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## The self and its values as content *per se* in terms of microgenesis and process philosophy

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**Abstract.** The idea of the self is still a philosophical problem for psychology, neurology, and even international law borrows ideas of the self to interpret the phenomenon of national identity and develop further regulations. The ambiguity surrounding the concept of the self creates challenges for academic and formal definitions, necessitating thorough analysis in this paper. Thus, the aim was to provide the reader with a series of non-substantial and non-dualistic versions of the self. In this paper the authors tried to approach the subject (the self) from microgenetic point of view based on works of Jason W. Brown. This analysis was justified by the non-linear, non-substantial and non-dualistic paradigms growing popular in globalised world and in academic communities. In particular, it was established that European Society for Process Thought, Claremont Process Nexus, International Process Network and other societies offer series of conferences on regular basis for many years to satisfy the need in more accurate definitions of the non-substantial versions of the self. It is demonstrated that duality of the self and the world can be eliminated by consideration of the self from the process point of view, that is, as a dynamical subject-superject, not a classic subject-object relation. The results of the paper can be used by PhD students, scholars and researchers in their further advances in neurology, psychology, law, identity studies, sociology that aim to provide both theoretical and practical solutions in their areas

**Keywords:** microgenesis; creative evolution; Alfred North Whitehead; process psychology; neurology; coincidentia oppositorum

### Introduction

Law, sociology, cognition therapies, philosophy – all these sciences attempt to find and define the elements that constitute the principles. One of the principles is to start from the utmost possible entity that can be perceived or logically understood. For identity theories (in law studies, sociology, cognition, epistemology) this entity is the self. Science still does not know how to approach this entity. Some methods are used, such as comparative or analogy, where the self is supposed to

be the product of the brain and the brain is, supposedly, can be compared to computer machine or modular systems. Another method is introspection, where the self is supposed to be identical to bare what it is. In psychology the self can be understood as an interplay between the outer world and mind. In some cognition studies the self is either the sum of subconscious and conscious, or it can be the source of what therapists call *id*, *libido*, *sublime* etc. And since these results of researches

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are different, this article aimed at further explanation of the self from microgenetic point of view. This version of the self is growing popular in Western academic environment but quite new for the rest of the world.

In the period from 2018 to 2024, some articles were published on this topic. In particular, when the self is studied, it is argued that the dualism of the mind and brain can be overcome by introducing the categories of time and serial order, how the self can be interpreted in terms of events of perception. P. Stenner (2024) argues that the category of time, as such, must be interpreted in terms of the self. Which means, in its turn, that the self is a condition that needed to perceive past, present, and the future as modes (categories) of time. This problem requires revision if the concept of time back to St. Augustinus (*Confession*, book eleven). Human beings can experience and interpret events such as the *now* of the past or the *now* of the future through their perception, cognition, and emotional connection in time. But most interesting observation was done in 2020 when perception of the self was associated with different states of perceiver (dream state, wakefulness, disease, mental malfunction etc.). It is shown that the ideas of the entity that used to be called the self can be interpreted partly as an illusion, partly as experience of *its own* experience. This was reflected in J.W. Brown (2020). It requires a more detailed explanation of how we define the nature, experience, and concept of illusion.

In J.W. Brown (2021) was demonstrated how novel states of mind can be arisen from the so-called short-term memory, and long-term memory. These are different realms in the self that provide consciousness of the self with different data on the level of phenomena, as the specific events of consciousness. The connection between mind and brain is explained by non-dualistic approach to the process of cognition and needs further studies in what we call “inner” and “outer” experience, “feeling” and “category”. The self was demonstrated as many-dimensional entity not only in terms of its temporal dynamic evolution (microgenesis) but also in light of inner states or *qualia*, namely, in terms of drives and values, or instincts and ideals. This work was done mostly by J.W. Brown & D. Zhadiaiev (2022) and it shows that some mechanisms between pre-established functions, needs (survival, nutrition, etc.) and categories (thoughts as ideas, ideals, principles) can be traced. The problem for science remains to determine whether formal, mechanistic terminology can adequately describe microgenetic processes.

More applicable studies were recently conducted by X. Gao *et al.* (2022) in definition of the self in terms of brain, face recognition, numbers. This method provided solid data based on clinical researches but, as any practical and empirical approach, it may blur the difference between different concepts as it operates by continuous data and formulates in discrete definitions, concepts. The concrete empirical data of the brain events that

can help understand the idea of the self can be complimented by rather philosophical, fundamental works and one of them is by R. Lestienne (2022) about Whitehead where ground-breaking cosmology of the Alfred North Whitehead considered as a philosophy of time. This work is important for the research as it takes into account the category of time that aids the understanding and interpretation of the self as dynamical, not substance-based entity and as a process where outer data merge into the one event called microgenetic cognition. Based on the above-mentioned studies, this article aims to explore the concept of “self”, to consider its potential content and to assess the relevance of the subject-object duality in its understanding. The research aimed to explore possible answers to several key tasks:

1. Assessing the relevance of a dualistic approach in understanding the values of the self.
2. Interpreting the idea of the self in terms of its dynamic relationships, including part-whole and past-now-future dimensions.
3. Investigating the content of the self that defines it as an event, thing, or process.

Methods used in the paper were the next: analysis (deconstruction of the key-terms), comparison (the idea of the self is compared to new, recent, and traditional interpretations), synthesis (the idea of the self is constructed on the basis microgenetic approach and popular theories), descriptive (the idea of the self is described as it is not the thing that can be actively experimented by). The novelty of this work provides complex-based solution as it enriches current researches with contextual data in terms of traditional philosophical views and new neurological data.

### Historical and philosophical context of microgenetic theory

The *continuity* of the Brown's ideas with the historico-philosophical context can most evidently be found in that binary character of the theoretical understanding (logical quantifiers: *all*, *some*, *affirmo/nego*) and in an attempt to overcome that. Nicolas de Cusa tried to do that before neurology developed its approaches to study binary mind/brain relations. Demonstrating his principle *coincidentia oppositorum* (unity of the opposite) he used an analogy with the circle and straight line: if radius increases *ad infinitum*, then one geometrical figure (circle) turns to be the other (straight line). Despite this demonstration was used for theology (and social and political transformations), its pure metaphysical nature was borrowed centuries later, H. Bergson (1911) made kind of theoretical inversion of this same principle when considers the principles of scientific methodology – a ratio between an intellect and intuition. In particular, he makes analogy between intellect and straight line and between an intuition and the circle: an intellect (formal logic) has advantages because it gives precision, a definitive knowledge

(Brown & Stenner, 2024). However, this definition achieved at cost of limiting the scopes of research, that is, by ignoring the context, historical development (temporality), uniqueness of the event (all what postulates dialectical logic of Hegel in opposition to formal approaches). It can be possible to make right decision in particular situation that will turn out to be wrong in a long run (Stenner, 2023). That is why H. Bergson compared intellect to a straight line taken as an infinitely small fragment of the circle (here inversion happens when H. Bergson appealed to an *infinitely small* piece of circle and Nicolas of Cusa suggested *infinitely large* circle). Despite these approaches are contrary to each other (are contrary in their forms, not in their content or meaning), they give qualitatively same results (different elements of experience are turning into each other).

A novelty of microgenetic approach is that it does not borrow known principles (however, “known” “principles” in metaphysics do not mean they are outdated, for principles *per se* are as novel and actual as far as they eternal. Otherwise it is not about the *principles*, but having just rules, opinions, or different thoughts in mind) but develops quite different approach (and thus, this trend is a sign of philosophical, not just technical, mode of thought). For sure, some readers may find out that J.W. Brown uses the idea that was developed by Heraclitus (all things flow, *panta rhei*) but this is another evidence that the principles of microgenetic theory as actual as they are eternal – they still in the context of historical evolution of thought of human kind yet with new observations and thus, newly interpreted for the sake of avoidance of those inconsistencies caused by too rigorous use of clarity and exactness promised by laws of formal logic (Whitehead, 1933). The question J.W. Brown addresses in these *Essays* – a proper ration of endogeneous and exogenous processes – is, actually, the core riddle of the last 2500 years and it is not only about psychology (Whitehead, 1978). Once we know the proper answer, many sciences and art will advance prominently since endo- and exogenous phenomena (processes) are just another perspective of part-whole, of what is actual and of what is non-temporal, of conceptual and of emotional, of immanent and of transcendent, of substantial and of accidental, of particle and of wave etc (Brown, 2018).

However, it seems possible to make some progress towards the answer and, possibly, make an operation that incited some epic turns in philosophy. One of them was well-known Kant’s so-called Copernicus’ turn: despite Kant said that it was Hume who awakened him from the dogmatic slumber, Kant himself abandoned the most popular question at his times (since 1500 to 1800) on how many substances are out there (one – monism, Spinoza), (two- dualism, Descartes), (many – pluralism, Leibniz and, to some extent, Whitehead, though he is totally against any substance-theory) (Zhadiaiev, 2023). All these approaches to solve

question on how many substances are there have really powerful arguments and it is very likely that 500 years later one of them will be popular again with the new interpretation (Dewey, 1939). B. Spinoza’s monism is getting more and more popular in light of eco-movements: “a separation or alienation of man from the nature as different organisms is not convincing since human being borrows part of the Earth’s atmosphere each second – they are breathing and in this process the line that separates two seemingly different organisms – of the planet and of the human being – is blurred in lungs, in brain... in mind...”. And there is another point closely related not only to B. Spinoza’s monism but also to J.W. Brown’s microgenesis – psychology cannot explain mind/brain problem (see *The Mind/Brain* chapter) on the basis of duality and microgenesis helps as an approach that can figuratively be called “more dynamic version of monism,” or, say, “cellular monism.”

In the way Kant implemented his epic turn stepping away from the so-called main problem – the question about substance – Kant asks rather: how it is possible to be able to know being, objects, phenomena? It is not implied that Kant should be followed in his theory, of course (and if he would, Kant himself would be very embarrassed since in this way a “follower” uses one of the established framework of mind, which cannot be any real philosophy but imitation of it). So, to make any ambitious attempt to give the answer to the problem of duality is to step away from the duality and to rethink duality (endogenous-exogenous). Possibly, the hint can be given by Origen from Alexandria. It may sound irrelevant to psychology and Origen was not accepted by official church, but the authors think his interpretation was brilliant. And the way Medieval theology borrowed ancient Greek philosophy (Thomas Aquinas did not create his famous five demonstrations of God’s existence but used rhetoric to develop the only argument of Aristotle on God as first mover – Aquinas applied it to few more different terms (beauty, perfection etc.), leaving in the same principle). In the chapter on “Feeling and Action” of the recent work mentioned J.W. Brown (2024) reader can find more details but it is necessary to consider how the duality of freedom and necessity was overcome in centuries before and, perhaps, a hidden *pattern* for finding the methodology to approach the solution of this problem could be found. Pattern *per se* in J.W. Brown’s works is not associated with kind of cliché but: “a real... in nature that goes unnoticed because it is uniform” (Brown, 2002). Origen, making his quest in to what degree God is almighty comes to conclusion, that there is not just two opposite categories. The opposite categories were represented in Old and New Testament controversy: God’s power to *influence* the mind and humans responsibility of their *free* choice. If God has that power to influence (and thus, to commit sins), then human being should not be fully responsible for sins committed. If sins are committed by free will,

then God should punish for sins and for that choice not properly made. To avoid this antinomy Origen offers three coordinated categories (e.g., freedom, necessity, and possibility) instead of two. The new factor here is the one he pictures as the rain (*possibility*) that can pour onto field with seeds (good deeds done freely) or not. So, in terms of pure metaphysics, Origen avoided duality by implementing the category that unites opposite categories. In his beautiful explanation the soil (the field) is what given to us as granted (*necessity*), and the wish to sow the seeds (free will to make a choice for the good – category of *freedom*) or being lazy for that (a choice for the bad) is human's responsibility that God can punish or reward – these images are exemplification of the freedom we possess and responsibility for it. So, it is not the opposition where one category may or may not dominate the other but the *possibility* (kind of randomness) that makes the final decision and solves that controversy: rain may pour or not for the harvest (God's blessing to reach Heavens) to grow and being reap or not (Origen, 2019).

### Microgenetic theory and its philosophical innovations

Some similar theoretical tactics must be implemented to avoid dual approach that cannot answer some questions of endo- and exogenous processes and in microgenesis it is an image of the fountain where top and the bottom parts are in constant flux, core of the self (or subconscious) reaching consciousness, self reaches external worlds and comes back, awareness reaches the content and comes back for another cycle (Zhadiaiev, 2020). In Whitehead, for example, it is the principle (1) many becomes (2) one and (3) increased by one (tree-part onto-epistemological scheme).

It was outlined here in this part that microgenetic ideas offered in J.W. Brown's (2017) book are organic outcomes out of convergent ideas (ones that aim at overcoming duality – Abelard's intention to add rational elements to irrational beliefs, B. Spinoza's pantheism, Nicolas of Cusa's *coincidentia oppositorum*, H. Bergson's evolution, intellect and intuition, A.N. Whitehead's principle *many become one and increased by one*, etc). Sometimes the mind explains the self, sometimes the self explains the mind. A human being cannot lie to their mind – it is mind that can lie to human being. The similar conclusion can be found in Immanuel Kant's works – people often use to play with their imagination not always understanding when it is imagination that plays with them. This line is another proof that man's mind works by the same principles (regardless the progress of technology, thus, cannot be reduced to technology, block- or modular theories) and indirectly it is another evidence of how contemporary and related to the past inquiries the question about the subject of psychology relevant and is organically up to the date (Seghal, 2016).

It is far easier to write some books than to read them, as Medieval philosopher once said (Abélard, 2022). There are, however, some books that easier to edit than others. This saying may echoing thousand years after P. Abélard thought on books. Some of them are written by J.W. Brown. The reader will find a dance of logic and clinical experience, the poetry of corollary in J.W. Brown's explanation – a style that organically developed out of his non-dualistic microgenetic theory, where multiplicity achieved out of unity and it is all one continuous stream, reflected in its discrete droplets (Brown, 2017). The thought to mention here one thousand years-old saying (seemingly, absolutely not relevant to the study of mind) was not occasional and suggested by three reasons (Stenner, 2015). First, the problem that J.W. Brown concerns mostly is the nature of interaction between different elements of experience (Stenner, 2011). This interaction happens not only in physical perception (between traditional, yet oversimplified concepts such as “subject” and “object” (S-O) but between writer and reader, between writer and its text, between text and the reader, in what author wrote and, how they were interpreted, in what author means and how they are understood. These all are not identical perspectives and suggest that the problem of cognition is far more complex (thus, is more interesting) than in banal duality of logical S-O relations: “It is less likely that the laws of mind are the basis of physical laws than the other way around, but the possibility is worth considering” (Brown, 2017). Second, the Medieval author was more interested in *reason* and *understanding* than in belief in somewhat similar way like J.W. Brown is concerned in *mind* as the flux out of which science collects more data about the brain and not in confession of popular theories of the brain as mechanical container of the mind (Stenner, 2024). It needs to be understood first what we are feeling and then believe it. Not vice versa. Where belief comes first and not understanding, human being is rather having hallucinations. Where P. Abélard states: *Nihil credendum nisi prius intellectum* (we should not believe if we do not understand first) to beat some social illusions of his time, J.W. Brown puts it like: *to think the world is illusion is one thing, to feel it another* (Brown, 2017). And the next (third) reason is more important here. In the century of technologies, when each “like” and “comment” is a potential source for currency and the income can be derivative (generated) out of interactions online, the thought *on* thinking and cognition (reflection) still matters as thousand or more years ago. Despite the world is changing dramatically, the modes of perception are still the same as at the times of Zhuangzi dreaming he is a butterfly, as in times when crowd of alumni gathered together to have opportunity to listen to P. Abélard, and to the date, when observed photons behave both as particle and a wave at the same time, and as at the times of virtual and augmented reality (Zhadiaiev, 2020). This comparison

suggests that the world and the self, mind and all what it understands (or hopes to) are only seemingly in opposition but actually not in fully true state of things are opposed as subject and object of perception: to perceive an object and to describe that perception of that object are different, at least, not identical perceptions (though object can be agreed to be considered the same): “no actual entity can be conscious of its own satisfaction; for such knowledge would be a component in the process, and would thereby alter the satisfaction” (Whitehead, 1978).

This topic was mostly covered by J.W. Brown in his book series and about 200 articles published over the past 40 years. It represents a coherent point of view in which theory of evolution expands beyond just biological domain and reaches the level of perception where the paradigm of the subject-object relationships is absent or performs only derivative role (Brown, 2023). Since the article concerns the phenomenon of the self in relation to perception, M. Seghal (2016) is another author that explains a process and web-like character of how consciousness works. The main material was borrowed from A.N. Whitehead (1933; 1978) and H. Bergson (1911). These last sources represent a solid cosmological ground for metaphysical scheme we aim to draw with its application to microgenetic ideas (Gao *et al.*, 2022). One of the recent editions of Origen (2019) serves this research as another example of the fact that it is not that ideas are dependent on time passage but it is time and contemporaneity is shaped by some new versions of interpretations of known philosophical ideas.

### New perspectives: Microgenesis as a horizon

When it comes to psychology, we logically and naturally assume the *mind*. When it comes to neurology, we associate term *brain* with it. Each science should provide a definition of its subject. With mind, in comparison to the brain, it is more getting complicated (Lestienne, 2022). But the science without justification of what it gives to others is not a science. Here philosophy is at work: it gives such and such forms of arguments and definitions for psychology (actually, philosophy is at work when it comes to any other sciences for sciences themselves have no apparatus to explain the need for the good what it aims to produce (Weber, 1946). However, it is much easier to provide a definition of an object or phenomena that experienced by human being, which is felt (Lyotard, 1979). In psychology the problem with its subject (the definition of the subject studied) is thrice more complex:

▲ Since Aristotle’s judgment about the soul (how difficult it is to define it) it is still not that easy to define something what is not experienced directly.

▲ The definition of the subject (mind) must be provided by the same subject (mind), what is different from traditional way of academic research where

subject perceives an object. That is, if we follow the requirement to define what we study in psychology, psychology then stands in a different set of sciences, not natural sciences and, may be, not even humanities or social sciences since the very paradigm of understanding is different.

