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Article

Alternative evaluation of states' resilience changes in the context of security: The case of the Baltic States

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Abstract: Since the external environment on a global level is very unstable, recovering from various unexpected shocks becomes a challenging question for all countries. Thus, for each country it is necessary to understand its weaknesses and threats. Further, the preparation for any level of uncertainty in various fields must be imperative. Even for the most unpredictable shocks such as pandemic, cyberthreat, or even war. The aim of the article is to evaluate the state resilience of the Baltic States by creating the national resilience index. A state's resilience is based on four pillars: economic, social, good governance, and defence. The methodology is based the SAW method, data has been collected from NATO and Eurostat databases. As the result of the study, resilience index has been estimated for each year from 2015 to 2022. Results revealed vulnerability and problematic areas of each country.

Keywords: state resilience; defence; security; Baltic States; SAW method

1. Introduction

The new millennium has brought new challenges and problems, such as the financial crisis in 2008, COVID-19, the energy crisis in 2022, the Russian-Ukraine war, high inflation, a decline in economic growth all over the world in 2023, and a critical situation in climate change. Due to the globalisation, countries experience different types of crises, thus the challenging sustainability approach towards all life areas, has been tempered by a more modern concept of resilience. In addition, implementation of all three pillars (social, economic, environmental) of sustainability has failed and proved that all seventeen goals of sustainable development are difficult to implement in the long-run. Meanwhile, resilience is generally defined as the ability to withstand a shock or, failing that, recover from it. A resilient country is now also recognised as one that can adapt to changing circumstances. Thus, in the scientific literature, the national resilience is analysed from the different angles by covering social-economic, health and wellbeing, community resilience, security and defence, law and good governance, environmental and natural disasters', and other issues. For example, national resilience is linked to trust in the integrity of the government, parliament, and other national institutions, as well as strong national identity, social integration, and belief in social solidarity and patriotism (Zacharia et al., 2021). The other studies (Jnitova et al., 2021； Mardhani et al., 2020) highlight the importance of security and defence in building resilience. The concept of defence resilience emphasises the ability of defence forces to adapt quickly to changing environments while maintaining operational effectiveness and meeting stakeholder requirements.

The relevance of the scientific research is shown by the constant research conducted by the international organisations IMF, World Bank, and OECD on the topic of economic resilience. The OECD (2021) published a study examining countries' resilience to the COVID-19 crisis. The study provides recommendations for strengthening economic resilience and healthcare resilience. Research examines resilience from various perspectives: the resilience of the industrial sector to economic shocks (Boschma et al., 2013; Bristow, 2018; Diodato and Weterings, 2012; Doran and Fingleton, 2018), shocks in the banking sector and resilience interactions (Chowdhury and Stewart, 2021), resilience of urban and rural populations to economic shocks (Bristow, 2018), resilience of urban economies to COVID-19 (Wang and Zhang, 2023). Vasile and Zaman (2014) analyse regional resilience and the ratio of economic resilience and economic vulnerability. Meanwhile, in the United States, resilience has been officially approved in a national doctrine as part of the National Security Strategy in 2017. The Baltic States provide a unique case study for resilience, particularly in the face of various challenges and threats. The region has demonstrated a strong commitment to enhancing its resilience across different domains, including cybersecurity, societal participation, defence, and response to crises. One key aspect of resilience in the Baltic States is their focus on bolstering cyber resilience, driven by perceived threats, particularly from Russia (Górka, 2023). This emphasis on digital capabilities and cybersecurity reflects the region's proactive approach to addressing modern security challenges. Moreover, the Baltic States have shown resilience in their defence strategies, with a particular emphasis on total defence systems and societal involvement (Atmante, 2020). By strengthening national defence mechanisms and engaging society in resilience-building efforts, the Baltic States have taken significant steps to enhance their overall resilience and deterrence capabilities. Additionally, the Baltic States have been proactive in responding to crises, such as the COVID-19 pandemic. Lessons learned from the early responses to the pandemic highlight the region's ability to implement measures to prevent virus transmission and manage uncertainties effectively (Webb et al., 2022). This adaptive response underscores the Baltic States' resilience in the face of unexpected and disruptive events. Furthermore, the Baltic States have demonstrated resilience in the face of geopolitical challenges, such as the deteriorated security environment following the Ukraine crisis. The region has emphasised collective defence, deterrence, and enhanced NATO presence in the Eastern flank, showcasing a commitment to maintaining security and stability (Raik and Šešelgytė, 2022).

The aim of the paper is to estimate the national resilience index for the Baltic countries in the context of security. For methodological purposes, the article is divided into three parts. The first one discusses the theoretical concepts of resilience. The second one is dedicated to the methodology of the research. The third one presents results and discussion.

