff in individual states (Pingle, 2007). Another study conducted in Greece and spanning from 2011 to 2014 (Hausmann, Nedelkoska, 2018) confirmed a strong relationship between the increase of wages and unqualified emigrants as well as with a lower unemployment rate.

The results demonstrate that a higher number of military staff, i.e. bigger expenditure on security, has a significant relationship with a larger GDP. Further research could integrate additional factors to elucidate the Lithuanian regional security complex.

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