▲ The mind and the self of it supposed to be a substance (something, that lied below the surface of things or phenomena), a “thing” that provides an “inception” of perception, something that feels the action upon itself and we seemingly do not have such a thing for study either: (a) none outside of the mind has such a direct access to it as to any other ordinary objects and (b) if human being has that only access, then what it *is* that access’ to it? If it *is something* different, we do not have full access to the mind, and if it is the same as the self, then perception is like multiplying by zero and having “zero” in sum (the “bits” of perception amount to zero) or multiplying by one and having in sum the same entity, not more and not less (self cannot know more than it is already knows about itself).

▲ In his other work (*The self-embodying mind: Process, brain dynamics and the conscious present*) J.W. Brown (2002) notifies reader that: “Mental events are unobservable in one’s self; the event evades detection; the act of observing alters the observed event”. That is, the perspective these *Selected Essays* opens is a non-substantial approach (and as such, it is a process (Lyotard, 1979). It would be worth to skip lengthy theoretical analysis (reader will make it and test it on their own) and rather demonstrate ideas seemed to be most interesting. In many other works J.W. Brown hesitates if the self is an illusion or not. On the one hand, yes, it is an illusion:

▲ for it is not possible to demonstrate that self which is *evident*;

▲ for attributes ascribed to the self are different at different times and the self, as a substratum of those attributes (accidents, in terms of substance-qualities approaches): is human being the one who possess such and such knowledge or not? And if human being gradually masters such and such skills which they had not before, then what defines its self?.

On the other hand, the self supposed to be more real than it appears to be in theory since it is the “ground” where outer world objects, “lands on,” the platform for any other possibility for epistemology and ontology. At least, to add something to the explanation of perception, the perceiver needs that “something” to which new event of perception adds “something else” (James, 1890). This last construction (or scheme) seems logical or, at least, reasonable, understandable, not contradictory (Zhadiaiev, 2023).

To avoid abstract reasoning and ask about illusionary nature of the idea of the self, is to consider the self as starting point for drives and values it is surprising how the subjects at all levels of animal life (human including)

strive to defend themselves or avoid harm or, feels fear to lose itself in death (Brown, 2022). All these emotions have no verbal and logical explanations (Pachalska, 2012). Quite opposite: logic and language follow this fear or drive and particular individual life and civilisations are building up into sophisticated ramification of languages and cultures being rooted to that self.

In cases when conflicts reach their extreme points and opponents fearlessly prove their beliefs – beliefs and values are often explained as ideals not of external world but as *ideas* (impossible to “exist” or explained without the self) (McLean, 1990). Quite often, these values and ideals are not justified as goals towards which we should aim on imperative basis (forced education, discipline, etc.) but justified *ad contrario* – a supposition to reject that values (justice, arts, idea of God etc.) which, in its turn, logically leads to contradictory and not satisfying conclusions: if, say, someone is allowed to steal, then they will not likely to agree to be robbed (James, 1912). These abstract, vague ontological questions necessarily make the authors to think that without the self all of values are meaningless (Pachalska & MacQueen, 2005). Moreover, even when conflicts of the events in history trapped into dead end, the *Golden Rule* in almost all religions and cultures steps into its positive or negative definition where the final appeal is to the self (“do as *you yourself* want to be treated by others” or, in negative definition (*apophatic*): “do not act the way *you* do not want others acted upon *you*”). This self (imagined as that “substrate,” “substance,” “ground,” “platform” etc.) is not a “thing” in a set of external objects. It is from different “set” and, possibly, something out of any “sets” since it gives kind of unity – it “glues” the world of external objects with itself. Its function could be compared to mixbus compressors in music production that turn different sounds into entire piece making it sound relatively uniform (in terms of dynamics).

Yet, even this comparison-approximation is wrong, for music is not made by compressors or for compressors and the self transforms the world perceived and stands as its final goal. One of the explanations offered by the authors J.W. Brown & P. Stenner (2024) in their new book is: “But there are deeper problems with self-knowledge: contents other than those in introspection are unavailable to awareness, there is a lack of access to subsurface cognition, and there is a question as to the agential status of awareness; that

is, awareness does not search out a content but is produced by the content it is looking for. Microgenesis obligates that awareness is created by surfacing contents with an inability to know submerged (transformed) phases from which the surface is elaborated. These deeper stages have been studied with experimental and clinical methods”.

## Conclusions

This article makes it evident that the self is not such a thing that can be understood as a regular object. Based on J.W. Brown’s works, P. Stenner and other authors came to conclusion, that any subject-object approaches are outdated as they postulate substance-accident mode of analysis and which introduces some dualism (ambiguity) in understanding of the self as phenomenon. As it becomes clearer that the phenomenon of the self based on process-like events, not things or substances, it is not accurate to call it “phenomenon” *per se* since it exists in the dynamics of the events traditionally called “past”, “now” and “future”. Also, this actual entity (the self) should be considered in its dynamics of the states and parts: wakefulness-sleep, core-drive-consciousness-values.

The peculiar character of such entity is that it is both the perceiver of its content and the content itself for its perception. This makes quite unusual this entity to be analyzed by traditional methodology or in terms of subject-object dualism. So, the values of the self have elusive character as they need to be specified by the content different from the self. For now, it is argued that the values of the self are the self as its own content. Prospective researches can be focused on the nature, principles or mechanisms of how it is possible to apply accidental *qualia* to such an entity like the self and whether it can be described in terms of logical predicates, pronouns, values, functions. Important role will play those researches which differentiate the self from the so-called ego (psychology, religion, spirituality etc.) and if they specify in what way the self can have elements of conscience (ethics).

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## Conflict of interest

None.

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## «Я» і його цінності як зміст *per se* з точки зору мікрогенезу та процесної філософії

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**Анотація.** Ідея «Я» все ще залишається філософською проблемою для психології, неврології, і навіть міжнародне право запозичує ідеї «Я» для інтерпретації феномену національної ідентичності та розробки подальших нормативних актів. Неоднозначність поняття «самість» створює труднощі для академічних і формальних визначень, що зумовлює необхідність ретельного аналізу в цій статті. Таким чином, мета полягала в тому, щоб надати читачеві серію несуттєвих і недуалістичних версій «Я». У цій статті автори намагались підійти до суб'єкта (самості) з мікрогенетичної точки зору, спираючись на роботи Джейсона В. Брауна. Такий аналіз виправданий нелінійними, несубстанційними та недуалістичними парадигмами, що стають все більш популярними в глобалізованому світі та в академічних колах. Зокрема встановлено, що Європейське товариство процесуальної думки, Claremont Process Nexus, International Process Network та інші товариства вже багато років регулярно проводять серії конференцій, щоб задовольнити потребу в більш точних визначеннях несубстанційних версій «Я». Продемонстровано, що дуальність «Я» і світу може бути усунена шляхом розгляду «Я» з процесуальної точки зору, тобто як динамічного суб'єкт-суб'єктного, а не класичного суб'єкт-об'єктного відношення. Результати статті можуть бути використані аспірантами, науковцями та дослідниками у подальших дослідженнях у галузі неврології, психології, юриспруденції, ідентичності, соціології, які мають на меті забезпечити як теоретичні, так і практичні рішення у своїх галузях

**Ключові слова:** мікрогенез; творча еволюція; Альфред Норт Вайтхед; психологія процесу; неврологія; *coincidentia oppositorum*



## Technological sovereignty of the state: Practical experience of Ukraine and the European Union

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**Abstract.** The purpose of the study was to comprehensively examine the impact of technological sovereignty on economic and national security. The paper considered key aspects of technological sovereignty. The results of the study showed that technological sovereignty has a substantial and multifaceted impact on national security, including economic, energy stability, and military security of the country. This ensures the sustainability of national economies and reduces dependence on global markets and critical technologies, which is especially important in the context of growing competition with major technology players. Ensuring economic independence also allows the country to control strategically important resources, contributing to more sustainable development in the face of international turbulence. The impact on energy security is manifested through the introduction of innovations in the field of renewable energy sources, the development of own energy efficiency technologies, and the creation of national networks for energy management, which helps to reduce dependence on imported energy resources and increases resistance to external influences, such as energy crises and economic sanctions. Military security, as an important component of national security, is also substantially strengthened through technological sovereignty. In particular, the development of its own cyber technologies, defence systems, artificial intelligence systems, and data analysis technologies minimises the risks of external interference in defence processes and ensures the country's independence in the field of national defence. Technological sovereignty allows for a more effective protection of critical infrastructure from cyber attacks and a reduction of dependence on foreign developments. The experience of Ukraine and the EU showed different approaches to achieving technological independence, including support for national research, development of their own semiconductors and digital technologies, cybersecurity programs and initiatives to reduce technological dependence. These factors highlighted the need to integrate public strategies to build technological sovereignty as a key component of national and economic security

**Keywords:** technological sovereignty; economic independence; digital infrastructure; data protection; innovation; cybersecurity; energy efficiency

### Introduction

Ensuring technological sovereignty in the face of fierce competition and dependence on foreign technologies is one of the priorities of national governments, as it becomes critical for ensuring national security in general and its sectors such as military, economic, and energy security. States feel an urgent need to develop and implement their own technologies, strengthen control over critical infrastructure, and minimise dependence on imported technology solutions. Ensuring

technological sovereignty is crucial to reducing the risks of economic vulnerability, especially in the face of global economic competition and the possibility of applying technological sanctions.

Previous research confirms that technological sovereignty and the ability to implement and develop its own technologies is one of the critical factors for ensuring the national security and economic sustainability of the state. In the paper of Y.T. Zang & F. Xiong (2020),

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it is argued that the development of innovation infrastructure and the support for local technology companies are fundamental aspects of achieving technological independence of the state. The researchers argue that building a solid foundation for long-term economic growth requires actively attracting public investment in research and development projects.

M. Robles-Carrillo (2023) and O. Omar *et al.* (2022), in turn, emphasise that technological sovereignty is closely linked to the problems of ensuring cybersecurity and controlling critical information. Their study proves that the availability of national technologies for data protection and control over digital infrastructure provides a high level of protection against external threats. In particular, these researchers point out that digital control is a strategic component of a country's national security, especially in the face of increasing cyber threats. Issues of ensuring technological and digital sovereignty at the academic level are raised in the studies by D. Eckert (2024), H. Roberts (2024), and Ye. Novikov (2024), who considered digital sovereignty as an independent measurement of technological sovereignty. These authors argue that effective management of national digital platforms, the development of their own cyber defence technologies and the implementation of data control contribute to strengthening national security. Countries that create and actively develop their own technology platforms can reduce the economic and political risks associated with external influence.

F. Crespi *et al.* (2021) and R. Csernaton (2022) draws attention to the importance of adapting foreign technologies to national needs. This is due to the fact that dependence on imported technologies limits the opportunities for implementing own strategic initiatives. As these authors emphasise, the development and implementation of national technological solutions is a necessary condition for achieving full technological sovereignty, which avoids potential threats associated with foreign influence.

J. Hackenbroich *et al.* (2020) and M. Prathap *et al.* (2024) in their studies, focus on the economic aspect of technological sovereignty. They believe that the development of own technologies contributes to creating new jobs and increasing the competitiveness of the national economy. Therefore, national governments must support local companies through public investment and promote startup development to ensure sustainable economic growth in the long term. This, in turn, will help reduce dependence on imported technologies and strengthen national economic sovereignty.

O. Ivanytska & O. Voznenko (2024), and P. Foley *et al.* (2024) draw attention to such an important aspect of the problem as strengthening control over critical infrastructure. Having own technologies is a prerequisite for ensuring the sustainability of life support systems, in particular, in the fields of energy, health, and transport.

The researchers argue that controlling infrastructure is key to achieving full sovereignty, as it avoids threats associated with external interference. Studies by D. Badea & D. Ranf (2021), and D. Boga (2024), which highlight the impact of technological sovereignty on military security also deserve attention. The authors argue that the development of national defence technologies is a necessary condition for ensuring protection against potential threats. They emphasise that dependence on foreign technologies in the military sphere can create risks that endanger national security.

The problem of international cooperation in the development of technological standards is raised in the publication of U. Cantner (2024). The author notes that the establishment of international legal norms and standards will help to increase the level of technological independence of each country, reducing the risks associated with unilateral dependence on leading technology players. Previous research confirms that technological sovereignty is critical to national security and economic sustainability. Important aspects are the development of innovative infrastructure and support for local technologies, which reduces dependence on imports and economic risks.

The purpose of this study was to identify the theoretical aspects of technological sovereignty and examine its impact on the economic, energy, and military security of the state. The main objectives of the study were:

- ▲ investigate strategies for ensuring technological sovereignty on the example of the EU and Ukraine, covering support for innovation, research, and local technology companies;
- ▲ analysis of the relationship between technological and digital sovereignty through the prism of data control, cybersecurity, infrastructure;
- ▲ examine the role of technological sovereignty in ensuring economic, energy, and military security on the example of practices used in the EU and Ukraine.

## Materials and methods

This study applied a comprehensive approach to the analysis of technological sovereignty and determining its importance for ensuring national security. The approach involves a step-by-step examination of the relationship between controlling critical infrastructure, developing proprietary technologies, and strategies to reduce import dependence. The EU and Ukraine were chosen for the study, as they are actively working to strengthen their technological independence, which makes them illustrative examples for analysis. The study was conducted in stages, with the aim of providing in-depth analysis and systematisation of information related to technological sovereignty. At the first stage, a thorough preparatory work was conducted, which included the collection and analysis of a wide range of political and legal documents, that highlighted in Table 1:

**Table 1.** Analysed policy and legal documents

| Document                                                              | Title                                                                                                                                       | Year      |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Law of Ukraine No. 2297-VI                                            | "On the Protection of Personal Data"                                                                                                        | 2010      |
| Directive of the European Parliament and of the Council No. 2016/1148 | "Concerning Measures for a High Common Level of Security of Network and Information Systems Across the Union"                               | 2016      |
| Directive of the European Parliament and of the Council No. 2016/943  | "On the Protection of Undisclosed Know-How and Business Information (Trade Secrets) Against Their Unlawful Acquisition, Use and Disclosure" | 2016      |
| Law of Ukraine No. 2163-VIII                                          | "On the Basic Principles of Cybersecurity in Ukraine"                                                                                       | 2017      |
| Order of the Cabinet of Ministers No. 605-r                           | "On Approval of the Energy Strategy of Ukraine for the Period up to 2035 'Security, Energy Efficiency, Competitiveness'"                    | 2023      |
| Law of Ukraine No. 2657-XII                                           | "On Information"                                                                                                                            | 2023      |
| Law of Ukraine No. 1116-IX                                            | "On State Support of Investment Projects with substantial Investments in Ukraine"                                                           | 2023      |
| Law of Ukraine No. 3687-XII                                           | On Protection of Rights to Inventions and Utility Models                                                                                    | 2023      |
| Law of Ukraine No. 3792-XII                                           | "On Copyright and Related Rights"                                                                                                           | 2023      |
| Law of Ukraine No. 1089-IX                                            | "On Electronic Communications"                                                                                                              | 2024      |
| European Commission Documents                                         | Various data and reports                                                                                                                    | 2020-2024 |
| Reports of International Organisations                                | "United States Agency for International Development"                                                                                        | 2022      |

**Source:** developed by the author

Special attention was paid to sources covering issues of technological sovereignty in the context of modern challenges of globalisation, the development of digital technologies, and information security. The collection of information allowed forming a general picture of current trends that determine countries' policies in the field of technological independence. Key strategies aimed at strengthening control over critical technologies, in particular, data protection, cybersecurity, creating a national digital infrastructure and developing own technology solutions, were examined.

The second stage of the study consisted of a detailed analysis of the strategy for ensuring technological sovereignty in the EU and Ukraine, in particular, the development of innovation potential, mechanisms for supporting local technology companies and creating a modern research infrastructure. Specific initiatives aimed at promoting the growth of Ukrainian companies in strategic industries were analysed. The third stage explored the relationship between technological and digital sovereignty, where data control, cybersecurity, and the development of reliable infrastructure played an important role. In this context, special attention was paid to data exchange, protection, and storage policies, as data is a key resource in the digital economy. The method of content analysis of EU and Ukrainian documents revealed the main points that demonstrate the interdependence between technological achievements and the need to protect the digital sphere.

The fourth stage was devoted to the assessment of the role of technological sovereignty in ensuring national security, with a special focus on the economic, energy, and military spheres. The mechanisms by which technological independence contributes to the

strengthening of security in various industries, such as reducing dependence on foreign suppliers in the energy sector or strengthening military capabilities through the development of their own technologies, were examined. A comparative analysis of examples from the EU and Ukraine's practice in the fields of cybersecurity, state support for information technology (IT) and telecommunications, and the development of technological products exports was conducted, which helped to identify specific mechanisms and solutions through which technological sovereignty increases the country's resilience to external threats and ensures stability in strategically important sectors.

## Results

### Theoretical foundations of technological and economic sovereignty

Technological sovereignty, as the ability of a state to maintain independence in the field of critical technologies, is an important element of national security and economic stability. The concept of technological sovereignty includes the ability of a country not only to meet critical technology needs but also to actively develop its own resources and technological solutions. Technological sovereignty ensures the control of the national government over key industries and processes, in particular, over critical infrastructure, which is the basis for the functioning of the economy and the social system in general.

In modern globalised world, where the technological sphere is rapidly developing, the issue of sovereignty goes beyond domestic politics and becomes of strategic importance for any state. The country's ability to ensure relative autonomy in information and

communication technologies, cybersecurity, and the development of its own scientific research are fundamental factors for its independence in the technological field. This reduces the risks associated with possible external dependence and provides resilience to crisis situations, such as supply chain disruptions, which were clearly demonstrated during the COVID-19 pandemic. Reducing dependence on imports of strategically important technologies and components is also an important aspect of technological sovereignty. This is especially important in the area of critical infrastructure, where reliable control over resources and technologies can be a crucial factor in national security. In addition, the ability to develop its own technologies and innovative solutions contributes to economic growth and increases the country's competitiveness in the global market. Technological sovereignty not only has a positive impact on the internal stability of the state but also strengthens its position in international relations. Such relative autonomy gives the national population the opportunity to independently choose the vector of its development and maintain stability in the unstable conditions of the global economy.