2. The concept of resilience

One of the main questions in the scientific literature is to understand the meaning of resilience. The word "resiliere" comes from the Latin language, meaning "to jump back". It might be interpreted as the ability to avoid shocks or quickly recover from

shocks. The general definition of resilience is very well described in engineering studies as the ability of a complex system to deal effectively with unanticipated events. Originally, resilience was not the concept of classical economics theories or social sciences. Scientific literature distinguishes three types of resilience. First of all, engineering (balance-oriented) resilience, which focuses on maintaining or returning to equilibrium of a specific structure (Hill et al. 2012) after a disruption, emphasising the system's ability to absorb disturbances and reorganise while maintaining its essential functions, structure, identity, and feedbacks (Afroogh et al., 2021). Engineering resilience aims to balance safety and efficiency pressures to prevent wastage and accidents, particularly in complex socio-technical systems (Patriarca, 2021; Peñaloza et al., 2017). Further, it focuses on addressing risks, enhancing safety, and managing operations in complex systems, emphasising the importance of system organisation in achieving these goals (Mayar et al., 2022). This concept also entails the expectation that natural systems have a preferred equilibrium to which they will return after a shock or disturbance, highlighting the importance of preservation and restoration as rational goals (Craig, 2020). Resilience is also described as the ability to maintain a stable balance, which is vital for coping with stress and maintaining equilibrium. Further, ecological resilience exists (panarchy-oriented), which puts emphasis on the forces that might have been caused by some shocks. Thus, the system should sustain and adapt thorough an ongoing adaptive cycle (Martin and Sunley, 2015). This concept is rooted in the idea that ecosystems exhibit non-linear behaviours and alternate between stable states, maintaining diversity in components, spatial patterns, and genetic attributes "undefined". Panarchy theory highlights the dynamic nature of social-ecological systems, illustrating their nestedness and interconnectedness over time and space (Winkler et al., 2022). It emphasises the ability of systems to absorb changes and persist, showcasing the capacity for adaptation and transformation (Folke et al., 2010). Furthermore, ecological resilience in a panarchy context involves within-scale diversity of ecological functions and processes, as well as cross-scale redundancy and reinforcement, enabling systems to balance functional overlaps and redundancies to withstand environmental changes (Varey, 2011). The panarchy model suggests that cross-scale interactions occur during critical phases of ecological change, leading to non-linear dynamics and threshold behaviours (Kleindl et al., 2018). This framework provides a basis for understanding the adaptive nature of complex systems, emphasizing the capacity for change and learning from experiences (Reyes-García et al., 2016). The third type of resilience is adaptive (complexity-oriented) resilience. Adaptive resilience within a complexity-oriented framework focuses on the system's ability to not only withstand and recover from disturbances but also to adapt and evolve in response to changing and unpredictable environments. This concept emphasises the integration of adaptive capacity into systems to enhance their ability to resist failure and recover functionality in complex operating conditions (Cannon and Paulo, 2018). Adaptable platform-based engineering is identified as a key enabler of resilience, particularly suited for designing long-lived resilient systems that can evolve and adapt over time (Small et al., 2017). Resilience studies emphasise the importance of enhancing a system's capacity to adapt to changes and survive in turbulent and unpredictable circumstances, underscoring the need for flexible institutions and networks to support adaptive governance systems

(Pollock and Steen, 2020). In summary, adaptive resilience within a complexity-oriented perspective involves not only the ability to withstand and recover from disruptions but also the capacity to adapt, evolve, and thrive in the face of changing and uncertain environments. It emphasises the integration of adaptive capacity into systems, the dynamic nature of resilience processes, and the importance of flexibility, adaptability, and forward-thinking in building resilient systems and organizations. It means that complex systems should stabilise adaptively in an evolutionary path way. When it turns out that the economy cannot fully adapt to the new circumstances, its recovery may be incomplete, leading the economy to settle at a lower level of economic activity than it would have otherwise achieved (Martin and Simmie, 2010). One of the most common criticisms of economic resilience is that it is a vague concept that allows the same term to be used in very different contexts. It is also an area that uses similar terms to refer to very different processes. One example is the use of the term adaptation when referring to changes in the existing path of economic development and adaptation when referring to the transformation of the economy to adopt new paths (Boschma et al., 2013). Economic resilience is mostly only evaluated in many scientific studies. For example, the dissertation prepared by Palekienė (2016) in Lithuania focuses on the development of a methodology for assessing the resilience of regions to economic shocks. Meanwhile, Collon (2016) models economic resilience, but does not delve into increasing resilience to economic shocks, choosing measures for that. However, this scientist focuses on the aspect of sustainability when modelling the country's economic resilience. Furthermore, increasing economic, social, security, and environmental shocks enhances the studies on resilience and vulnerability of the country (Lazzeretti and Oliva, 2018). Vasile and Zaman (2014) have parallelly analysed two concepts: economic resilience (ER) and economic vulnerability (EV). Economic resilience is mostly associated with the decision-making, various policies, and measures that may prevent shocks, recover from them quickly, neutralise, reduce, and protect from negative effect of various factors of the environment. Economic vulnerability does not take-into-account a number of permanent or temporary (inherent) characteristics that prevent decision-making from being direct and decisive, more or less predictable. It's more about material disasters, extreme natural events, climate change and global conditions, and more. Furthermore, national resilience highly also depends on social, which encompasses community resilience, social support, resilience and self-efficacy, youth resilience, parenting sense of competence, workforce communities' resilience, and life satisfaction. Additionally, social resilience includes the community's resistance to propaganda, fake news, conspiracy theories, etc. Thus, social resilience, representing behaviour of the community members, their psychological health, unity, and patriotism highly related to the defence resilience.

Further, good governance resilience is mandatory to develop the national resilience. Furthermore, good governance as a factor influences the effectiveness of emergency preparedness, response, and recovery (Obuobi-Donkor et al., 2022). Thus, good governance and the national resilience are interconnected (Bedi et al., 2014). Higher quality of government is associated with greater regional resilience, indicating that good governance practices contribute to enhancing resilience, particularly during challenging periods like the Great Recession (Ezcurra and Ríos, 2019). Hence, good

governance in resilient systems ensures access to resources without constraints due to transparent flow of information, and a sufficient number of well-motivated human resources, underscoring the role of governance in ensuring effective resource utilisation and transparency (Borzuchowska et al., 2023). Additionally, dynamic governance practices have a significant impact on formulating appropriate policies to enhance creative industry resilience, both during and after crises, highlighting the role of governance in fostering sector-specific resilience (Usman, 2024). Despite economic, social, and good governance resilience makes a huge impact and the national resilience. However, defence and security ensure the country's conditions for existence. Defence resilience encompasses a multidimensional approach that includes psychological training, coping strategies, trust in defence mechanisms, and organisational factors to ensure the readiness and effectiveness of defence forces in challenging and dynamic environments. By prioritising resilience in training programmes and policies, military organisations can enhance their ability to respond to threats and maintain operational effectiveness. Understanding the relationship between coping mechanisms, stress, and resilience is important for supporting the mental health and well-being of military personnel (Mitchell et al., 2022). In addition, the resilience of the country should increase its ability to prevent or recover from threats to democracy and economy. In order, to enhance the of the U.S. the Department of Homeland Security has developed a series of goals, objectives, and measures. *Concept of security.* In present days, security is understood much wider than military as it is a complex phenomenon. For example, Belammy and Hunt (2015) reveal that security to supposed to be composed of four primary elements. The first one is defining the object that is supposed to be secured, the second is an identification a threat; and the third is an identification of the most advantageous measure to deal with the threat. Finally, the fourth is a determination of appropriate action to deal with the potential threat. Bregar and Kafol (2017) analyse cyber security and propose methodology to guide organisations how to create high levels of sustainable protection systems in order to avoid cyberattacks. Kullenberg (2002) emphasises that security to supposed to include economic, social, and ecological aspects. Small Baltic States face unique challenges due to their limited security capabilities and resources. However, they also benefit from their participation in collective security arrangements such as NATO and the European Union. One aspect of resilience in the Baltic States is their defence burden and military expenditures. Existing empirical evidence suggests that smaller countries tend to free-ride on larger countries in terms of military spending (Neumayer and Plümper, 2014). This is because larger countries have broader military and geostrategic interests that result in larger defence burdens. However, this evidence is based on the assumption that larger military expenditures per GDP indicate free-riding behaviour. Alternative predictions that ignore differences in military spending levels have been developed to address this identification problem. To strengthen their resilience, small NATO countries have undertaken various measures. For example, Lithuania and the other Baltic States have implemented legal, procedural, financial, and technical measures to boost resilience and deterrence in the face of conventional Russian forces deployed in the region (Statkus and Zdanavičius, 2020).