Control over critical infrastructure is the basis for ensuring national security and sovereignty, especially in the present time, where information and energy systems are important for the functioning of the state and society. Critical infrastructure includes energy networks, telecommunications systems, transport networks, water supply, as well as medical and financial institutions, the continuous operation of which is necessary for the stable functioning of the economy and the well-being of the population. Dependence on foreign suppliers or weaknesses in the cyber defence systems of such infrastructures can create serious risks, including increasing vulnerability to cyber attacks, espionage, and economic pressure from other states or corporations. For states seeking to secure their technological sovereignty, it is important to create their own solutions related to the development of hardware and software for critical infrastructure and organise a high level of cybersecurity. This approach minimises risks and prevents potential threats from unfriendly states that may use technological dependence as a tool of influence. For example, in the energy sector, this may include the development of national energy grid management systems that are independent of software and technologies supplied by foreign companies.

The EU pays special attention to ensuring the security of critical infrastructures, as evidenced by the adoption of the Directive on measures for a high common level of cybersecurity across the Union (NIS2 Directive) (European Commission, 2023a), which obliges member states to provide a reliable level of protection in cyberspace and strengthen the security of national infrastructures. This directive defines common standards for protecting networks and information

systems, including monitoring cyber threats, responding quickly to incidents, and ensuring data security in the event of cyber attacks. Thus, NIS2 not only enhances cybersecurity but also supports the EU's technological independence, reducing reliance on external suppliers, which minimises the potential risks associated with foreign interference.

In the context of global digital transformation, ensuring control over critical infrastructure is becoming a strategic priority for many countries, including Ukraine, which is also actively developing its own cybersecurity infrastructure. In view of geopolitical instability and constant cyber threats from Russia, the Ukrainian government pays special attention to strengthening national cybersecurity since the country's critical infrastructure, in particular, the energy, financial, transport and telecommunications sectors, are potential targets for cyber attacks. Ukraine is implementing initiatives to improve cyber defence, in particular, the project "Cybersecurity for critical infrastructure", funded by the EU and the United States of America (United States Agency for International Development, 2022). This project provides for strengthening cyber defence in strategic sectors of the economy through the introduction of modern technologies for monitoring and responding to incidents, as well as the creation of educational programmes for training specialists in the field of cybersecurity. An important step in this area was the adoption of The Law of Ukraine No. 2163-VIII (2017), which regulates the activities of public and private institutions in the field of cybersecurity, defines the rights and obligations of critical infrastructure operators, and provides for mandatory information about cyber incidents. Ukraine is also focusing its efforts on modernising its digital infrastructure and improving its protection systems against cyber attacks in the face of Russian aggression, which has substantially worsened cybersecurity issues.

The main goal of Ukrainian cybersecurity legislation is to protect critical infrastructure, national information resources, and the confidentiality and security of citizens' data. Therewith, Ukrainian legislation still has some gaps compared to the EU, where cybersecurity is regulated by the standards defined by the NIS2 directive. Directive of the European Parliament and of the Council No. 2016/1148 (2016) and its updated version NIS2 (European Commission, 2023a), are the main regulations defining cybersecurity policies in EU member states. The directive obliges the governments of EU member states to develop national cybersecurity strategies, establish focal points and cooperate at the EU level to ensure cybersecurity. NIS2 expands the range of organisations that are required to comply with cybersecurity requirements, including more critical infrastructure sectors such as finance, energy, transportation, and the healthcare sector. NIS2 strengthens the requirements for Risk Management, which includes

mandatory measures for managing data privacy, monitoring cyber threats, and preventing and responding to incidents. An important element is also the introduction of sanctions for violation of requirements, which encourages entities to ensure a high quality of cybersecurity.

Ukrainian legislation in the field of cybersecurity and NIS2 have a lot in common, but there are also substantial differences in the details and binding requirements. For example, Ukrainian legislation focuses less on sanctions and risk management than NIS2. Although the Law of Ukraine No. 2163-VIII (2017) defines the basic principles of cyber defence, it does not regulate in sufficient detail the requirements for risk management, monitoring of cyber threats and data privacy protection, especially in critical infrastructure industries. The EU has stricter data privacy requirements, which include mandatory regular security audits, mandatory reporting on cyber incidents, and critical data access control systems. In Ukraine, such requirements are partially provided for and the legislation does not require regular inspections or audits in certain sectors. This creates potential risks for the sustainability of Ukrainian networks and the confidentiality of critical data.

Ukrainian cybersecurity legislation needs comprehensive improvement to ensure the effective protection of national interests in the digital sphere. The first important issue is cyber risk management. Ukraine needs to introduce mandatory procedures for monitoring and evaluating cyber risks, which are the standard in the EU thanks to the NIS2 directive. The directive obliges EU member states to ensure systematic monitoring of cyber risks in the public and private sectors and impose sanctions on organisations that neglect established standards. This will help strengthen companies' responsibility for data security and increase their readiness for cyber threats.

The second key issue is the protection of the privacy and personal data of citizens. The introduction of mandatory protocols for the protection of personal information is extremely important, especially in the face of increased cyber threats. In this area, it is necessary to establish clearer rules for access to confidential data and tighten the requirements for the entities that process them. For example, EU law provides for strict sanctions for data privacy violations, which helps reduce the risk of leaks and unauthorised access. The third area that needs substantial improvement concerns the protection of critical infrastructure. The law should provide for mandatory certification of equipment used in critical networks to ensure its resistance to cyber attacks. The EU has special certification requirements for equipment manufacturers that guarantee that products comply with cybersecurity standards (European Green Deal, 2019). In Ukraine, such certification is just beginning to be implemented, and additional steps at the legislative level are needed to fully protect such critical sectors as energy, transport, and communications.

Since 2022, the government has been actively implementing initiatives aimed at strengthening national cybersecurity, relying on the support of international partners, including the United Nations and various international foundations. This collaboration includes the development and implementation of comprehensive measures covering a wide range of tasks to reduce cyber threats. In particular, the government has initiated programmes such as the Tallinn Mechanism (Ministry of Foreign..., 2023) and Cybersecurity (United States Agency for International Development, 2022) aimed at protecting critical infrastructure, such as energy, transport, and financial networks, from potential cyber attacks that can disrupt the work of government agencies and affect the daily lives of citizens. These programmes include several key components. Firstly, the government, together with international partners, constantly monitors cyber threats, analysing threats from various sources to respond in a timely manner to any attempts of unauthorised access to critical systems. For this purpose, modern technologies are used, such as artificial intelligence and machine learning, which allows automatically identifying suspicious activity and preventing potential attacks. In addition, one of the priority areas is the creation of educational programmes to raise awareness about cybersecurity among citizens and civil servants (European Commission, 2022b). Under the auspices of the United Nations and other international foundations, a series of training seminars and trainings was organised for employees of government agencies, during which cybersecurity specialists transfer their knowledge and skills. These measures are aimed at ensuring that employees have threat recognition skills and know how to act correctly in the face of a cyber incident, which substantially increases the overall level of data security. Considerable attention is also paid to the development of the national cyber defence system, which provides for the modernisation of equipment and expansion of the network of data centres, and the introduction of new information security standards. Due to the cooperation with international organisations, Ukraine receives technical support that allows it to introduce the latest technologies in the field of cybersecurity. For example, some applications include the use of advanced encryption tools to protect citizens' sensitive data and the development of tools to detect phishing attacks and other cybercrimes.

Reducing dependence on imports in strategically important areas is one of the priorities of economic policy, as it helps to avoid risks that arise during global crises, such as the COVID-19 pandemic, which clearly demonstrated the vulnerability of international supply chains. With borders closed and global commodity flows severely restricted, the economies of many countries heavily dependent on imports were threatened by shortages of essential goods, medical supplies, food, and other critical resources. This situation has prompted

states to rethink their policy of supporting their own production. The import substitution policy, which has become a response to these challenges, focuses on creating conditions for the development of national production of goods and services that were previously imported from abroad.

In addition, such policies create new jobs and stimulate employment growth, which has a positive impact on the economic stability of the state. Support for national manufacturers of critical goods, such as medicines, medical equipment, food, and personal protective equipment, allows creating a reliable internal reserves for rapid response to emergencies. The EU also actively invests in research aimed at creating innovative products and technologies that can replace imported analogues, increasing the competitiveness of local producers in the domestic and foreign markets (European Commission, 2021a). Such policies contribute to strengthening the economic sustainability and independence of both member states and the entire united Europe. In the event of new crises associated with restrictions on the international market, a state that has a developed internal production base will be able to provide the population with the necessary resources and goods, reducing the impact of external factors on the domestic economy. Thus, import substitution becomes a critical element on the path to economic autonomy, contributing to the long-term stability and sustainability of the economy.

In the field of cybersecurity, protection from cyber threats and the development of intellectual property are equally important. Ukrainian legislation in the field of intellectual property is important for protecting the development of companies and scientists working on innovative technologies. In the context of rapid technology development and globalisation, intellectual property protection is a critical factor for stimulating innovation and attracting investment. The protection of intellectual property in Ukraine is conducted through such legal instruments as patents, copyrights, and trade secrets but the effectiveness of each of these tools depends on how much they meet European standards and how much their application contributes to innovation.

In Ukraine, relations in the field of patent law are regulated by The Law of Ukraine No. 3687-XII (2023). According to this law, a patent grants its owner the exclusive right to an invention or utility model, allowing third parties to prohibit the use of this object without the permission of the patent owner. In Ukraine, as in the EU countries, a patent can be issued for new, useful, and industrially applicable inventions. The law also allows the transfer of patents and licenses to others, which is important for the commercialisation of innovations. Thereby, unlike many EU member states, Ukraine's patent system has some gaps. For example, in Ukraine, there are difficulties with effective patent protection in court since patent cases are often considered for a long

time and legal costs can be high. In the EU, according to the European Patent Convention (2020), there is a single patenting system for all member states, which simplifies the process of protecting intellectual property at the European level. The introduction of such practices in Ukraine could improve the legal protection of inventions of Ukrainian developers and researchers.

The Law of Ukraine No. 3792-XII "On Copyright and Related Rights" (2023) regulates the protection of creative works, such as literary and artistic works, software, music, photographs, and other forms of creative activity. In Ukraine, copyright protects works during the author's lifetime and 70 years after their death, which meets European standards. Copyright provides authors with the right to control the use of their works and receive remuneration for their commercial use. Despite the existence of such legislation, copyright protection in Ukraine faces certain challenges. The main problem is the high level of piracy, in particular, in the digital sphere, and insufficient law enforcement practice to protect copyright in court. In the EU, considerable attention is paid to the protection of copyright on the internet, in particular, under the Digital Single Market Copyright Directive, which obliges platforms to remove content that violates copyright (European Commission, 2021b). Ukraine has not yet fully adapted this legislation, which is a challenge for Ukrainian developers and authors who suffer losses due to the illegal use of their works. It is advisable to improve the mechanisms for protecting copyright on the internet and increase responsibility for violations of these rights to strengthen legal protection in Ukraine.

Trade secrets in Ukraine are protected by The Law of Ukraine No. 236/96-VR (2020) and are also partially regulated by the Civil Code. Trade secrets protect information that is valuable to businesses but not patented, such as production processes, formulas, marketing strategies, and other confidential information. Owners of trade secrets have the right to prohibit access to this information by third parties, which helps prevent its illegal use. However, in Ukraine, the protection of trade secrets has limitations compared to European standards. The Directive of the European Parliament and of the Council No. 2016/943 (2016), which provides broader protection of confidential information and introduces specific requirements for evidence and sanctions in the event of its illegal disclosure. Ukrainian legislation does not provide for clear procedures and sanctions, which makes the protection of trade secrets less effective. The introduction of European standards in Ukraine could strengthen the protection of confidential information and help protect innovations, in particular, in high-tech industries where such assets are extremely valuable.

Ukrainian legislation in the field of intellectual property is important for protecting innovations and stimulating the development of technologies but

it needs to be improved to ensure better compliance with European standards. It is necessary to improve the protection mechanisms in the judicial system, adapt the regulations on copyright protection on the internet, and strengthen the protection of trade secrets to improve the protection of intellectual property in Ukraine. The introduction of European standards will help create favourable conditions for Ukrainian innovators, reduce the risks associated with unfair use of their developments, and ensure better integration of Ukraine into the international system of intellectual property protection.

Ukraine needs to strengthen legal mechanisms and improve relevant legislation to strengthen national sovereignty in the digital sphere and ensure the protection of public and private interests. This is particularly important in light of the growing influence of large international corporations such as Google, Microsoft, and Amazon, which play a critical role in the development of digital infrastructure in Ukraine, the EU, and the world in general. Their activities cover the provision of cloud services, the development of artificial intelligence, internet services, and other technological solutions that are becoming critical for the modern economy and society. However, along with these advantages, their influence poses a threat to the digital sovereignty of states because such companies control a substantial part of digital infrastructure, data, and communication channels. The EU and Ukraine are gradually implementing various legal mechanisms and expanding regulation in the field of cybersecurity and data management to minimise these risks and maintain control over strategic digital resources.

The EU adopted the Digital Markets Act (DMA) in 2022, which has become an important tool for limiting the dominance of large technology companies (European Commission, 2022c). The DMA Law defines the so-called “watchmen” of digital markets – companies that have a large market share and control major platforms such as search engines, online markets, and cloud services. These companies include Google, Amazon, Apple, Microsoft, and Meta. The DMA Law sets out a number of responsibilities and prohibitions for these companies, in particular, prohibits abuse of a dominant position, such as restricting access to competitors, requires ensuring the interoperability of their services with other platforms, and prohibits the preferential promotion of their own products in search results or other services. This law is designed to reduce barriers to entry for new companies and ensure competition, promoting balanced digital sovereignty in the EU. With DMA, EU member states can have greater control over data generated and processed on their territory, limiting the ability of large corporations to monopolise digital infrastructure and services.

For Ukraine, which seeks integration with the EU, adapting such initiatives is an important task. Although

the Ukrainian legislation, in particular, The Law of Ukraine No. 1089-IX (2024), regulates certain aspects of the digital sphere, it does not cover all the issues that the DMA solves, in particular, the control of the dominance of large corporations. The use of DMA experience in Ukraine leads to several important changes, for example, the establishment of criteria for determining companies that have a dominant position in the market and restrictions on monopolisation of markets to support local players and ensure equal conditions for all market participants. Another important initiative could be the development of mechanisms for monitoring the storage and processing of data on the territory of Ukraine. Large technology corporations store substantial amounts of data from citizens and businesses in foreign data centres, which poses a potential threat to national security. A legal restriction on the storage of certain categories of data outside the country and the requirement for transparency in data processing could strengthen Ukraine’s digital sovereignty. However, Ukraine faces certain challenges in implementing such initiatives. The dominance of international corporations is often the result of their technological and resource superiority, which is difficult to quickly compensate for by the local market since Ukrainian companies often do not have enough resources to compete with technology giants such as Microsoft or Google. In addition, the adaptation of the DMA requires substantial institutional and resource changes, including the creation of an independent body to monitor the activities of technology giants in a market that requires funding, specialised knowledge, and technical resources that can be difficult to find in an economic crisis.

Ensuring independence in critical technology areas allows states to reduce dependence on external suppliers, increase economic sustainability, and protect national interests. Strategies of technological sovereignty are aimed at developing their own scientific and technological competencies, supporting internal innovations, and creating conditions for the production of strategically important technologies at the national level. The development of the IT sector and telecommunications industry has substantial potential to stimulate employment. According to the state statistics service of Ukraine, in 2023, about 300 thousand people were employed in the IT sector, and this number is growing by 6-7% annually (IT Research Ukraine, 2023). With additional investment, especially in national startups and telecommunications equipment, it can be expected that the number of new jobs may increase. For comparison, in EU countries that have implemented government programmes to support the digital economy, employment growth in IT industries increased from 3.5% to 4.6% from 2015-2023. For example, in Poland, job creation in technology industries increased from 2.6% in 2015 to 4.6% in 2023, due to government support in innovation programmes (Eurostat, 2023).

The increase in exports is an important indicator of economic growth and the country's ability to compete in the international market. In 2023, Ukraine's exports brought the Ukrainian economy USD 6.7 billion in revenue, which is usually 8.5% less than in 2022, but still a record number. The IT sector has reduced its share in total service exports to 42% but the sector still retains its status as the first largest among Ukrainian export industries (IT Ukraine Association, 2024). Investments in the telecommunications sector, especially in national producers, could substantially increase this indicator, creating new export directions, contributing to the growth of gross domestic product (GDP), and strengthening the country's economic independence. In addition to stimulating domestic production, such investments have the potential to strengthen the innovation base and attract highly qualified personnel to the sector, which in the future can increase Ukraine's competitiveness on the world stage. For comparison, the export volume of IT and telecommunications equipment in Poland in 2023 amounted to about USD 25.5 billion (Statista, 2023), which was made possible by the expansion of the domestic manufacturers' market, the implementation of national grants programmes, such as SMART path (National Centre for..., 2023) and FENG (National Centre for..., 2021), and support for research projects in the field of telecommunications technologies. Poland has successfully integrated its manufacturers into European supply chains, focusing on high-tech solutions and cooperation with international partners.

Similar programmes in Ukraine could become an impetus for the development of national producers, contributing to their entry into foreign markets, in particular, to the EU and the United States. Measures such as government grants for research and development, tax breaks for exporters, and the creation of industrial parks focused on the production of telecommunications equipment can substantially strengthen the country's economic potential. The success of such initiatives depends on their focus on supporting both large companies and small innovative enterprises that form the ecosystem for sustainable development of the sector.

The development of technological sovereignty is a complex multi-component process that involves the constant introduction of the latest technologies and innovative solutions. Without active investment

in innovation, this process is impossible since it is the innovation that contributes to the creation of technological products that can compete in the global market. The EU, aware of the importance of technological independence, has developed a number of programmes to drive innovation, such as Horizon Europe, an initiative aimed at supporting research and development in key areas, including digital technologies, environmental stability, and cybersecurity (European Commission, 2021b). This programme provides funding for research projects that contribute to the development of the European scientific and technological base, strengthening its competitiveness and reducing dependence on third-country technologies.

The EU experience can be particularly useful for Ukraine, which also strives to achieve technological sovereignty and actively develops the innovation sector. In Ukraine, more and more attention is paid to supporting startups and technology companies, such as the "State in a smartphone". Such initiatives are aimed at promoting the development of high-tech enterprises, providing them with access to investment, tax incentives, and modern infrastructure for implementing innovative projects. It is also worth noting that EU programmes, such as Horizon Europe, place special emphasis on the sustainability and safety of technologies being developed. This is extremely relevant for Ukraine, as creating a stable ecosystem for technology startups will help strengthen the country's cybersecurity and ensure the smooth functioning of critical infrastructure in the face of external threats. Such efforts will help Ukraine strengthen its national economy and create its own technological products that meet international quality and safety standards.