3. Materials and methods

Most of the studies focus either on economic resilience, sustainability, or security issues. However, a state's resilience involves a complex set of factors that encompasses various factors and dimensions. For example, Vasile and Zaman (2014) divide factors that may show countries ability to resist external and internal shocks or recover from them into economic resilience and economic vulnerability. Dachin (2012) includes the trade dependence index, import penetration index, and export propensity index into the estimation of the economic vulnerability of Romania. Earlier experts (Aldger, 2004; Briguglio et al., 2009) emphasise the four indices that might be included in the estimation of economic resilience: economic openness (an indicator of international factors), export concentration (lack of diversification), and dependence on strategic imports. The academic literature focuses on a small number of key indicators. These usually include GDP as a measure of the resilience of business activity and total employment as an indicator of labour market resilience. Some researchers believe that the unemployment rate also indicates the degree of resilience. In addition, the other studies included wage income, household incomes, annual business turnover and credit or debit ratios (for measuring the resilience of companies). Social resilience includes the ability of human and community systems to cope with, adapt to, and learn. Thus, the level of education is included in the estimation. The death rate, infant death rate, and life expectancy refer to the inhabitants' ability to receive proper health services, and conditions for a long and fulfilling life. The number of females in senior and middle management shows equal rights for all genders. Global competitiveness measures good governance as control of corruption, political stability, lack of bureaucracy, effective governance. Most importantly, different measures can show different resistance results. Hence, resilience means how a country is prepared for various types of shocks and manages to recover. For that reason, the proposed resilience index will include more factors to measure the resilience of the country (**Table 1**). The index, based on various definitions of resilience and interlinkages with sustainability. Thus, it will expand three pillars of sustainability and include 4 groups of factors and 25 sub-factors. They are economic, social, good governance, and defence. All sub-factors may represent positive aspects of resilience or negative aspects of vulnerability. The resilience index will be estimated based on simple additive weighting method (SAW method). The SAW method is a quantitative index-overlay approach that has been utilised in various studies across different disciplines to develop indices and rankings. In the context of index methodology, the SAW method involves assigning weights to different parameters and then combining them to create an overall index. This method allows for a systematic and structured approach to decision-making and evaluation processes. It evaluates indicators of various dimensions. The sum of the significances of all indicators must be equal to one. For instance, in the study by Hassaballa (2024), the SAW approach was employed to establish a groundwater Potential (GWP) map in the Al-Ahsa Oasis, Eastern Saudi Arabia, by assigning equal weight to all parameters. Kaykhosravi et al. (2019) used the SAW method to generate the Low-Impact Development Demand Index by overlaying socioeconomic and environmental indices. The study by Kim et al. (2020) focused on developing a sport fan equity index using

the SAW method based on a cross-sectional survey. Moreover, the SAW method has been applied in diverse fields such as decision-making processes for paint and coating in decision making process, construction of a Sustainable Energy Development Index (Ligus and Peternek, 2022), and assessment of land fragmentation for sustainable urban renewal (Kilić et al., 2019). The method has also been used for prioritizing action plans in disaster management (Büyüközkan et al., 2022) and evaluating success factors for AI application in supply chain management (Güler et al., 2022). Overall, the SAW method offers a structured and transparent approach to developing indices and rankings by assigning weights to parameters and combining them to derive an overall score. Its versatility and applicability across various domains make it a valuable tool for decision-making, evaluation, and index methodology. In our case, it is assumed that each factor has the same significance in strengthing or weakening the resilience of the country.

$$\sum_{n}^{i=1} w_{\mathrm{i}} = 1$$

As dimensions of the factors' measurement, they will be normalized. The following formulas are applied:

For the maximizing factors:

$$x_{ij} = \frac{a_{ij}}{a_j^{max}}$$

For minimizing factors:

$$x_{ij} = \frac{a_{ij}^{min}}{a_{ij}}$$

where, w_i is the weight of the factors, a_{ij} is the attribute of each criterion, x_{ij} −normalized performance rating, a_{ij}^{max}–the maximum value of the criterion; a_{ij}^{min} is the minimum value of each criterion. Further, each member of the normalized matrix of the same alternative is multiplied by its significance and added with other members of the alternative.

$$\mathrm{I} = \sum_{i=1}^{n} x_{ij} \times w_i$$

Due to the lack of data of some factors, the index is be estimated for each year from 2015 to 2022.

The data set for the analysis has been created by using several data bases such as for the analyses of economic, social sub-factors, environmental sub-factors has been collected from Eurostat, World Bank databases, data for good governance is collected from the Global competitiveness report. The analysis of defence factors is based on NATO and Global FirePower ranking (GFP) data.

Table 1. Factors and sub-factors of the proposed resilience index.

Factor	Sub-factor	Measurement	Min or max
Economic	Economic development	GDP per capita	Max
	Current account balance	% of GDP	Min
	Domestic credit to private sector	% of GDP	Min
	Public expenses	% of GDP	Max
	Exports of goods and services	% of GDP	Max
	Foreign direct investment	Net inflows, % of GDP	Max
	High-technology exports	% of manufactured exports	Max
	Imports of goods and services	% of GDP	Min
	Inflation	Consumer price, (annual %)	Min
Social	Education	Education expenditure in current dollars	Max
	Death rate	Crude (per 1000 people)	Min
	Health expenditure	% of GDP	Max
	Employment to population ratio	15+, total (%)	Max
	Females in senior and middle management	Share of employment in %	Max
	Internet access	Individuals using the Internet in % of population	Max
	Life expectancy	In years for both genders	Max
	Infant death	Number of infant deaths per year	Min
Good governance	Control of corruption	Percentile rank	Max
	Government effectiveness	Index	Max
	Political stability and absence of violence/terrorism	Index	Min
	Regulatory quality	Index	Max
Defence	Expenditure on defence	% GDP/per capita	Max
	Military personnel	Number in thousands of people	Max
	Expenditure on equipment	% of expenditures of defence	Max
	Expenditure on personnel	% of expenditures of defence	Max

Source: (Author, 2024).

4. Results and discussion

This estimation of defence sub-index is based on the annual data from NATO over the period between 2014–2022. NATO provides data on the defence expenditure of its member countries, and has been doing so since the year in which each of those member countries joined the alliance. The United States is one of the founding members of the alliance, having signed the North Atlantic Treaty in 1949. The United States is the largest NATO donor. Since Russia has started a full-scale war in Ukraine, NATO countries, in response to such a situation, considered increasing expenditures on defence. Even small NATO countries with limited financial resources started consequently to increase spending on defence, and consider additional funding sources. For example, Lithuania is one of the small NATO members targets to increase expenditure on defence to 3.5 percent of GDP by 2026. In 2022, only five smallest NATO members spent 2% or more of their GDP on defence. The greatest amount of defence to GDP has been devoted the Baltic States: Lithuania (2.36%), followed by Estonia (2.34%), Latvia (2.10%). Hence, according to NATO data, by 2024 Estonia

plans to increase its spending on defence to 3.43%, Latvia to 3.15% and Lithuania to 2.85%. The greatest spending on defence is planned by Poland (4.12%), which is even higher than the U.S. (3.38%). The **Figure 1** shows the comparison of defence expenditure as a share of GDP in 2014 and 2024. Most of the countries have reduced their expenditures on defence since the Cold war ended. Even more, NATO members reduced expenditures due to the financial crisis in 2007–2009. Thus, in 2014, the majority of the NATO members even did not spend 2% of GDP on defence.

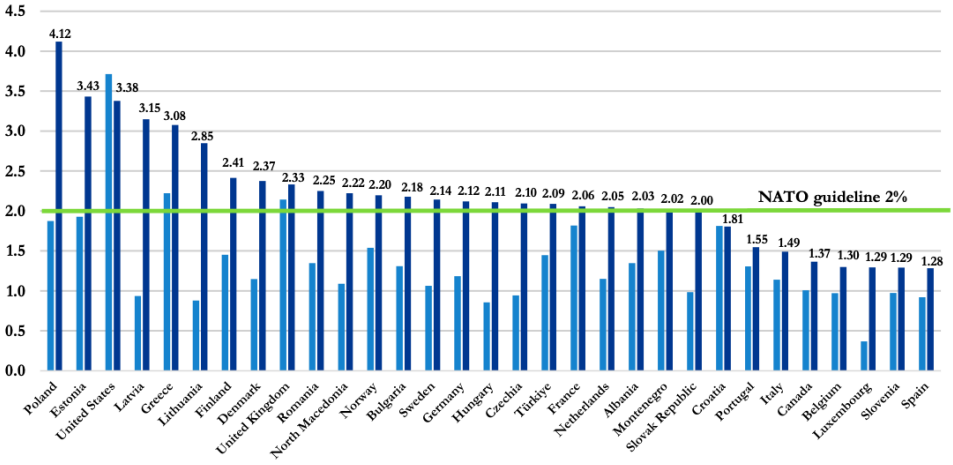

Figure 1. Defence expenditure as a share of GDP in percentage in 2014 and 2024 (based on 2015 prices and exchange rates).

Source: NATO, 2024.