Research funding is a critical factor in achieving technological sovereignty, as it provides the necessary resources to develop innovations and technologies that can reduce the country's dependence on foreign markets. The experience of the EU, where about 2% of GDP is spent on research and development, is substantial: substantial funds are invested in strategic areas such as green energy, artificial intelligence, cybersecurity, and advanced manufacturing technologies (Table 1). This allows EU countries not only to develop their domestic technological potential but also to consolidate their positions in highly competitive global markets.

**Table 2.** Comparison of research and development costs in Ukraine and the EU

| Year | Spending in Ukraine<br>(% of GDP) | Spending in the EU<br>(% of GDP) | Ukraine's GDP (in current<br>US dollars), billion | EU GDP (in current US<br>dollars), trillion |
|------|-----------------------------------|----------------------------------|---------------------------------------------------|---------------------------------------------|
| 2018 | 0.47                              | 2.19                             | 130                                               | 15.9                                        |
| 2019 | 0.43                              | 2.22                             | 153                                               | 15.6                                        |
| 2020 | 0.4                               | 2.3                              | 156                                               | 15.3                                        |
| 2021 | 0.38                              | 2.28                             | 199                                               | 17.3                                        |
| 2022 | 0.33                              | 2.27                             | 161                                               | 16.7                                        |

**Source:** compiled on the basis of World Bank (2024a; 2024b)

For Ukraine, increasing investment in research and innovation projects is an important step towards creating a strong technological infrastructure that will contribute to ensuring national security and economic sustainability. Investing in developing technology solutions and supporting innovative startups can help a country avoid dependence on imported technologies, which can be critical in the face of global crises or sanctions restrictions. Successful implementation of these plans requires attracting not only public but also private investment and active cooperation with universities, scientific institutes, and international organisations. Co-financing programmes and incubators for innovative projects can create an effective ecosystem for the development of research activities.

National companies and startups are the basis for the development of technological sovereignty, as they are able to generate innovative solutions adapted to the needs of the domestic market. The support of such companies helps to create the country's own high-tech products, reducing dependence on foreign technologies and licenses. For example, the EU has a specialised programme, the European Innovation Council (2024), which provides grants and investments to promising startups and small businesses, contributing to their growth and competitiveness in the global market. This allows the EU to encourage the creation of unique technologies and maintain control over critical technological processes. Ukraine is also implementing mechanisms for financing and supporting national innovative enterprises. The Ukrainian Startup Foundation provides grant support to young companies operating in high-tech industries such as IT, medical technologies, green energy, and artificial intelligence. This fund helps not only financially but also provides access to mentoring programmes that promote business development and increase its innovative potential. Due to such initiatives, Ukrainian technology companies are able to implement their own ideas, while maintaining control over intellectual property and reducing the need for imported technologies.

Additionally, special economic zones and tax incentives for startups are often created at the national level, which encourages their development and allows them to attract investment. Such measures are aimed at ensuring that young companies can get the necessary resources and technological infrastructure to develop products that meet national needs. The support of local technology companies not only contributes to the development of the national innovation ecosystem but also helps to strengthen the country's position in the global technology market, gradually building economic independence and technological sovereignty.

In the context of technological sovereignty, it is important to consider separately the issue of digital sovereignty, which reflects the ability of a state or organisation not only to own and control digital information,

technologies, and infrastructure within its jurisdiction but also to create conditions for their effective protection from external threats and influences. Digital sovereignty provides states with the ability to control data flows, regulate access to them, and set their own rules for processing them, which is especially important in an era of globalisation and the growing importance of data as a strategic resource. This aspect of sovereignty is critical in a globalised economy, where data volumes are growing exponentially and their uncontrolled use can pose a potential threat to national security. In an environment where most of the data is stored in cloud services controlled by large technology companies based abroad, there is a risk of transmitting confidential information to foreign governments or unfriendly structures. Digital sovereignty involves not only technical measures to protect data but also the creation of a legislative framework that controls the use of information by foreign companies. This includes the adoption of national data protection standards and the introduction of legislation restricting the ability of foreign organisations to access citizens' personal data without appropriate government permits. One of the most influential examples is the General Data Protection Regulation (2018) (GDPR) in the EU, which sets strict rules for the processing of personal data of EU citizens. It includes the requirement to obtain consent to data processing, restrictions on their transfer outside the EU, and sanctions for violations. The GDPR applies to all companies that work with the data of EU citizens, in particular, foreign ones, which allows the EU to strengthen digital sovereignty. Notably, Germany introduced the Information Technology Security Act 2.0, which expands cybersecurity measures to protect critical infrastructure from possible threats and restricts the use of foreign technologies in strategically important sectors (Federal Office for..., 2021). This allows the government to conduct national security checks against suppliers, helping to strengthen digital sovereignty.

In Ukraine, The Law of Ukraine No. 2297-VI (2010) operates, which was supplemented in accordance with the GDPR standards. It ensures the protection of the personal data of citizens, defines the requirements for the processing and storage of data, and restricts their transfer abroad without the consent of the data subjects or the government. In the face of a full-scale war with Russia, Ukraine is actively working on additional standards to protect data of national importance. Unlike the broader concept of technological sovereignty, which encompasses the ability of a state or organisation to control the entire technological cycle – from hardware manufacturing to software development and scientific development – digital sovereignty focuses on protecting data and ensuring the reliability of information systems. This includes the ability of a country to use its own resources to protect its information assets, build a national infrastructure for data processing and

store strategically important information on the territory of the country, which ensures independence from external sources and prevents possible cyber attacks. Ensuring digital sovereignty also requires states to have special institutions and regulators that are able to control the information technology market and monitor its participants. In addition, within the framework of digital sovereignty, many countries are developing strategies to support national IT companies and create conditions for the development of their own technological solutions, which reduces dependence on foreign software and services. This policy allows increasing the level of data security, stimulating the development of the domestic market, and maintaining economic stability in the event of external threats, such as sanctions or geopolitical tensions.

Data control is a key aspect of both technological and digital sovereignty. This means ensuring a full cycle of storage, processing, and protection of information on the territory of the state, which minimises the risks of interference by foreign players, ensuring control over critical information, including personal data of citizens, commercial information, and government data. The EU has adopted a number of initiatives to ensure such conditions, in particular, the GDPR (2018), which sets high standards for data protection and requirements for companies that process personal data of EU citizens, regardless of where they are located. The GDPR regulates, in particular, the mandatory obtaining of consent to data processing, grants users the right to delete personal data (the “right to be forgotten”) and requires notification of data leaks.

Ukraine is also working to improve the level of data protection and bring it closer to European standards as part of the state’s overall digitalisation strategy. This includes the adoption of laws that bring Ukraine’s legal framework closer to EU standards and the introduction of modern technologies to strengthen cybersecurity. Ukrainian enterprises, especially those working with European markets, are adapting their practices to meet the requirements of the GDPR (2018), which allows them to remain competitive and reduce risks to the personal data of citizens. Data control is strategically important for maintaining information sovereignty and increasing citizens’ trust in digital services, providing them with security and confidentiality guarantees. In Ukraine, this role is performed by a number of legal acts aimed at ensuring the protection of personal information and compliance with national and international standards. The fundamental document in this area is the Law of Ukraine No. 2297-VI (2010). It regulates the processing and protection of personal data, ensuring the rights of subjects to privacy and control over personal information. The law obliges data processing entities to ensure the confidentiality and security of information, which creates a basis for protecting citizens’ rights and increases trust in digital

services. The Law of Ukraine No. 2657-XII (2023) is also important as it plays a critical role in ensuring information sovereignty, as it determines the procedure for storing, processing, and distributing information, including personal data. This law protects the rights of citizens to the confidentiality of personal data and restricts the possibility of their illegal access without the permission of the relevant person. This contributes to the creation of a secure digital environment for personal and commercial transactions and contributes to the economic development of the state in the face of globalisation and constant cyber threats.

Another important component is ensuring cybersecurity, as cyberspace in 2024 is critical for the economic, social, and national security of each country. With the proliferation of digital technologies and the growing dependence of government institutions, businesses, and citizens on network technologies and systems, protecting against cyber threats is becoming a top priority to ensure digital sovereignty. A security breach in cyberspace can lead to the loss of sensitive data, economic losses, and in some cases even undermine the stability of the state. The EU sees cybersecurity as one of the fundamental elements of its digital sovereignty strategy. In 2020, the Cybersecurity Act (European Commission, 2020a) was adopted, which established the basis for strengthening common security standards in EU member states. One of the key institutions responsible for implementing this strategy is the European Union Agency for Network and Information Security (ENISA), which develops and implements a pan-European Cybersecurity Policy. ENISA supports member states in improving their cyberattack protection systems by providing expert advice, research, and recommendations on protecting critical infrastructures. ENISA is also engaged in raising awareness of cyber threats among the public, which is an important aspect of ensuring a collective level of cybersecurity in the EU.

Ukraine, in turn, also pays considerable attention to cybersecurity, especially given the growing cyber attacks by states and groups that pose a threat to national security. One of the main documents in this area is the national cybersecurity strategy of Ukraine, which defines the main tasks and priorities in ensuring the protection of public and private sectors from cyber threats (Decree of the..., 2021b). The strategy includes measures to strengthen the protection of critical infrastructures, such as the energy sector, transport, communications, and the banking system. Ukraine is also working to create and strengthen specialised institutions responsible for protection in cyberspace. In particular, the Government Computer Emergency Response Team of Ukraine was created – a cyber incident response team that provides monitoring and rapid response to cyber attacks. In addition, Ukraine is developing partnerships with other countries and international organisations, in particular, the EU and NATO, to exchange

experience and information on cyber threats and receive expert support. Due to the aggression from Russia, Ukraine is forced to quickly increase the level of cyber defence, paying attention not only to the protection of state institutions but also to the private sector. It is important that cybersecurity in Ukraine includes measures to raise citizens' awareness of the basics of digital hygiene, which helps reduce the risk of cyber threats.

Infrastructure is another aspect that ensures the interaction of technological and digital sovereignty. The EU invests in the development of its own data centres and data networks, in particular, through GAIA-X projects to ensure the sustainability and independence of digital infrastructure. Infrastructure is one of the key aspects that unite technological and digital sovereignty, as it provides the physical basis for the functioning of all digital systems. Infrastructure refers to hardware and software resources and data transmission networks that ensure the smooth operation of digital services, cloud technologies, and data processing. In a globalised environment, this includes not only national networks, but also cross-border communications, data centres, and information storage platforms, which in turn requires substantial investment and appropriate policies. Infrastructure plays an important role in ensuring technological and digital sovereignty both in the EU and in Ukraine. Investing in national networks and data centres and ensuring high cybersecurity standards is essential to reduce dependence on foreign suppliers and maintain control over critical digital resources.

Digital and technological sovereignty are interrelated but relatively autonomous phenomena, the provision of which is crucial for the national security, and political and economic independence of the state. Technological sovereignty implies the ability of a country to develop, control, and implement its own technological solutions, minimising dependence on foreign suppliers and ensuring the autonomy of critical systems. Digital sovereignty,

in turn, focuses on controlling information resources, including the protection of personal data, cybersecurity, and the ability of the state to maintain the functioning of information infrastructure regardless of external threats or pressure. The relationship between technological and digital sovereignty is manifested due to the fact that the achievement of one is impossible without the other. For example, effective control over data, in particular, its processing and storage, depends on the availability of a sovereign technical infrastructure that a country owns and manages. Countries that do not have a sufficiently developed internal infrastructure are often forced to turn to foreign cloud storage service providers, which can lead to loss of control over critical data.

In the current conditions of global instability and increased international competition, the issue of technological sovereignty is becoming of key importance for ensuring the economic, energy, and military security of countries. Technological sovereignty implies the ability of the state to control the development, production, and implementation of strategically important technologies without critical dependence on foreign suppliers. The lack of such capabilities poses risks to national security, limits the ability to quickly adapt to changes in the global political and economic environment, and increases vulnerability to external pressure. The concept of technological sovereignty is becoming particularly important in the context of growing technological competition at the global level. A country's economic security depends on its ability to meet its own technological needs and avoid critical dependence on external suppliers, which is especially important for strategically important industries such as energy, defence, and information technology. The economic stability of the state directly depends on the development of its technologies, which are the foundation for ensuring competitiveness in the world market and protecting national interests (Table 2).

**Table 3.** High-tech exports (in current US dollars) to Ukraine and the EU

| Year | Exports in Ukraine (billion) | Exports in the EU (billion) |
|------|------------------------------|-----------------------------|
| 2018 | 1.2                          | 571.5                       |
| 2019 | 1.1                          | 580.2                       |
| 2020 | 1.1                          | 528                         |
| 2021 | 1.2                          | 633.8                       |
| 2022 | 0.8                          | 693.6                       |

**Source:** compiled on the basis of World Bank (2024c)

Continuous access to advanced technologies is one of the key factors of economic sustainability, as it allows states to reduce production costs, improve the quality of goods and services, and expand employment through the development of high-tech industries. In addition, the presence of own technologies substantially reduces the risk of a technological embargo that may be imposed in the context of worsening international relations. In this context, economic independence is an

important factor in national security, because a country dependent on the import of strategic technologies can suffer substantial losses if access to them is restricted.

The EU, considering the challenges of the global economy, is actively developing its own technological base to reduce dependence on foreign suppliers in strategic sectors. Industries such as semiconductor manufacturing, pharmaceuticals, advanced materials manufacturing, and energy equipment are a priority

for the EU. In 2020, the European Commission adopted the “European Industrial Strategy”, which provides for the creation of production facilities in high-tech sectors (European Commission, 2020b). According to this document, the EU aims to meet domestic demand for strategic technologies, in particular, in the field of semiconductors used in all sectors of the economy – from the automotive to the information-communications industry. This approach allows the EU to minimise the risks associated with potential dependence on external suppliers and ensure stability in the event of economic or political upheaval.

In Ukraine, similar goals are laid down in the concept of “digital sovereignty”, which includes the development of national technology products and the strengthening of local IT infrastructure. This concept provides for the creation of our own data centres, cloud services, and the development of advanced technologies such as artificial intelligence, blockchain, and cybersecurity. These measures are aimed at strengthening Ukraine’s digital independence and reducing dependence on foreign IT solutions and technologies, which is especially important in the context of global instability and hybrid threats. Ukraine is also taking steps to attract investment in national technology startups that will be able to provide the country with innovative solutions in the future and strengthen its position in the global market.

Ensuring technological sovereignty is vital to reducing a country’s economic vulnerability, as it reduces dependence on foreign suppliers and protects the economy from external threats such as economic sanctions, trade barriers, and political conflicts. Developing our own technologies and manufacturing capabilities helps strengthen the national economy, ensuring continuous access to critical resources, products, and services, even in the face of global crises or political instability. The EU example clearly illustrates how the introduction of resource-based technology solutions increases economic sustainability in a world where geopolitical and economic challenges are becoming increasingly unpredictable. The EU has launched an active policy of supporting strategic autonomy, in particular, through initiatives related to the semiconductor industry, renewable energy, and digital technologies. The COVID-19 pandemic has demonstrated the dangers of dependence on global supply chains: production shutdowns in one region have led to shortages of vital resources such as medical equipment, medicines, and materials for their production. This experience has forced the EU to reconsider its strategies and increase investment in the domestic technology base, which has reduced the risks of economic disruptions and increased the ability to respond quickly to emergencies.

For Ukraine, reducing economic vulnerability is an extremely important task, given the systematic challenges caused by Russia’s military aggression and the unstable political situation in the region. Economic

vulnerability increases a country’s dependence on external economic conditions, which may limit its ability to withstand economic shocks such as export blockages, energy crises, or financial sanctions. In the context of prolonged military aggression, economic independence becomes a strategic priority, as it allows strengthening the financial stability of the state, preserving the viability of the national economy, and reducing the influence of external forces on internal processes. A number of legislative acts were introduced to increase economic stability. In Ukraine, one of the key documents is The Law of Ukraine No. 2163-VIII (2017), which is aimed at protecting critical infrastructure from cyber attacks, which is especially relevant in the context of modern hybrid threats. Another example is The Law of Ukraine No. 1116-IX (2023a) which aims to create favourable conditions for attracting domestic and foreign investment, which strengthens the economy and reduces dependence on external loans.

The development of technological sovereignty is not only a matter of national prestige but also a strategic necessity for improving economic security. It allows maintaining control over critical industries, reducing dependence on imported technologies and resources, and strengthening the country’s position in the international arena. Considering the current economic and political challenges, creating conditions for the development of technologies becomes a necessary element of a long-term economic development strategy. Technological sovereignty in the energy sector means the ability of the state not only to use but also to develop and implement own technological solutions to ensure a stable and safe energy supply, minimising dependence on external suppliers. This approach includes the development of national energy technologies that allow the state to be more independent of global fluctuations in energy markets and increase resilience to risks associated with the political and economic instability of energy suppliers. The development of own technological potential in the energy sector helps to reduce the vulnerability of the economy to external threats, such as sharp fluctuations in the prices of oil, natural gas, and other energy carriers, which can affect the cost of production and the standard of living of the population. In addition, the availability of national energy technologies allows the state to move faster and more efficiently to renewable energy sources, such as solar, wind, and hydropower, which is an important factor in the context of current global challenges related to climate change and the need to reduce greenhouse gas emissions. Countries invest in the development of innovation, research, and implementation of advanced solutions in such areas as smartgrids, energy-efficient technologies, energy storage, and demand management systems to achieve technological sovereignty in the energy sector. These technologies allow ensuring reliable energy supply and optimising its consumption,

thus reducing dependence on energy imports and increasing energy security.