The other factor is the current account balance, which shows the country's financial inflow and outflow record. Theoretically, the current account balance should be zero. However, it is very rare that a country reaches it. Thus, the current account might be negative or positive. A surplus means that country is the creditor to the rest of world. While deficit is opposite, which means that country is the debtor to the rest of world. Thus, among the Baltic States, none of them has a zero or balanced current account in the analysed period. Further, the resilience index will include domestic credit to the private sector (% of GDP). This ratio has been chosen as it describes financial resources provided to the private sector by financial corporations that establish a claim for repayment, such as loans. At the end of 2022 in Estonia (59%) this ratio was much greater than in other neighbouring countries, Latvia (31.1%), and Lithuania (37.53%). The other important economic indicators are exports and imports. In this study, export and import are included as separate factors, rather than the one that might represent international trade. Actually, imports show dependence on the other markets and countries. In considering the other economic ratios, in Estonia high-tech exports made 19%, while in Lithuania only 11.5% and Latvia 16.5%. In 2022, Estonia, among the smallest Baltic States, attracted the highest number of net FDI flows, which made 19.79% of the GDP, while in Lithuania it made only 4.3%. The other factor that has a crucial impact on purchasing power and the economy is inflation. From 2021 to 2022, inflation increased significantly all over the world. However, the Baltic States were the most affected by increased prices in the EU. In Lithuania inflation hit to 19.71%, followed by Estonia (19.4%), and Latvia (17.4%). Meanwhile, consideration for increasing expenditures on defence would mean greater

government debt unless the country would implement the other measures for funding defence sector. For example, in the case of Lithuania, increased taxes and excise on alcohol, tobacco, and fuel would result in higher inflation as the business companies target constantly growing profitability. For estimating the index of states' resilience, the social factors are important as much as economics and defence. Health and education systems in the country make a significant impact on society, its ability to work in a high-tech or low-tech, lifetime. Meanwhile, the largest rate is in Latvia (18.4) followed, by Lithuania (17) and Estonia (14) with the spending on health at 4.7%, 5.2%, and 6% respectively. Life expectancy for both genders in the Baltic States has distributed from 73.2 years (Latvia) to 74 years (Lithuania), and 76 years in Estonia. However, the greatest number of infant deaths per year was found in Lithuania (74) and the lowest in Estonia (11). Further, employment to population rate is included in the index; it varied from 57.16% (Latvia) to 61.33%. (Estonia). The female share of employment in senior and middle management shows the equality in careers for males and females. However, the greatest percentage of female share in senior and middle management was Latvia (46.2%). Further good governance includes four factors. The control of corruption in percentage varied from 76.8% (Latvia) to 89.9% (Estonia). Governance effectiveness in points fluctuated from 0.64 (Latvia) to 1.38 (Estonia). According to the data from the World Bank, the political stability and absence of violence/terrorism was 0.69 (Latvia) and with the greatest in Lithuania (0.82), while the ratio may vary in the range of −2.5 to 2.5, when the greater negative number shows worse political stability and absence of violence or terrorism. The other good governance representing factor is regulatory quality. Data shows that the best regulation is in Estonia (1.56) points out of 2.5), while in Latvia (1.22) and Lithuania (1.24) this ratio slightly differs. Furthermore, Lithuania has been increasing its expenditure on defence and security for the last five years, with the target to reach 3.5% of GDP by 2025. Thus, this is one of the reasons that the Lithuanian government recently introduced new taxes. However, increasing the resilience of the country is not possible without good governance, transparency, and low level of corruption. For that reason, the good governance factors have been included in the estimation of the resilience index of the country. Even more, in richer countries the satisfaction of life, and happiness in the country is greater than in poorer ones. Thus, it consequently entails that unity of society, solidarity, and spirit to defend the homeland would be greater.

The results of the estimated resilience index (**Table 2**) of the Baltic States showed that Lithuania (0.562) was the most prepared for various types of shocks, risk at different level of uncertainty in 2022. In the Lithuanian case, the resilience index has been constantly increasing except in 2021 which was slightly greater in comparison to 2022. This might be explained why the situation in the international area has changed since 24 February 2022, as Europe has faced new unexpected challenges. For example, the Russian-Ukraine war caused by new refugees' flow, an increase in energy, and high inflation. In order to control and reduce inflation, the European Central Bank has increased Euribor. Thus, it made it more difficult to borrow for businesses and individuals. At the same time, the households had to reduce consumption, and unemployment has increased. The European economy shrank. Hence, Estonia had the best resilience index almost ten years ago, and it was twice greater than Lithuanian.

The results show that the Estonian resilience index has been declining with slight fluctuation. Meanwhile, we can notice two weakest points over the period in Estonia. These are economic and defence factors. Hence, this finding is unexpected as the greatest GDP per capita in Estonia ($28,247) is greater than in Latvia ($21,799.5) and Lithuania ($25,064.81). The values of social factors have been increasing over time in all three Baltic States. Meanwhile, good governance has been fluctuating in Estonia and Lithuania, while in Latvia this sub-index has been increasing. This might be explained by the fact that Latvia has more successfully implemented some reforms regarding reducing corruption and bureaucracy, and other issues. Hence, it seems that Estonia and Lithuania have not been so successful due to the lack of continuity after elections when the members of the government and parliament change. For example, Lithuania has problems making decisions regarding education and health systems.

Table 2. Resilience index and its sub-factors.

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Economic subfactors								
Estonia	0.227	0.116	0.00038	0.092	0.0085	0.083	0.078	0.096
Latvia	0.048	−0.036	−0.00043	0.095	0.091	0.080	0.065	0.100
Lithuania	−0.078	0.085	0.055	0.079	0.079	0.083	0.087	0.083
Social subfactors								
Estonia	0.118	0.119	0.124	0.127	0.123	0.125	0.130	0.130
Latvia	0.111	0.114	0.119	0.119	0.114	0.115	0.123	0.121
Lithuania	0.109	0.110	0.115	0.117	0.113	0.114	0.116	0.117
Good governance								
Estonia	0.151	0.147	0.147	0.141	0.141	0.140	0.152	0.155
Latvia	0.113	0.113	0.109	0.106	0.106	0.110	0.113	0.123
Lithuania	0.125	0.133	0.129	0.120	0.120	0.120	0.133	0.135
Defence								
Estonia	0.1374	0.1076	0.1193	0.1091	0.1057	0.1047	0.1098	0.1165
Latvia	0.0842	0.0878	0.1073	0.0948	0.1231	0.1082	0.1067	0.1191
Lithuania	0.1092	0.1180	0.1432	0.1383	0.1493	0.1506	0.1405	0.1420
Resilience of the Sate								
Estonia	0.6578	0.5174	0.4169	0.4976	0.4859	0.4964	0.4982	0.528
Latvia	0.4476	0.3645	0.4202	0.5131	0.5223	0.4986	0.5051	0.551
Lithuania	0.3555	0.5302	0.5212	0.5449	0.5464	0.5483	0.5669	0.562

Even more, social, economic, and good governance factors very are often associated with the trust of the government. Concluding, we can claim that sub-factors of national resilience are intertwined and reflect on each other. In order to determine whether any relationship exists between the state's reliance index and its sub-indexes, the correlation coefficient has been estimated (**Table 3**).

Table 3. Correlation between state's resilience index and its sub-factors.

Estonia					
	Economic factors	**Social factors**	**Good governance factors**	**Defence factors**	**Resilience of the State**
Economic factors	1	−0.516	0.253	0.581	0.986***
Social factors	−0.516	1	−0.391	−0.391	−0.433
Good governance factors	0.253	0.201	1	0.550	0.253
Defence factors	0.581	−0.391	0.550	1	0.666*
Resilience of the State	0.986	−0.433	0.253	0.666*	1
Latvia					
	Economic factors	**Social factors**	**Good governance factors**	**Defence factors**	**Resilience of the State**
Economic factors	1	0.250	0.036	0.530	0.971***
Social factors	0.250	1	0.264	0.440	0.420
Good governance factors	0.036	0.264	1	0.103	0.145
Defence factors	0.530	0.440	0.103	1	0.666*
Resilience of the State	0.971	0.420	0.145	0.666*	1
Lithuania					
	Economic factors	**Social factors**	**Good governance factors**	**Defence factors**	**Resilience of the State**
Economic factors	1	−0.072	0.092	−0.136	0.177
Social factors	−0.072	1	0.072	0.784**	0.717**
Good governance factors	0.092	0.072	1	−0.216	0.146
Defence factors	−0.136	0.784**	−0.216	1	0.780**
Resilience of the State	0.177	0.717**	0.146	0.780**	1

Correlation is significant at * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The results reveal that in the case of Estonia, a strong relationship exists between resilience of the state and economic sub-index (r = 0.986, $p = 0.001$). Meanwhile, the moderate interlinkage has been estimated between the index of resilience of the state and defence sub-index (r = 0.666, $p = 0.062$). The other sub-indexes do not have significant relationships among themselves and the index of resilience of the state. Further, situation in Latvia is similar as in Estonia. Only two sub-indexes have relationship with the resilience of the state. A strong relationship has been estimated between the resilience of the state and the economic sub-index (r = 0.971, $p = 0.001$) and a moderate relationship between defence and resilience of the state has been found (r = 0.666, $p = 0.071$). Hence, in the case of Lithuania, the results are different. There is no significant relationship between the economic sub-index and resilience of the state. Strong relationship exists between resilience of the state and social sub-index (r = 0.717, $p = 0.045$). Significant correlation has been estimated between resilience of the state and defence sub-index (r = 0.780, $p = 0.22$). Additionally, a strong relationship has been found between social sub-index and defence (r = 0.784, $p = 0.021$). For further modelling, only statistically significant correlated sub-indexes will be included.

The first and second models (**Table 4**) include economic and defence indexes as independent variables. In the third model, social and defence sub-indexes are included as independent variables. While the dependent variable is the resilience of the state.