In addition, energy technological sovereignty helps the state avoid foreign policy pressure associated with the need to import energy resources. As the EU experience shows, countries that invest in the development of their own renewable energy sources and energy infrastructure can achieve greater autonomy and sustainability. This approach is particularly important for countries facing geopolitical risks, in particular, in the case of Ukraine, which, due to its dependence on fossil fuel imports, is at constant risk of energy vulnerability. The EU in its strategic documents, such as The European Green Deal (2019), focuses on the need to reduce dependence on energy imports and directs substantial efforts to develop an independent energy system. This strategy provides for achieving climate neutrality by 2050 and creating a new model of economic growth based on the use of renewable energy sources, energy conservation, and the gradual abandonment of fossil fuels. One of the key goals of the European Green Course is to develop technologies that can not only reduce greenhouse gas emissions but also increase the energy independence of EU member states. This approach aims to reduce vulnerability to external energy crises that may arise due to geopolitical conflicts or fluctuations in oil and gas prices. The development of renewable sources such as solar, wind, and hydropower allows the EU to reduce its dependence on imported energy resources and ensure a sustainable energy balance. In particular, the EU aims to achieve the goal of 45% of the share of renewable energy in total energy consumption by 2030 (European Commission, 2023b).

In Ukraine, similar goals are laid down in the energy strategy until 2035, which provides for reducing dependence on energy imports by developing its own energy sector and gradually switching to renewable energy sources (Order of the era, 2023). The strategy aims to increase the country's energy independence, in particular, by stimulating the production of energy from renewable sources such as solar, wind, hydro, and bioenergy, which will reduce the volume of purchases of fossil fuels on international markets. The energy strategy until 2035 also provides for measures to modernise the energy infrastructure and improve energy-saving technologies and energy efficiency in industry and utilities. This includes the reconstruction of old power plants, reducing energy losses during transportation and optimising energy systems, which will increase the stability of energy supply and reduce dependence on energy imports. The transition to renewable sources is an important strategic step not only for energy independence but also for the environmental security of Ukraine. The introduction of green energy reduces greenhouse gas emissions and contributes to the achievement of EU environmental standards, which Ukraine strives for in the framework of cooperation with the EU. The energy

strategy also focuses on the need to integrate the Ukrainian energy system with the European one, which will contribute not only to the stability of the domestic market but also create opportunities for exporting Ukrainian green energy to the European market.

Smart energy and renewable energy sources are also important elements of energy sovereignty, which allow efficient management of energy resources and minimise energy losses. Smart networks integrate technologies that provide monitoring, control, and optimisation of energy flows, increasing the stability and flexibility of the power grid. Through the introduction of smart technologies, the EU seeks to reduce dependence on external suppliers and make the energy system more adaptive to market fluctuations. Renewable energy sources – wind, solar, hydro, and bioenergy – are the basis of modern energy strategies aimed at ensuring energy security. The use of renewable energy sources reduces dependence on imported energy resources and contributes to the stability of energy supply, especially in the face of fluctuations in prices for traditional energy carriers.

One of the advantages of technological sovereignty in the energy sector is the ability to reduce the country's energy vulnerability, which is critical for the stable functioning of the national economy and ensuring the well-being of the population. Dependence on imports of energy resources and equipment makes states vulnerable to price fluctuations, geopolitical conflicts, and external sanctions and limits their ability to respond independently to emergencies in the energy sector. Maintaining technological sovereignty through the development of our own energy technologies, including renewable energy sources, helps reduce these risks. The EU has been working for many years to reduce energy dependence, especially on oil and natural gas imports from unstable or potentially unfriendly countries. The EU strategy provides for the active development of renewable energy sources and local technological capacities, including energy storage technologies and the development of smart networks, which ensures the sustainability of the energy system and the stability of supplies. The European Green Deal (2019) initiative, as well as the REPowerEU (European Commission, 2022a) plan, are aimed at reducing Russian energy imports, improving the efficiency of the energy sector, and expanding the share of renewable energy sources in the EU's energy balance (European Commission, 2021a). This not only helps to reduce the risk of an energy crisis but also creates additional opportunities for innovation and job creation in the green sector of the economy.

For Ukraine, reducing energy vulnerability is a priority in the context of constant threats to energy security, in particular, in the context of military aggression and possible restrictions on energy supplies from abroad. In the face of these challenges, technological sovereignty in the energy sector becomes the key to economic and national security. The introduction of

national technologies for energy production and support for the development of renewable energy sources, in particular, solar, wind, and bioenergy, contribute to reducing dependence on imported energy carriers, which ensures stability in crisis conditions. Ukraine is actively implementing such initiatives, in particular, in the development of solar and wind power plants, which reduces dependence on energy imports. Technological sovereignty in the military field is a strategic advantage that allows a state to effectively protect its national interests and ensure security without having to rely on foreign technology, equipment, or spare parts. This means that the state is able to independently develop, produce, and modernise weapons and military equipment, which ensures independence from external suppliers and substantially reduces the risks of loss of defence capability in the event of restrictions or sanctions. In today's environment, where conflicts are often hybrid in nature and use high-tech means of warfare, the ability to respond quickly and adapt to new threats is crucial.

Dependence on foreign military-technical supplies creates a number of risks. Firstly, it increases vulnerability to the policy decisions of supplier countries, which may restrict access to critical technologies or even completely cut off supplies in the event of an escalation of conflicts. Secondly, limited access to advanced technologies makes it impossible to effectively modernise the armed forces and creates a technological gap between the state and potential opponents. For example, states that have limited access to modern communications systems, cyber defence, or intelligence tools risk losing their edge in a modern war where information and technology play a vital role.

EU countries are aware of the importance of technological sovereignty in the military field and are taking measures to strengthen their autonomy. For example, the European Defence Fund programme aims to support research and development in the field of defence technologies, including artificial intelligence systems, cyber defence tools, robotics, and the latest weapons systems (European Commission, 2020c). This allows EU countries to jointly develop technologies, reducing their dependence on third countries and simultaneously increasing their collective security. For Ukraine, the issue of military technological sovereignty has become particularly important in the context of a full-scale war with Russia, which substantially affects the country's security strategy. The ability to independently produce and maintain critical elements of military equipment is key to ensuring the operational independence of the Armed Forces of Ukraine and reducing dependence on foreign supplies, which may be limited or even blocked in crisis situations. The ability of Ukraine to independently produce armoured vehicles, air defence systems, unmanned aerial vehicles, electronic warfare systems, and other high-tech means helps to strengthen the combat capability and mobility

of the Ukrainian army and provides a faster response to operational needs. The National defence-industrial strategy of Ukraine, approved by the government, provides for the development of advanced technologies in the field of defence and incentives for local producers of defence products (Decree of the..., 2021a). It is aimed at creating an independent and competitive defence industry that can meet both domestic needs and ensure the export of defence products. This allows saving financial resources within the country, investing them in the local research and development sector, which contributes to the creation of new jobs, the development of the high-tech sector, and the improvement of the economic situation in general.

In addition, technological sovereignty provides Ukraine with the ability to adapt its weapons systems to specific combat conditions, which is important given the specific challenges and threats that the country faces. In the context of modern hybrid warfare, Ukraine is actively developing cyber defence technologies, electronic warfare tools, and systems for collecting intelligence information, which allows effectively counteracting modern methods of aggression. The development of the country's own technologies ensures not only defence capability but also contributes to the formation of national technological potential, which is an important aspect for long-term economic and political stability.

The development of our own military technologies is an important factor for improving military capabilities, operational independence, and ensuring national security in the face of modern threats. The EU is aware of the importance of technological sovereignty in the military sphere, and therefore actively works to develop its defence capabilities. Within the framework of the EU defence policy, projects are being implemented aimed at introducing the latest technologies into command and control systems, which allows member states to better coordinate actions, improve information exchange, and respond to threats faster and more effectively. In particular, the development of European unmanned aerial vehicles and intelligence systems is aimed at ensuring autonomy in the field of defence and reducing dependence on third-country technologies. Programmes such as the European Defence Fund support innovative research and development of the latest military technologies, including work on artificial intelligence, cyber defence, and robotic systems (European Commission, 2020c).

Ukraine is also implementing programmes aimed at developing and implementing modern military technologies to improve national security. Among the most successful examples is the development and use of unmanned aircraft systems, such as the Bayraktar complex, which is used to monitor borders and protect against potential threats. Although Bayraktar is of Turkish origin, Ukraine is actively involved in its modernisation and adaptation to local conditions (Ministry

of Defence..., 2024). The use of such systems gives Ukraine a substantial advantage in intelligence and rapid response to threats. In addition, Ukraine is actively developing its own air defence and radar systems to protect against air threats. Modernisation and local production of radar systems can substantially strengthen the country's ability to resist air attacks, in particular, from unmanned aerial vehicles and missiles.

Technological sovereignty is a key condition for ensuring the country's economic, energy, and military security, especially in the current context of global challenges and threats. The development of technologies allows states to reduce dependence on foreign suppliers, strengthen economic sustainability, and increase the level of independence in strategically important sectors. Ensuring economic sustainability directly depends on the ability of the state to develop and use its own technologies because external dependence on suppliers increases the risks of economic vulnerability. In the energy sector, technological sovereignty ensures energy independence, especially through the development of renewable energy sources and the introduction of smart energy solutions. Military security also depends substantially on technological sovereignty, because the development of national defence technologies, such as unmanned systems, air defence systems, and cyber defence tools, allows strengthening defence capabilities and independence in the field of security. Technological sovereignty is the basis for the stability and independence of the state. Providing their own technological capabilities in the economic, energy, and military spheres is an important strategic direction for countries seeking to minimise external dependence and protect their interests in the face of global instability.

## Discussion

The results of the study emphasise the importance of technological and economic sovereignty for national security and stability of the state's economy. Technological sovereignty allows a country to control critical infrastructure, protect data, and develop its own innovative capabilities, which reduces dependence on foreign technologies and minimises the risks associated with cyber threats or economic pressure from other countries. This helps strengthen the state's resilience to global challenges, such as geopolitical conflicts, sanctions, or disruptions in the supply of key technologies.

The studies by I. Yakoviyk & Ye. Novikov (2023), and K. Lingfu *et al.* (2024) emphasise that technological independence is not only a sign of a country's economic maturity but also a critical factor in its sustainability in the face of global challenges. The authors state that reducing dependence on foreign technologies allows countries to avoid the negative impact of fluctuations in world markets, especially in cases of political instability or trade sanctions. Such measures reduce the vulnerability of the economy and provide an opportunity

for the continuous development of key industries. The country's ability to produce and develop its own technologies provides control over critical infrastructures, increases competitiveness in the international arena, and contributes to the creation of new jobs in the technology sector. The results of this study also confirm this trend: countries that invest in the development of domestic technological potential show a more stable economy, less susceptible to external economic shocks and risks associated with dependence on imports. Technological independence contributes to increasing innovation potential, which in the long term allows states to develop high-tech industries and maintain economic growth at a more stable level.

The study shows the importance of digital sovereignty as a separate aspect of technological sovereignty. Digital sovereignty provides states with the ability to control key elements of their digital infrastructures and effectively protect critical data from external influences. An analysis of cyber threats in the EU confirms that the ability to protect digital resources and information flows is critical for national security. Implementing digital sovereignty strategies aimed at strengthening internal control over data allows countries to ensure stability and reduce the risks of influence from foreign companies and governments. A. Shoker (2023) and B. Park (2024) emphasise that this approach contributes to the formation of a sustainable digital ecosystem that makes states less vulnerable to cyber attacks and threats to the information space. This area is particularly important in the context of the current growth of cyber attacks and the growing influence of foreign companies on data management.

Based on the conclusions of J. Edler *et al.* (2023), strategic support for innovation can increase the level of technological independence and create favourable conditions for the active development of the national technology market. This includes financial support for research and development, the creation of incubators for startups, and assistance in creating a favourable legislative environment that encourages innovation. The study further emphasises that strategic support for innovation helps attract talented specialists and create high-tech clusters that can become the basis for long-term economic growth. Investment in innovation also helps to increase the competitiveness of national companies in international markets, allowing them to implement the latest technologies and optimise production processes. Countries that actively support innovative startups and promote technology development achieve the highest level of technological sovereignty and economic stability. Such countries can respond more effectively to global challenges, reduce dependence on imported technologies, and develop their own scientific developments. In addition, the development of the domestic technology market creates new jobs, promotes economic diversification, and

reduces the risks associated with economic fluctuations at the global level.

Energy independence is another important aspect of technological sovereignty that was analysed in this study. The conclusions are consistent with those of B. Andriienko (2024) and M. Ade (2024), noting that the development of smart energy and renewable energy sources is key to the energy security of states. The experience of the EU and Ukraine, examined in the framework of this paper, demonstrates that the use of renewable energy sources allows states to reduce dependence on energy imports and increase energy stability. Thus, the results confirm that the development of energy resources contributes to strengthening national sovereignty and protecting the economy from global fluctuations in energy prices.

Special attention is paid to the relationship between technological and military sovereignty since both of these aspects play a key role in ensuring national security and strategic independence. The study confirms that the development of national technologies in the defence sector, including cybersecurity, can substantially increase the level of state protection from external threats. According to the findings of F. Sauer (2021) and J. Reis *et al.* (2021), investments in the development of defence technologies contribute to reducing dependence on foreign weapons and control systems, which provides greater control over critical military resources and reduces the level of military risks.

The study confirms that ensuring technological independence in the field of defence plays a critical role in maintaining national security and stability of the state. This not only allows the country to protect its interests more effectively but also forms a strategic basis for state sovereignty. States that develop their own defence technologies are becoming less dependent on external suppliers of weapons and equipment, which, in turn, reduces the risks associated with possible sanctions or embargoes from other countries. In addition, it provides an opportunity to adapt weapons and systems to the specific defence needs of the country, making the national security system more flexible and independent. This is confirmed by the studies conducted by S. Kılıç (2024), and F. Attinà & M. Karamia (2024), which stress that such states also occupy a more stable position in international relations since the ability to provide their own protection increases their autonomy on the world stage. Investing in defence technologies, including the development of air defence systems, radars, drones, and cybersecurity systems, allows effectively responding to new threats such as hybrid wars, cyber attacks, and new types of weapons used by potential aggressors. For example, the active introduction of high-tech defence solutions contributes to the country's ability to quickly restore its defence potential and take countermeasures in response to any threats.

An important component of the study was the assessment of EU policies, which largely determine the content and direction of economic, political, administrative, and legal reforms in candidate countries and neighbouring states. This is evident both in the requirements for compliance with EU standards and in the mechanisms of economic and legal cooperation that regulate the EU's relations with these states. This is confirmed by the papers of I. Yakoviyk *et al.* (2018) and N. Helwig & V. Sinkkonen (2022), noting that it is the EU, as a supranational entity, that sets the framework for the political identity and administrative reforms of these countries. National governments, despite the influence of the EU, choose the direction and pace of integration themselves, coordinating them with their own national interests. The study confirms the importance of technological sovereignty for state security and economic independence. The development of the state's own technologies in the fields of energy, cybersecurity, and defence helps to reduce the risks of dependence on imports and ensures the stability and sustainability of the country in the face of global challenges.

## Conclusions

The results of the study confirm that technological sovereignty contributes to sustainable economic development by reducing import dependence and ensuring the integration of national innovations in important industries such as information technology, energy, telecommunications and defence. Thanks to the development of its own technological potential, the state increases its competitiveness in the world market, as well as protects its economy from possible fluctuations in international markets and economic crises. This is particularly relevant in the current context of growing global instability. Technological sovereignty also contributes to improving energy security, in particular, through the introduction of renewable energy sources, the development of energy-efficient technologies and the creation of National Energy Management Systems. This not only reduces their dependence on imported energy but also makes them less vulnerable to external influences, such as energy crises or economic sanctions. The introduction of domestic production of energy technologies allows maintaining the stability of the economy and protecting it from global risks. In addition to economic and energy security, technological sovereignty plays an important role in ensuring military security. The development of its own defence technologies and cyber defence systems substantially reduces the risk of interference in military processes, as well as increases the level of state autonomy in providing national defence.

The experience of Ukraine and the EU clearly illustrates different approaches to achieving technological independence. In Ukraine, technological sovereignty is seen as an important component of national security, including the development of cybersecurity,

national research, and semiconductor development. The EU pays considerable attention to digital technologies and cybersecurity, developing programmes to support research and initiatives to reduce technological dependence on partner countries. Key challenges to technological sovereignty are the lack of political will in individual countries, especially due to internal political conflicts or short-term economic interests, as well as limited access to resources in developing countries to implement their own technologies. Corruption, especially in countries with low levels of transparency, can undermine the implementation of technology strategies through the interests of certain economic groups that are interested in maintaining the status quo. The combination of these factors slows down the process

of achieving technological independence and requires more detailed analysis. The limitation of the study was also the limited available data, since the concept of technological sovereignty is relatively new in economic and political science, which makes it difficult to analyse its long-term impact. Further research may focus on analysing specific strategies to support national technologies and develop innovative institutions to strengthen economic stability.

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### Conflict of interest

None.

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## Технологічний суверенітет держави: практичний досвід України та Європейського Союзу

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**Анотація.** Метою дослідження було всебічне вивчення впливу технологічного суверенітету на економічну та національну безпеку. У роботі розглянуто ключові аспекти технологічного суверенітету. Результати дослідження засвідчили, що технологічний суверенітет чинить значний і багатогранний вплив на національну безпеку, охоплюючи економічну, енергетичну стабільність та військову безпеку країни. Це забезпечує стійкість національних економік, знижує залежність від глобальних ринків та критичних технологій, що особливо важливо у контексті зростаючої конкуренції з великими технологічними гравцями. Забезпечення економічної незалежності також дозволяє країні контролювати стратегічно важливі ресурси, сприяючи більш стійкому розвитку в умовах міжнародної турбулентності. Вплив на енергетичну безпеку проявляється через впровадження інновацій у галузі відновлюваних джерел енергії, розвитку власних технологій з енергоефективності та створення національних мереж для управління енергоресурсами, що сприяє зниженню залежності від імпортованих енергоресурсів і підвищує стійкість до зовнішніх впливів, таких як енергетичні кризи та економічні санкції. Військова безпека, як важливий компонент національної безпеки, також значно зміцнюється завдяки технологічному суверенітету. Зокрема, розвиток власних кібертехнологій, оборонних систем, систем штучного інтелекту та технологій аналізу даних мінімізує ризики зовнішнього втручання в оборонні процеси та забезпечує країні незалежність у сфері національної оборони. Технологічний суверенітет дозволяє ефективніше захищати критичну інфраструктуру від кібератак і знижувати залежність від іноземних розробок. Досвід України та ЄС свідчить про різні підходи до досягнення технологічної незалежності, що включають підтримку національних досліджень, розробку власних напівпровідників, розвиток цифрових технологій, програм кібербезпеки та ініціатив для зменшення технологічної залежності. Ці фактори підкреслили необхідність інтеграції державних стратегій для побудови технологічного суверенітету як ключової складової національної та економічної безпеки.