Table 4. Regression modelling.

	Model 1 (Estonia)	**Model 2 (Latvia)**	**Model 3 (Lithuania)**
Constant	0.318	0.322	−0.553
Economic	0.977*** (0.072)	1.082*** (0.097)	
Social			6.188 (9.810)
Defence	0.867* (0.412)	0.923** (0.341)	2.727 (2.089)
R	0.993	0.989	0.799
R square	0.985	0.979	0.638
F	165.110	114.632	4.404
Significance	< 0.001	< 0.001	0.079

Significant at * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The first model is statistically significant, and independent variables explain 98.5% of the distribution. Both independent variables have an impact on the resilience of the state. If the economic sub-index would increase by 1 unit, thus the resilience of the state would grow by 0.977 points. While an increase of 1 unit in the defence sub-index would result in 0.867 points increase in the resilience of the state. The second model is statistically significant, and independent variables explain 97.9% of the distribution. In the case of Latvia, both independent variables have a positive and similar impact on the resilience of the state. For example, if the economic sub-index would grow by 1 point, the resilience of the state would increase by 1.082 points. Thus, economic factors have a greater impact on the resilience of the state in Latvia, than in Estonia. Further, the increase of the defence sub-index would have a positive impact on the resilience of the state as well. Its growth by 1 point would contribute to 0.923 points in the increase of the resilience of the state. Meanwhile, the third model is composed of social sub-index and defence sub-index and independent factors. The results show that the model 3 explains 63.8% of the distribution at the significance level of 0.1. Further, it was revealed that both independent variables are insignificant in a multivariate model.

5. Conclusions

The problem of how to increase the national resilience and preparedness for various types of disasters, economic, security, or other shocks remains for every country in the world. However, on the global level, we face different levels of resilience and understand the need for improvement in resilience. In order, to improve the state's resilience, it is necessary to understand the meaning of resilience and criteria for estimating resilience. We have included factors based on the sustainability three pillars by additionally including defence factors. For estimating the state's resilience index, we have applied the multicriteria decision making method, which one of the advantages is the ability to minimise or maximise criteria. We claim that minimised criteria represent the vulnerability of the country, and maximised shows factors that increased resilience. It is in line with the research of Vasile and Zaman (2014), who

were estimating economic resilience in Romania with the comparison to the other countries. However, this research showed only vulnerabilities and resilience from an economic point of view. They maintained that economic resilience deals with diminishing the probability of failure. A similar methodological idea has been developed by Krausmann and Rose (2013), who developed a resilience index for business recovery. Christmann et al. (2010) emphasised only social vulnerability and resilience.

Theoretical and practical implications. Thus, the results of research add value to the theory of resilience by providing alternative methodology for estimation of the state's resilience index. Additionally, the results might be useful for the institution responsible for the state's long-term strategy development by identifying the most problematic area in increasing resilience of the country. Four blocks of factors have been developed that represent strategically important issues that deal every country. All factors are in line with the sustainability, and wealth of the inhabitant in the country. Defence resilience is a crucial aspect of defence organisations, focussing on their ability to adapt, respond effectively to challenges, and maintain operational readiness in dynamic and uncertain environments. By embracing resilience, defence and security organisations can improve their preparedness and adaptive capabilities in the face of complex security challenges. The results reveal that in Estonia and Latvia resilience of the state is related to economic and defence factors. Meanwhile, in Lithuania, resilience of the state has interlinkages with defence and social factors. Even more, in Lithuania, defence and social factors demonstrated significant correlation. Thus, in Latvia and Estonia, it is necessary to analyse how economic and defence factors affect resilience of the state. At the same time, the social and good governance factors must strengthen that they would have impact on resilience of the state. As each country has to be prepared for various different shocks. Hence, in Lithuania, economic factors have no such relationship with resilience of the state. Thus, the government should improve economic development strategy by introducing measures which would allow to react quickly to any crisis or shocks. In conclusion, defence resilience is a multifaceted concept that encompasses the ability of defence forces to adapt, respond, and recover from disruptions effectively. By prioritising resilience in defence strategies and investments, military and security organisations can enhance their operational readiness, mitigate risks, and ensure mission success in dynamic and uncertain environments.

Limitations and future research. First of all, the research is limited only to the Baltic States which, might be extended to the comparison to the EU members, or even the NATO alliance. Additionally, more factors might be included in the resilience index, which would allow us to identify the vulnerability and resilience of the country. Furthermore, the resilience index should be continuously estimated every year in order to compare the changes in situation. The research is very limited to the defence resilience factors, which did not cover stress management, psychological health of the military personnel, enthusiasm and determination to defend the homeland, and patriotism.

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