**Ключові слова:** технологічний суверенітет; економічна незалежність; цифрова інфраструктура; захист даних; інновації; кібербезпека; енергоефективність



## Formation and development of regional economic integration in North America (a case study of NAFTA)

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**Abstract.** The study focused on analysing the stages of development and formation of regional economic integration in North America. The methodology involved a comprehensive assessment of the evolution of integration processes and their impact on the participating states' economies, political systems, and social aspects. The research examined the legal framework and economic changes resulting from integrating the USA, Canada, and Mexico under the North American Free Trade Agreement and its modern successor, the United States-Mexico-Canada Agreement. Attention was given to various forms of regional integration, ranging from free trade areas to political unions. A key aspect of the study was the legal regulation of integration processes, including the harmonisation of national legislation with international agreements and the role of supranational bodies in ensuring compliance and resolving disputes. The study examined the economic and political prerequisites for the agreement's conclusion, as well as the legal mechanisms governing international trade, investment, intellectual property, and dispute resolution. The United States' exports to Canada increased from USD 43.5 billion in 1994 to USD 91.9 billion in 2019, while exports to Mexico rose from USD 50.8 billion to USD 256.4 billion over the same period. Similarly, imports from Canada grew from USD 31 billion to USD 202.7 billion, and imports from Mexico followed the same trend, increasing from USD 31 billion to USD 202.7 billion. Notably, the USA's exports to USMCA member states rose from USD 580 billion in 2020 to USD 860 billion in 2023, while Canada's exports increased from USD 230 billion to USD 520 billion, and Mexico's from USD 250 billion to USD 540 billion. The practical significance of the study lies in the potential application of its findings to enhance the legal mechanisms of regional integration, formulate economic and environmental policies, and support decision-making in international trade, investment, and labour standards by governments and international organisations

**Keywords:** regional economic integration; international trade; international agreements; legal regulation; North American Free Trade Agreement; United States-Mexico-Canada Agreement

### Introduction

With its significant economic power, North America plays a vital role in the global economy. The last 30 years have been characterised by a particular emphasis on the processes of regional economic integration, in particular thanks to the North American Free Trade Agreement (NAFTA) (1992). Signed in 1992 between the USA, Canada and Mexico, this agreement became one of the largest economic integration projects in the world. In the context of globalisation, which contributes to the growth of economic interdependence between states,

the issue of developing regional integration initiatives is becoming increasingly important.

Integration in North America is important for several reasons. It stimulates economic growth, removes trade barriers and improves the investment climate. In addition to the economic impact, integration processes also change the social, political and environmental aspects of the life of the participating states. Therefore, the study of such agreements is important for understanding the general trends in the development of the

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world economy. Analysing NAFTA's experience provides insight into how economic integration shapes the economies of the three countries and their position in the global landscape. The most common types of integration are agreements that reduce or eliminate trade barriers, and simplify the movement of capital and labour. These principles are implemented through the obligations of the participating countries at the legislative level, as well as through the creation of joint regulatory bodies and dispute-resolution mechanisms.

In the process of analysing the establishment of regional economic integration in North America, researchers paid particular attention to assessing the impact of NAFTA on the economies of the participating countries and global trade. In particular, V. Verhun *et al.* (2020) emphasised that the agreement contributed to a significant increase in trade between the USA, Canada and Mexico, which allowed the creation of one of the largest free trade zones in the world. At the same time, A.K. Kikkawa *et al.* (2019) noted that this process had a heterogeneous impact on individual industries, in particular, on the manufacturing sector of Mexico, which faced competition from the more powerful US economy. J. Berasaluce & J.A. Romero (2020) focused on the role of NAFTA in attracting foreign investment to Mexico, which became a catalyst for economic growth, but, according to the authors, could not solve the problem of economic inequality between the regions of this country. V.M. Cuevas Ahumada & R.I. López Churata (2019) believed that one of the main advantages of the agreement was the creation of opportunities for the development of entrepreneurial activity due to a more favourable institutional environment. However, this sometimes led to the displacement of less competitive local producers. F. Benguria (2023), in his analysis of NAFTA's impact on the labour market, noted that while employment growth was observed in the USA and Canada, the agreement simultaneously caused a decrease in the number of low-skilled jobs, as production moved to regions with cheaper labour. A different approach was demonstrated by X. Zhao *et al.* (2020), who studied the impact of the agreement on consumers and concluded that consumers benefited from lower prices for goods due to increased competition and optimisation of production chains. F. Gladstone *et al.* (2021) pointed out that integration within NAFTA increased environmental pressure on countries, especially in the context of industrial production in Mexico, where environmental standards remained lower than in the USA and Canada. R. Labonté *et al.* (2019) drew attention to issues related to regulatory harmonisation and noted that it often caused tension between countries due to differences in approaches to protecting the rights of consumers and workers. In a more general context, E. Eteria (2022) considered NAFTA as part of global integration trends and emphasised that its experience can serve as a model for other regions of the world, although it requires

adaptation to local conditions. A. Trejo-Nieto (2023) analysed the transformation of NAFTA into the United States-Mexico-Canada Agreement (USMCA) (2018), emphasising that the changes were aimed at solving many critical problems identified in the previous agreement, such as the distribution of benefits between countries and environmental challenges.

Thus, the generalisation of previous publications has revealed the multidimensional impact of NAFTA and emphasises the importance of its analysis in modern conditions. One such aspect that has not been explored by other authors is the impact of NAFTA on social changes in the participating countries, in particular on the level of social inequality and working conditions. In addition, there is insufficient research on the relationship between political and institutional changes in countries and their impact on the effectiveness of the agreement, which is an important aspect for assessing the sustainability and possible directions of NAFTA's development.

This study aimed to comprehensively analyse various aspects of NAFTA's impact on the state-legal and socio-economic development of North American countries, as well as to assess the long-term consequences for regional economic integration. The objectives of the study were to examine the social changes caused by NAFTA, in particular their impact on the level of social inequality and working conditions in the countries participating in the agreement, as well as to study the relationship between political and institutional changes in the countries and their impact on the effectiveness of economic integration.

## Materials and methods

This research employed a broad spectrum of analytical approaches and methods to assess the processes of regional economic integration, particularly through the analysis of the North American Free Trade Agreement (NAFTA) (1992) and the United States-Mexico-Canada Agreement (USMCA) (2018), and their impact on the economies of the USA, Canada, and Mexico. To evaluate the effectiveness of integration processes, both quantitative and qualitative methods were used, including a comparative analysis of economic indicators and statistical data, which allowed for a detailed assessment of changes in the economies of the participating countries.

To analyse foreign trade, export and import volumes, and structural shifts in national economies, data from the Statista database (n.d.) were used, allowing the dynamics of trade relations between the countries to be traced from 1994 to 2020 under NAFTA and from 2020 to 2023 under USMCA. Comparative analysis methods made it possible to assess changes in economic relations between the USA, Canada, and Mexico after the signing of NAFTA and compare them with the current USMCA agreement. For this purpose, a sample of indicators was used, such as the share of exports and

imports in the GDP structure of each country, as well as changes in the volume of trade between countries. This approach provided insights into how economic relations evolved and the outcomes of the agreement for the three leading economies of North America.

The study also applied methods of analysing international agreements and legal acts related to NAFTA and USMCA. This included reviewing the main provisions of the agreement, such as rules of origin, dispute resolution mechanisms, issues of investment and intellectual property protection, as well as social and labour standards. These provisions were analysed from documents such as NAFTA and the North American Free Trade Agreement Implementation Act (1993). The analysis also covered changes in legal mechanisms that occurred after the modernisation of NAFTA as part of the signing of USMCA in 2018.

To study economic changes and integration processes under the USMCA agreement, the official USMCA website was used as the main source of data. This resource contains up-to-date information on the regulatory framework, economic reports, as well as statistical data on trade, investment and employment in the participating countries. To assess the impact of integration on the economies of countries, methods of economic modelling and statistical analysis were used. This enabled an examination of the long-term effects of integration by analysing the export and import of goods and services, as well as the influence of factors such as changes in labour standards, industrial development, and job creation. Particular attention was paid to the social and environmental consequences of integration. The impact of the agreement on working conditions and income levels, as well as environmental standards, particularly in Mexico, where increased production was accompanied by a deterioration of the environmental situation due to the low level of environmental protection, was studied.

## Results

Regional economic integration is a complex process that involves the unification of several countries for joint economic development by eliminating barriers to trade, creating common economic spaces, and harmonising national policies. The basis of this process is the idea of increasing the efficiency of resource use and creating more sustainable economic systems within the integrated region. Integration can manifest itself in various forms. The simplest is a free trade area, which involves the abolition of customs and trade restrictions between the participating countries. The next level is a customs union, which complements the free trade area with a single customs policy towards third countries. The common market includes not only free trade but also the free movement of labour, capital and services (Yakoviyyk, 2014). The economic union unites economies at the policy level, including

the harmonisation of financial and social systems. The highest form of integration is a political union, where countries delegate a significant part of their sovereignty to supranational bodies. The stages of integration usually develop gradually: from the conclusion of trade agreements and the reduction of barriers to the full harmonisation of economic and political policies. Each stage requires deep cooperation between countries and institutional adaptation.

The effectiveness of regional integration largely depends on the legal framework that governs relations between participating countries. The foundation is international agreements, which record the obligations of the parties to create a free trade area, customs union or other forms of integration. Such agreements often regulate aspects of market access, tariff policy, investment guarantees, environmental standards and dispute resolution mechanisms. An important part of integration is the harmonisation of the domestic legislation of the participating countries with the requirements of international agreements (Jetschke & Murray, 2020). This includes harmonising the trade, financial, labour and environmental legislation of the participating countries to ensure the effective functioning of both the integration association as a whole and each member state. For example, within the EU, member states must comply with the provisions of EU regulations, which ensure the unity of the market. A special role is played by the European Commission, which represents supranational (pan-European) interests and is informally called the “guardian of the founding treaties”, given its obligation to oversee compliance by member states with EU law. EU institutions are designed to help resolve conflicts that may arise in the process of the functioning of the integration association.

The EU is a prime example of successful regional economic, and later political, integration. Starting its operation in 1951, when the European Coal and Steel Community was created, a united Europe went through stages in its development from the formation of a customs union to the creation of a single market, and then to the formation of an economic and monetary union. This allowed the EU to coordinate national policies in such important areas as trade, transport, environmental protection and social security, creating a stable and prosperous economic zone (Hartley *et al.*, 2020). The EU experience has become a model for the creation of other regional associations, which has demonstrated the importance of both economic and political integration for achieving sustainable development. One can mention such integration projects as the Association of Southeast Asian Nations and the Regional Comprehensive Economic Partnership, which are focused on the gradual liberalisation of trade and investment. These projects contributed to the reduction of trade barriers, however, unlike the EU, did not lead to political integration (Anwar, 2020).

At the end of the 20<sup>th</sup> century, integration processes spread to other regions. One such example is NAFTA, signed in 1992 (ratified in 1994), which united countries with different socioeconomic and political realities. Agreements like NAFTA reflect an adapted version of the European experience, where political integration was not the main goal. The integration models that emerged in North America, Asia and Latin America are developing taking into account the specifics of their realities and needs, which differs from European standards (Stanford, 2019). One of the important features of integration processes is the link between economic integration and state sovereignty. Within integration associations, member states deliberately resort to delegating the right to exercise certain sovereign rights and powers to the supranational level. This process usually takes place based on the principle of subsidiarity, when the institutions and bodies of the integration association are involved in the implementation of only those functions that cannot be effectively performed independently by national governments (Yakoviyk *et al.*, 2018).

The signing of NAFTA was the logical result of long-term preparatory economic and political processes taking place in the region. This agreement united the USA, Canada and Mexico into one of the world's largest free trade zones, opening up new opportunities for economic and social development. It should be noted that the prerequisites for its conclusion were complex and multifaceted, including both economic and political factors. The economic conditions for the creation of the agreement arose due to the complementarity of the economies of the three countries. The USA, as the largest economy in the world, sought to find new markets for its high-tech products and reduce costs, partially relocating production to countries with lower labour costs. Mexico, striving to modernise its infrastructure and stimulate economic development, tried to attract foreign investment and create new jobs. Canada, as a major supplier of raw materials and industrial goods, tried to maintain access to the US market, as its main trading partner.

At the end of the 20<sup>th</sup> century, global economic changes became an important factor that prompted the three states to sign the agreement. The processes of globalisation and the opening of world markets forced countries to join forces to strengthen their competitiveness. For Mexico, the conclusion of NAFTA was an important stage in the implementation of the economic liberalisation policy, which began in the 1980s after structural reforms and the transition to a market economy. Political factors also had a significant impact. The governments of the USA, Canada and Mexico viewed the agreement not only as an economic instrument but also as a strategic step. For the USA, this was an opportunity to strengthen stability on the southern border, as economic growth in Mexico could contribute to reducing

illegal migration and strengthening the fight against drug trafficking. For Mexico, integration with the economies of the USA and Canada symbolised the desire for modernisation and democratic reforms. For Canada, NAFTA opened up the opportunity to ensure balance in trilateral relations, protecting its own interests during negotiations with the USA (Lai, 2021).

The main points of the agreement cover a variety of economic and legal aspects governing trade, investment, intellectual property protection and dispute resolution mechanisms. One of the main goals of NAFTA was to create a free trade area, which involved the gradual elimination of tariff and non-tariff barriers between the three countries. The agreement included a clause on the gradual abolition of customs tariffs on most goods within 15 years, which contributed to the development of mutual trade, particularly in such sectors as automotive, agriculture and electronics production (Walmsley & Minor, 2021). NAFTA contributed to the significant liberalisation of trade in services and created a legal framework for the protection of investments. Investors received guarantees against discriminatory measures and nationalisation without adequate compensation. Mechanisms for the protection of intellectual property rights were also defined, in particular standards in such areas as copyrights, patents and trademarks.

International agreements on economic integration, such as NAFTA and USMCA, have significantly influenced the structure of industries that are key to the global economy. The oil and gas sector, as one of the most important in the world, has become an example of how integration has contributed to accelerating its development, growth of transnational trade and the introduction of innovations. However, this process is not limited to oil and gas: integration has created conditions for the energy transition to renewable energy sources, which is gradually transforming the dependence of states on fossil fuels.

The oil and gas industry has historically held a central place in the economies of countries such as the USA, Canada, and Mexico. Trade agreements, particularly NAFTA, have contributed to the deepening of economic ties between these countries, which ensured the unhindered movement of energy resources. For the USA, this integration meant access to cheaper raw materials from Canada (for example, oil from oil sands) and Mexico, which allowed to reduce the cost of domestic production. Canadian companies, in turn, gained stable access to the American market, where demand for oil and gas remained high, and joint projects allowed the use of joint technological innovations (Eckhouse & Zalik, 2022).

Mexico, which had significant reserves of hydrocarbons, benefited from the technologies, investments, and knowledge that became available through integration. However, its dependence on American consumers gradually increased: a significant part of Mexican oil

was exported to the USA, while imported processed products, such as gasoline, provided for Mexico's domestic demand. Thanks to integration, infrastructure was also developed, in particular oil pipelines, gas pipelines and processing plants. For example, the construction of cross-border energy projects greatly facilitated the transportation of raw materials and finished products, minimising logistical costs. This particularly affected the US economy, which actively imported heavy oil from Canada for its refineries in Texas, which specialised in processing this type of raw material (Winham & Grant, 2019).

Integration has created favourable conditions for a gradual transition to renewable energy sources. In the USA, for example, trade agreements have made it possible to reduce the cost of importing necessary components for "green" energy, such as solar panels and wind turbines. Investments in research and development have become more accessible through transnational cooperation with Canada and Mexico. Canada, with its large resources of hydropower, actively exported electricity to the USA, which contributed to the creation of a common energy market. Mexico, for its part, attracted foreign investment in solar energy development projects, using its natural conditions, such as a long sunny day (Segbefia *et al.*, 2023). Thus, integration has helped to lay the foundation for the growth of the renewable energy sector, which is gradually becoming the main successor to the oil and gas industry.

At the initial stages of integration, dependence on trade between the participating countries increased. The USA, Canada and Mexico mutually complemented each other in the energy sector: American demand for raw materials was ensured by supplies from Canada, and the processing capacities of the USA satisfied the needs of Mexico. This created the so-called energy triangle, which maintained balance within the region. However, the development of technologies, such as shale gas and oil in the USA, reduced the country's dependence on imports. The USA became not only self-sufficient in the production of many types of energy, but also began to export it to other countries. For Canada and Mexico, this meant the need to diversify their trading partners to reduce the risks associated with dependence on the American market (Yatsenko *et al.*, 2019). In the new USMCA agreement, the emphasis has shifted: countries are trying to develop cooperation in the field of renewable energy and climate policy. The USA, as a leader in technological innovation, contribute to the integration of new solutions in the region, which opens up new opportunities for trade and cooperation.

The legal mechanisms of NAFTA became an important tool to ensure the implementation of the provisions of the agreement. The section on dispute settlement, which offered three main mechanisms, deserves special attention. The first concerned the resolution of interstate disputes through negotiations or arbitration.

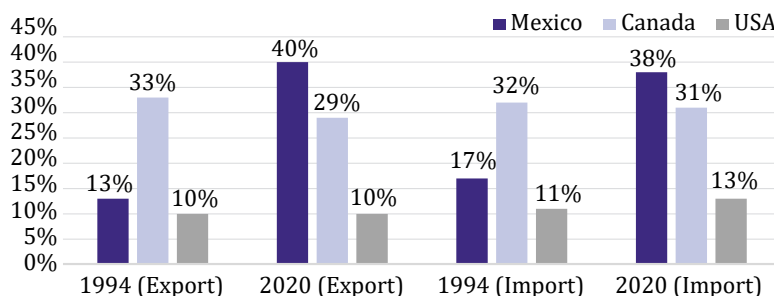
The second mechanism, designed for investment disputes, provided investors with the opportunity to file lawsuits against the governments of the participating countries in international arbitration. The third mechanism was focused on resolving trade disputes, such as anti-dumping measures or the application of countervailing duties. The provisions on rules of origin of goods, which determined the conditions under which products could enjoy the benefits of the agreement, played a special role. For example, cars had to contain a certain percentage of components produced in NAFTA countries to meet the requirements of duty-free trade. Although NAFTA had significant advantages, its legal mechanisms sometimes became the subject of criticism. Some participating countries considered them too complex and lengthy to apply. However, on the whole, they created a solid foundation for protecting the interests of the parties and ensuring stability in the region.

The implementation of NAFTA took place in several stages, each of which significantly influenced the economic development of the participating states. At the initial stage, after the agreement came into force on 1 January 1994, the countries focused their efforts on abolishing customs tariffs on key categories of goods. Initially, tariffs on industrial and agricultural goods were abolished, which led to a significant increase in trade between the USA, Canada and Mexico. At the same time, mechanisms for monitoring compliance with rules of origin were introduced, which allowed guaranteeing that the benefits from the agreement would be received only by goods produced within North America. The second stage was focused on deepening economic integration, in particular through stimulating investment and strengthening cooperation in strategic sectors. Joint projects in the automotive industry were of great importance at this stage, which gave the region a significant competitive advantage in the global market. However, at this stage, the first signs of economic imbalances began to appear: Mexico's growing dependence on exports to the USA and the uneven distribution of benefits between the participating countries caused numerous discussions. The third stage of NAFTA implementation became a period of new challenges. At the end of the 2000s, the global economic crisis, as well as changes in global trade, forced countries to review the effectiveness of the agreement. Growing criticism from American manufacturers, who were losing competitiveness due to the relocation of production to Mexico, cast doubt on the further existence of the agreement in its original form.

The modernisation of NAFTA took place in 2018 when a new agreement – USMCA – was signed. It came into force on 1 July 2020, reflecting changes in the economic environment and new priorities of the participating states. One of the main innovations of USMCA was the strengthening of rules of origin, especially for the automotive industry: now vehicles had to

contain at least 75% of components produced within the region, which stimulated production within the agreement zone (Villarreal and Fergusson, 2020). In addition, USMCA included new provisions on the protection of labour rights, in particular for workers in Mexico, which was intended to reduce economic inequality between countries. Particular attention was

paid to issues of digital trade, which were not previously taken into account within NAFTA. The agreement also provided for the modernisation of dispute resolution mechanisms and the strengthening of environmental standards. Figure 1 shows the share of exports and imports of goods and services for NAFTA countries in 1994 and 2020.



**Figure 1.** Share of exports and imports of goods and services for NAFTA countries in 1994 and 2020, in % of GDP  
Source: developed by the author based on Statista (n.d.)

The analysis of the table shows significant changes in the structure of foreign economic activity of NAFTA countries from 1994 to 2020. Mexico demonstrated a significant increase in dependence on exports and imports, where the share of exports increased from 13% to 40% of GDP, and imports – from 17% to 38%, which reflects its integration into global and regional supply chains. Canada, on the contrary, experienced a slight decrease in the share of exports (from 33% to 29%) and imports (from 32% to 31%), which may indicate a more stable position in trade with NAFTA countries. In the USA, the share of exports remained stable at 10%, while imports increased from 11% to 13%, which demonstrates a gradual increase in the consumption of

imported goods, despite maintaining a more autarkic economic structure compared to partners. These changes reflect different economic strategies and adaptation of countries to the conditions of regional integration. Regional economic integration within NAFTA, and later USMCA, had a significant impact on the US economy. As the largest economy in the region, the USA benefited from integration, as well as new challenges. Analysing the impact, several important aspects can be identified that relate to trade, production, investment and socio-economic consequences. One of the main results of NAFTA was the rapid growth of trade between the USA, Canada and Mexico. Table 1 shows the export of goods from the USA to Canada and Mexico, as well as imports to the USA.

**Table 1.** Export and import of goods from/to the USA to/from Canada and Mexico within NAFTA for 1994-2019, billion USD

| Years | Exports to Canada | Imports from Canada | Exports to Mexico | Imports from Mexico |
|-------|-------------------|---------------------|-------------------|---------------------|
| 1994  | 43.5              | 31                  | 50.8              | 31                  |
| 1995  | 48.5              | 43.9                | 46.3              | 43.9                |
| 1996  | 51.7              | 55.1                | 56.8              | 55.1                |
| 1997  | 61.4              | 62.8                | 71.4              | 62.8                |
| 1998  | 58.3              | 68.3                | 78.8              | 68.3                |
| 1999  | 57.2              | 71.3                | 86.9              | 71.3                |
| 2000  | 57.8              | 84                  | 111.3             | 84                  |
| 2001  | 60.5              | 81.1                | 101.3             | 81.2                |
| 2002  | 61.5              | 84.7                | 97.5              | 84.7                |
| 2003  | 62.5              | 87.9                | 97.4              | 87.9                |
| 2004  | 66.7              | 96                  | 110.7             | 96                  |
| 2005  | 75.8              | 107.1               | 120.2             | 107.1               |
| 2006  | 83.4              | 127.2               | 133.7             | 127.2               |
| 2007  | 87.3              | 134.1               | 135.9             | 134.1               |
| 2008  | 89.2              | 140.4               | 151.2             | 140.4               |
| 2009  | 72.4              | 107.6               | 128.9             | 107.6               |
| 2010  | 86.1              | 141                 | 163.7             | 141                 |
| 2011  | 93.2              | 163.4               | 198.3             | 163.4               |

Table 1. Continued

| Years | Exports to Canada | Imports from Canada | Exports to Mexico | Imports from Mexico |
|-------|-------------------|---------------------|-------------------|---------------------|
| 2012  | 99.2              | 168.4               | 215.9             | 168.4               |
| 2013  | 102.5             | 171.6               | 226               | 171.6               |
| 2014  | 103.7             | 182.2               | 241               | 182.2               |
| 2015  | 93.1              | 175.5               | 236.5             | 175.5               |
| 2016  | 89.6              | 170.9               | 230.2             | 170.9               |
| 2017  | 92.9              | 183.7               | 243.5             | 183.7               |
| 2018  | 95.6              | 200                 | 265.4             | 199.9               |
| 2019  | 91.9              | 202.7               | 256.4             | 202.7               |

**Source:** developed by the author based on Statista (n.d.)

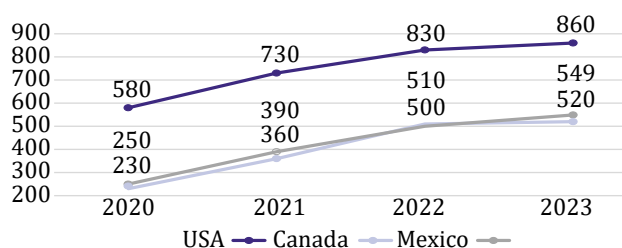
US exports to both countries increased significantly: from USD 43.5 billion to Canada in 1994 to USD 91.9 billion in 2019, and from USD 50.8 billion to Mexico to USD 256.4 billion in the same period. Imports from Canada increased from USD 31 billion to USD 202.7 billion, and from Mexico – from USD 31 billion to USD 202.7 billion, which reflects the deepening of economic integration and increased interdependence of economies. The largest increase in trade was observed in 2000-2010, after which the pace stabilised. The USA has a positive trade balance with Canada in certain years, while exports dominate with Mexico, which reflects different trade models and sectoral advantages of partners within NAFTA.

US exports to partner countries have increased significantly since the agreement was concluded, which has had a positive impact on certain industries, in particular agriculture, automotive and electronics. Free access to the markets of Canada and Mexico created new opportunities for American companies, which benefited from the expansion of export opportunities and diversification of sales markets. Another important aspect was the development of supply chains. The integration allowed enterprises in the USA to reduce costs by taking advantage of the production capacity of Mexico, where there was cheaper labour. This was especially felt in the automotive sector, where most production processes became interdependent between the three countries. This contributed to lowering the cost of production and strengthening the competitiveness of American goods in the world market.

However, integration also created serious challenges. One of the most controversial aspects concerned the transfer of production capacity to Mexico. The growing flow of capital to Mexico created pressure on the American workforce, especially in traditional manufacturing industries, such as textiles and heavy industry. This led to a reduction in jobs in the USA, particularly in regions that depended on such industries. The investment impact was also ambiguous. On the one hand, American companies gained access to a favourable environment for investment in Mexico, which allowed them to expand their business. On the other hand, such investments were often accompanied by a reduction in domestic investment in the USA, which could slow down the development

of certain regions. The socio-economic impact is also noteworthy. Integration has reduced the cost of consumer goods, which has had a positive impact on the well-being of the population. However, the economic benefits were distributed unevenly: megacities and export-oriented sectors received more benefits than rural and industrial regions, which led to economic polarization.

The modernisation of the agreement in the USMCA format was intended to address some of these challenges. The new provisions on labour standards, digital trade and rules of origin are aimed at ensuring a more balanced impact of integration on the US economy. In 2022, the volume of exports of goods from the USA to USMCA countries amounted to USD 680.8 billion, which is 16% (USD 94.1 billion) more than in 2021. Imports of goods from USMCA countries to the USA in 2022 reached USD 891.3 billion, which is 20.5% (USD 151.5 billion) more than in 2021. USMCA accounted for 33% of total US exports in 2022, which confirms the importance of regional partners for American trade. At the same time, the USA's trade balance deficit with USMCA countries increased to USD 210.6 billion, increasing by 37.5% (USD 57.4 billion) compared to 2021. Thus, US trade with USMCA countries demonstrates steady growth in both exports and imports, which emphasises the importance of integration for the regional economy, but at the same time is accompanied by a growing trade deficit. Figure 2 shows the volume of exports of goods and services to USMCA partners.



**Figure 2.** Export of goods and services to USMCA partners for 2020-2023, billion USD

**Source:** developed by the author

The table demonstrates a steady growth of exports of goods and services from countries to USMCA partners in 2020-2023. The growth of exports from Mexico

(+120% from 2020 to 2023) and Canada (+126%) is particularly noticeable, which indicates a deepening of regional integration. For the USA, export growth is less rapid (+48%), but the total volumes remain the highest, which confirms the leadership of the USA in trade within USMCA. Regional integration within NAFTA largely influenced the economies of Canada and Mexico, although the scale and consequences of this impact varied significantly depending on the economic potential, structure of the economy and the role of each country within the agreement. For Canada, NAFTA was a logical continuation of the Canada-US Free Trade Agreement, which was in effect since 1989. The main advantage for Canada was guaranteed access to the large American market, which stimulated export growth, particularly in sectors such as energy, automotive and agriculture. For example, oil, natural gas and timber became important export goods that contributed to strengthening the Canadian economy. On the other hand, integration made Canada more dependent on the American market. As of 2020, almost 75% of Canadian exports went to the USA, which created risks of economic vulnerability in the event of changes in US policy or economy. In addition, the Canadian economy faced competitive pressure, as American companies gained free access to the domestic market of Canada. This forced local enterprises to increase their efficiency and innovation potential to compete with powerful American players.

For Mexico, NAFTA became a historic milestone that allowed it to integrate into the world economy and made the country an important player in global supply chains. Integration with such powerful economies as the USA and Canada has made it possible to significantly expand the volume of exports, especially industrial products. The growth of production in Mexico was concentrated in sectors such as automotive, electronics and agriculture. In addition, NAFTA stimulated the inflow of foreign investment into Mexico, particularly in free trade zones (*maquiladoras*), which became centres of industrial growth. On the one hand, this contributed to the creation of jobs and increased competitiveness, but, on the other hand, there was a dependence on transnational corporations, which often used cheap labour without significant contribution to the sustainable development of the country. Despite the economic benefits, integration did not eliminate socio-economic inequality in Mexico. The benefits of NAFTA were more noticeable for the northern regions of the country, closer to the USA, while the southern regions remained less developed. In addition, trade liberalisation negatively affected Mexican agriculture, where small farmers could not withstand competition from American producers, which intensified migration flows.

Regional economic integration through NAFTA had a significant impact on social conditions in the three countries – the USA, Canada and Mexico. This was most felt through inequality, changes in working conditions

and employment. Mexico, in particular, benefited from NAFTA in terms of creating new jobs, as large international corporations opened factories and plants in border areas, which helped reduce unemployment. Thus, using the example of Mexican “*maquiladoras*” – factories located on the South American border, one can observe a positive effect on the local economy. However, these jobs were mostly low-paying, and working conditions did not always meet high standards, which caused criticism regarding the violation of workers’ rights.

In the USA and Canada, NAFTA led to significant changes in the labour market. For example, numerous production facilities were moved to Mexico due to cheaper labour. This caused a decrease in the number of jobs in industries such as textiles, leather goods and automotive, which mostly affected labour resources in the southern regions of the USA. Within the first 10 years of NAFTA’s existence, the USA lost approximately 700,000 jobs, particularly in these sectors. For the USA, integration meant opening up opportunities for the relocation of production to countries with cheaper labour, which caused a reduction in jobs in traditional manufacturing sectors, such as the automotive and textile industries. At the same time, the number of jobs in high-tech and service industries, which required higher qualifications, increased. Legal regulation in the USA was aimed at protecting workers through requirements for working conditions, but competition with Mexican manufacturers led to a weakening of the positions of trade unions and stagnation of real wages for low-skilled workers. Meanwhile, under the USMCA, new rules were introduced requiring Mexico to strengthen the protection of workers’ rights to level the playing field in terms of competition.

Canada was able to maintain high-quality jobs thanks to a strong social policy and labour market regulation. Its economy focused on the export of raw materials and energy resources, ensuring the stability of employment in these sectors. Canadian labour laws remain among the most progressive in the region, including collective agreements, employment guarantees and working hours regulations. This allowed minimising the negative consequences of competition with countries where labour is cheaper. In Mexico, integration had mixed results. On the one hand, the country received a significant inflow of investment in the manufacturing sector, especially in the automotive, electronics and agriculture sectors. This created millions of jobs, but many of them remained low-paying. Trade unions in Mexico, which traditionally had weak positions, were often subordinated to the influence of the state or employers. Within the USMCA, several reforms were introduced, including the creation of independent trade unions and the strengthening of labour standards. This was an important step towards improving employment conditions.

In the US, the minimum wage varies by state, but at the federal level, it remains fixed at USD 7.25 per hour

since 2009. However, due to public pressure and the “Fight for USD 15” campaign, many states, such as California and New York, have decided to raise the minimum wage to 15 USD per hour. Integration has influenced employment in the manufacturing sectors, but at the same time contributed to the creation of high-paying jobs in the IT and finance sectors. In Canada, the minimum wage is also regulated at the provincial level. As of 2024, the federal minimum wage was USD 17.3, compared to USD 16.65 in 2023. Its growth has been stable over the past 10 years, which reflects high inflation and the need to maintain social standards (Federal minimum wage..., 2024). Thanks to integration, Canada was able to create conditions for improving labour productivity and maintaining competitive conditions. The minimum wage in Mexico showed the largest increase among the three countries. In 2019, it was 102.68 Mexican pesos (USD 5.4) per day, and by 2025 it increased to more than 279 pesos (USD 13.4) (Raboca, 2025). This increase was largely stimulated by the requirements of USMCA, which provided for the alignment of labour standards in the region.

The environmental consequences of NAFTA have also become an important issue. Mexico, as a country with fewer resources for environmental control, faced serious problems as a result of rapid industrialisation caused by the agreement. Although NAFTA included certain environmental standards, the reality was often far from ideal. For example, numerous factories operating on the southern border emitted toxic substances into the atmosphere and water, violating environmental regulations, which caused significant environmental pollution. At the same time, in Canada and the USA, where there are more developed environmental regulations, NAFTA stimulated environmental innovations and technologies, but these positive changes were not significant enough to compensate for the negative impact on the nature of Mexico. It was noted that the lack of an effective mechanism for implementing environmental standards at the level of all three countries led to insufficient responsibility for environmental pollution.

The transition from NAFTA to USMCA has been an important milestone in strengthening environmental regulation in North America. The new agreement has integrated environmental standards into its legally binding provisions, which affect trade and production in the USA, Canada and Mexico. In particular, Chapter 24 of USMCA covers key aspects such as the protection of marine ecosystems, the fight against illegal logging and timber trade, and the commitment of countries to maintain high environmental standards, without weakening them for the sake of gaining competitive advantages. For the USA, the agreement has become an impetus for strengthening domestic environmental legislation and investing in renewable energy. The requirements of USMCA have stimulated the introduction of policies to reduce greenhouse gas emissions in industry and

transport. Canada, for its part, has not only reaffirmed its commitment to high environmental standards but has also initiated new programs to conserve natural resources and combat plastic waste. Mexico, despite significant challenges, has also begun to implement projects to reduce methane emissions and address the problems of deforestation, although the pace of change remains slow due to institutional difficulties.

At the same time, monitoring mechanisms have been introduced within USMCA, which allow countries to monitor compliance with environmental regulations and apply sanctions to violators. These tools ensure transparency and accountability in the implementation of the environmental provisions of the agreement. Particular attention is paid to cooperation in energy transformation: the USA and Canada are actively developing renewable energy, while for Mexico this process is complicated by dependence on traditional energy sources. Despite these achievements, some aspects of the agreement are criticised for insufficient ambition in the context of the global fight against climate change. For example, the agreement does not provide clear mechanisms for adapting to the Paris Agreement, although it obliges the participating countries to comply with their domestic environmental laws.

Legal conflicts between the participating countries of NAFTA have also become part of the integration. One of the biggest examples is the dispute between the USA and Canada, which arose in 2000 when the USA decided to apply anti-dumping measures against Canadian steel exports. This led to a lengthy legal process within NAFTA, as a result of which the USA was forced to lift restrictions on steel imports from Canada. This conflict underscores the importance and limitations of the legal mechanisms in place under the agreement, as while the dispute resolution system was effective, the processes could be very lengthy and complex. Another example concerns disputes between the USA and Mexico in the agricultural sector. Mexico suffered significant losses due to the USA's subsidies on agricultural products, particularly corn. Mexican farmers could not compete with cheaper American goods, which led to losses for local producers. However, thanks to the NAFTA mechanisms, Mexico was able to appeal to the trade court, although the outcome did not always meet its expectations.

Therefore, NAFTA has significantly affected the social, environmental and legal aspects of the participating countries. On the one hand, the agreement contributed to economic growth, job creation and the development of new industries. On the other hand, it led to increased social inequality, caused environmental problems and revealed shortcomings in the legal mechanisms for resolving disputes. As a result, although integration brought positive economic results, it also provided important lessons for further regional cooperation processes, such as USMCA, in which it is important to take these challenges into account.

The development of USMCA, which replaced NAFTA, has the potential to improve these aspects, taking into account the experience of previous years, and will contribute to a more stable and fair integration in the future.

## Discussion

The results of the study provide a deeper understanding of the impact of regional economic integration on the economies of the USA, Canada and Mexico, as well as an assessment of the changes that have occurred since the transition from NAFTA to USMCA. This section discusses the key aspects of the impact of these agreements, in particular their economic, social and environmental consequences. One of the main conclusions is that NAFTA, signed in 1994, significantly contributed to strengthening economic ties between the three countries. The analysis of statistical data demonstrates a significant increase in trade between the USA, Canada and Mexico during the first 20 years after the agreement came into force. However, the benefits from the agreement were unevenly distributed: the US economy received significant advantages due to access to cheaper resources and labour, while in Mexico exports grew, but at the same time, economic dependence on the USA increased.

The transition to USMCA in 2020 reflected the need to modernise the previous agreement in light of changes in the global economy. The analysis of the provisions of the new agreement indicates the strengthening of regulatory requirements in the areas of labour and environment, in particular the introduction of stricter standards for the automotive industry and working conditions. This is an important step forward, especially for Mexico, where labour rights and environmental standards have long been ignored. However, the implementation of these changes requires significant resources and can be difficult for local businesses. J.G. Vargas-Hernández *et al.* (2019) studied the economic consequences of NAFTA for small and medium-sized enterprises in the USA, Canada and Mexico. They found that for the USA and Canada, there are significant benefits in reducing production costs and increasing export potential. N.S. Khan (2020) found that for Mexico the results were less clear-cut: although exports increased, many Mexican enterprises faced difficulties due to greater dependence on the American market. The current results confirm the authors' conclusions regarding economic benefits for the USA and Canada, as well as increased dependence of Mexico on the USA, but also draw attention to social aspects, in particular the deterioration of working conditions in Mexico, which the authors did not emphasise in their studies.

Changes in the rules of origin of goods and the increase in the local production component in the automotive industry had a complex effect. On the one hand, this contributed to the growth of employment in the manufacturing sectors of the USA and Canada, but on

the other hand, the increase in costs for manufacturers could lead to an increase in final prices for products. It is noted that this also had a slight negative impact on the competitiveness of the region in the international market due to the increase in the cost of goods. A.L. Espino (2024) focused on the study of changes in production chains in the context of the transition from NAFTA to USMCA and noted that the new rules on the origin of goods contributed to the development of production capacity in the USA and Canada, but also increased the cost of products, particularly in the automotive sector. D. Tetreault (2022) noted that the growth of production in the USA caused an increase in the import of raw materials from Mexico, however, restrictions on processing within the country reduced the efficiency of this process. The current results confirm these conclusions, especially regarding increased costs due to changes in the rules of origin of goods, although this study focuses on the social and environmental aspects of these changes.

J.P. Meltzer (2021) explored the impact of USMCA on infrastructure development in the region. He noted that under the agreement, investments in transport and logistics infrastructure increased, especially in the border regions of the USA and Mexico. According to him, this has significantly improved the efficiency of trade, but also created an imbalance, as mainly large hubs are developing, leaving other regions without proper investment. The current results confirm that infrastructure investment is one of the positive consequences of USMCA, but also highlights the negative impact of these changes on the environment and local communities.

Social aspects also deserve special attention. The new provisions of USMCA relating to the protection of labour rights particularly affected Mexico, where minimum wage standards were introduced and trade union activity was strengthened. This has the potential to improve the living standards of workers but creates additional pressure on employers who previously used the benefits of cheap labour. T. Payan (2023) studied changes in labour markets after the signing of the USMCA, particularly in Mexico. He noted that the new labour standards have positively influenced the improvement of conditions for workers, but pointed out that the increase in the minimum wage has created additional pressure on local enterprises, especially in the textile and electronics industries. The current results also confirm that wages have increased in Mexico, but attention has been drawn to the wider context, including social and environmental aspects, whereas the author focused more only on labour issues.

The environmental consequences of regional integration are also important. The USMCA agreement strengthens the countries' commitments to comply with international environmental standards, which has a positive impact on sustainable development. However, the environmental analysis indicates that export-oriented

industries, such as agriculture and manufacturing, still have significant problems with emissions and environmental degradation, especially in Mexico. In their study, N. Laurens *et al.* (2022) focused on the environmental consequences of integration within NAFTA and USMCA. They noted that compared to NAFTA, USMCA includes more stringent environmental requirements, which helps reduce the negative impact on the environment in all three countries. E. Trujillo (2023), in turn, pointed out that Mexico, due to its underdeveloped infrastructure, still has significant difficulties in complying with environmental standards. In the current study, it was also noted that environmental regulations have become stricter after the transition to USMCA, but the focus was on the problems in Mexico regarding pollution, which is associated with export-oriented industries, such as agriculture. Therefore, although the conclusions coincide, the current study focuses more on the problems of the practical application of environmental regulations in Mexico.

It is important to highlight that the modern USMCA agreement takes into account the new trends of the digital economy, including provisions relating to e-commerce and data protection. This significantly opens up new opportunities for small and medium-sized businesses, facilitating their integration into global supply chains. P. Leblond (2022) explored the impact of digitalisation and ecommerce within USMCA, noting that these aspects of the agreement contributed to the development of small and medium-sized businesses in all three countries. He emphasised that companies that actively use the latest technologies and e-commerce receive significantly more opportunities to enter the markets of the USA and Canada. Although the current study did not focus on digitalisation as deeply as in the author's article, his conclusions can be taken into account in the overall analysis as a positive aspect that complements the results on economic growth. In general, the results indicate that economic integration within NAFTA and USMCA has brought both benefits and challenges for the participating countries. The benefits include increased trade volumes, increased employment in certain sectors and improved social standards. At the same time, the uneven distribution of benefits, the increase in costs for compliance with new regulations and the risks of an environmental nature remain key challenges that require further analysis and solutions.

## Conclusions

This study analyses regional economic integration, its forms, stages, legal mechanisms and economic consequences, with a focus on the NAFTA and USMCA agreements. The main objective of integration is to eliminate trade barriers, create common economic spaces and harmonise policies to ensure the efficient use of

resources and the creation of stable economic systems. NAFTA, signed in 1992, was a significant step towards creating one of the world's largest free trade areas, uniting the USA, Canada and Mexico. After it came into force in 1994, the volume of trade between the countries increased significantly. In particular, US exports to Canada increased from USD 43.5 billion in 1994 to USD 91.9 billion in 2019, and to Mexico – from USD 50.8 billion to USD 256.4 billion in the same period. Similarly, imports from Canada grew from USD 31 billion to USD 202.7 billion, and from Mexico – from USD 31 billion to USD 202.7 billion.

The modernisation of NAFTA in 2018 by signing the USMCA was aimed at addressing several challenges. New provisions, such as strengthening the rules of origin of goods (for example, for cars – 75% of components must be produced in the region) and raising labour standards in Mexico, contributed to a more balanced development of integration. In 2022, US exports to USMCA countries increased by 16%, and imports – by 20.5%, which confirms the importance of the partnership, although the trade deficit reached USD 210.6 billion. A comparison of trade over the years 2020-2023 shows a steady growth of exports of goods and services between the member countries of USMCA. At the same time, the USA maintained a trade balance deficit, which indicates the complexity of balancing economic interests between countries. The growth of trade flows, however, emphasises the importance of this partnership for all parties to the agreement.

The aspect of employment has also changed significantly during the implementation of NAFTA and USMCA. New labour standards have been introduced in Mexico, which has had a positive impact on working conditions. This has contributed to improving the level of wages, especially in some areas of production, such as the automotive industry. Environmental changes within USMCA have become an important aspect after the transition from NAFTA. The agreement provides for new environmental standards that oblige the participating countries to adhere to high requirements for environmental protection. Prospects for further research may focus on a more detailed analysis of the impact of USMCA on specific sectors of the economy of each country, in particular on those that have undergone the greatest changes after the modernisation of the agreement. In addition, a promising direction is the study of environmental aspects of the agreement, in particular its effectiveness in reducing the negative impact on the environment.

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## Conflict of interest

None.

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## Становлення та розвиток регіональної економічної інтеграції в Північній Америці (на прикладі NAFTA)

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**Анотація.** Дослідження було зосереджене на аналізі етапів розвитку та формування регіональної економічної інтеграції в Північній Америці. Методологія роботи включала всебічну оцінку еволюції інтеграційних процесів, а також їхнього впливу на економіку, політичні системи та соціальні аспекти держав-учасниць. В дослідженні здійснено аналіз правового регулювання та економічних змін, спричинених інтеграцією США, Канади та Мексики в рамках North American Free Trade Agreement (NAFTA) та її сучасної версії – United States-Mexico-Canada Agreement (USMCA). Акцентувалась увага на різних формах регіональної інтеграції – від створення зон вільної торгівлі до політичних об'єднань. Важливим елементом є правове регулювання процесів інтеграції, узгодження національних законодавств з міжнародними угодами та функціонування наднаціональних органів для забезпечення виконання угод і врегулювання спірних ситуацій. У дослідженні розглянуто економічні та політичні передумови укладання угоди, правові механізми, зокрема в сфері регулювання міжнародної торгівлі, інвестицій, інтелектуальної власності та розв'язання спірних питань. Експорт США до Канади збільшився з 43,5 млрд доларів у 1994 році до 91,9 млрд доларів у 2019 році, а до Мексики – з 50,8 до 256,4 млрд доларів за той самий період. Аналогічно, імпорт з Канади виріс з 31 до 202,7 млрд доларів, а з Мексики – з 31 до 202,7 млрд доларів. Вказано зростання експорту США (від 580 млрд доларів в 2020 році до 860 млрд доларів в 2023); Канади (від 230 до 520 млрд доларів) та Мексики (від 250 до 540 млрд доларів) до USMCA. Практичне значення роботи полягає в можливості використання отриманих результатів для вдосконалення правових механізмів регіональної інтеграції, формулювання економічної та екологічної політики, а також для прийняття рішень у сфері міжнародної торгівлі, інвестицій та трудових стандартів урядами та міжнародними організаціями

**Ключові слова:** регіональна економічна інтеграція; міжнародна торгівля; міжнародні угоди; правове регулювання; North American Free Trade Agreement; United States-Mexico-Canada Agreement



## Restoration of the transport infrastructure of Ukraine in the conditions of war: A comparative analysis of economic models and stabilisation mechanisms

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**Abstract.** The relevance of the study is related to the urgent need to restore the transport infrastructure of Ukraine, which suffered large-scale destruction as a result of the war, taking into account that transport system that plays a key role in ensuring economic stability, logistical continuity and the country's integration into global economic processes. The purpose of the study was to develop a methodological approach that would minimise the level of entropy in transport systems and accelerate the reconstruction process by using elements of a mixed economic model. To achieve the goal and solve the tasks set, a comparative analysis of world models of infrastructure management in crisis recovery was used. The results of the study confirmed the effectiveness of the integration of different approaches to the assessment of economic models, which made it possible to formulate practical recommendations for the restoration of transport infrastructure in crisis conditions. In particular, it was found that the most acceptable model for the restoration of the transport infrastructure of Ukraine is a mixed economic model, which provides a synergistic combination of public and private resources. The study proposed priorities for the reconstruction of key infrastructure nodes that will contribute to the stability of economic processes and improve the orderliness of the transport system. A methodological approach that integrates the best practices of countries with different economic models, adapting them to the specific conditions and needs of Ukraine, has also been developed. The proposed solutions provide a comprehensive approach to infrastructure restoration, taking into account the limited resources and high level of risks. The results obtained are of important practical importance for the development of a state strategy for post-war restoration and infrastructure development of the country, which will reduce costs, optimise the use of resources and increase the speed of implementation of infrastructure projects in the post-war period, ensuring long-term economic stability

**Keywords:** transport system; economic system; infrastructure projects; post-war restoration; infrastructure development models

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## Introduction

The loss or damage of critical transport facilities significantly complicates the supply of goods and services, and also affects the mobility of the population, which in turn leads to economic losses. The restoration of transport infrastructure is one of the main priorities for achieving economic stability and restoring the functioning of key industries in the country. In such conditions, it is necessary to apply modern innovative approaches that will ensure rapid, effective and sustainable development of the transport system. The involvement of international experience, the use of modern technologies and mixed economic models will significantly increase the efficiency of restoration and adaptation to new challenges. Given the strategic importance of transport infrastructure for economic development, the study of this process is important for the formation of optimal policies and strategies for restoration in the context of post-conflict development of the country.

Modern conditions are characterised by a high level of risks. In such conditions, researchers propose to apply centralised management of restoration processes, since it is such approaches that allow to reduce the restoration time (Cherviakov, 2024). T. Charkina *et al.* (2019) in their work focus on the study of transport interchanges as a key element of railway infrastructure. The authors emphasise their role in optimising passenger flows, increasing travel comfort and integrating different modes of transport. They determine that the effectiveness of such nodes depends on rational planning and the implementation of modern technologies. The study demonstrates the importance of international cooperation and harmonisation of standards for creating sustainable and functional hubs. However, the study does not cover the aspects of restoring such nodes in crisis conditions, which is key to our topic, in particular in the context of war and increasing the resilience of Ukraine's transport infrastructure.

Y.C. Xiafei & Y.T. Fujiyama (2022) analyse the impact of transport interchanges on the choice of passenger routes in urban rail transport. The authors concluded that the convenience of transfers significantly affects the routing of passenger flows, increasing the overall efficiency of the system. However, the paper does not consider aspects of transport infrastructure restoration under resource constraints, which is important for our study, in particular for determining strategic approaches to the reconstruction of such nodes in Ukraine. F. Jia *et al.* (2021) investigated the calculation of the capacity of a passenger-oriented metro network. The authors determined that the efficiency of the network depends on the distribution of passenger traffic and the adaptation of the infrastructure to peak loads. Although the study is important for improving transport efficiency, but it does not take into account the specific conditions of infrastructure restoration after significant destruction, which

is key for our study of the transport infrastructure of Ukraine in wartime.

In the international context, it is worth noting studies that assess the impact of different economic models on infrastructure recovery. For example, M. Fedyk (2021) examines the macroeconomic consequences of the COVID-19 pandemic for the global transport system, demonstrating the advantages of mixed economic models. The experience of Sweden and Germany in adapting infrastructure to modern challenges is also valuable for Ukraine, but these countries have stable economic systems that differ significantly from Ukrainian realities. The annexation of Crimea and the war in Donbas have shown the specifics of Ukraine's market economy, where infrastructure projects are heavily dependent on economic support from Western institutions. As researchers T. Luchnikova *et al.* (2023) note, overcoming crisis phenomena in the transport sector is possible only under conditions of strategic investment, while countries with planned economies can use other methods to restore stability. However, the study is limited to the analysis of internal adaptation without sufficient attention to resource coordination models or stabilisation mechanisms on the scale of the national transport system. The study by D. Kotelevets (2022) defines the importance of infrastructure for the development of economic systems, focusing on the relationship between investments in infrastructure facilities and economic growth. The author emphasises the importance of an integrated approach to planning and managing infrastructure projects, but does not sufficiently consider aspects of the restoration of transport infrastructure in times of crisis or war, in particular the integration of stabilisation mechanisms and international experience.

An analysis of the scientific literature demonstrates that, despite a significant number of studies aimed at studying aspects of the development and restoration of transport infrastructure, their results remain fragmentary. Most works focus on general aspects of the development of transport nodes and multimodal systems, but do not sufficiently consider the mechanisms of their restoration in times of war or other crises. Other studies show the advantages of mixed economic models, but do not take into account the specifics of post-conflict restoration, in particular the integration of international standards. To develop a comprehensive strategy for the restoration and development of the transport system of Ukraine, a deeper analysis is needed that would take into account all the key factors affecting the industry. In particular, a comparative analysis of economic models can provide valuable experience for developing an optimal strategy that will contribute to the stable development of Ukraine's transport infrastructure in the face of global challenges. In general, this will allow choosing approaches to reducing the entropy of the system through the adaptation of best practices aimed

at stabilising the infrastructure and improving its functionality, which is critically important for the economic security of Ukraine.

The purpose of this study was to introduce innovative approaches to organising the process of restoring Ukraine's transport infrastructure, focused on integrating the best international practices and stabilisation mechanisms that ensure efficient use of limited resources and increase the system's adaptability to crisis conditions.

## Materials and methods

To achieve the goal of the study, a comprehensive approach was used, combining several stages of work, analysis methods and data sources. The main methodology was the concept of comparative analysis of economic models and stabilisation mechanisms in the restoration of transport infrastructure, adapted to the modern conditions of Ukraine. The study was conducted in three main stages:

*Preparatory stage.* At this stage, scientific sources devoted to the restoration of transport infrastructure in times of crisis were systematised. International scientometric databases (Scopus, Web of Science, JSTOR, Google Scholar) were used to collect materials. The search keywords were: "recovery of transport infrastructure", "economic models of recovery", "mixed economy", "post-conflict infrastructure". The selection was limited to works published from 2018 to 2024.

*Analytical stage.* At this stage, a comparative analysis of economic models for infrastructure restoration was conducted, including:

- ▲ Market models (USA, Great Britain): the main focus is on the use of private capital and decentralised management.

- ▲ Centralised models (China): emphasis on public financing and centralised project management.

- ▲ Mixed models (Germany, France, Ukraine): study of the synergy of public administration with private investments. The assessment was carried out according to the following criteria: speed of project implementation, financial accessibility, compliance with engineering and environmental standards, as well as socio-economic effect.

*Practical stage.* At the final stage, an adapted methodological approach to the restoration of Ukraine's transport infrastructure using elements of the mixed economy was developed. This approach includes recommendations for prioritising projects, attracting international investments, and integrating innovative technologies. To implement the research objectives the comparative analysis method was used to compare different economic models (market, command, mixed) and their approaches to the restoration of transport infrastructure. The analysis was carried out according to key criteria, such as the speed of project implementation, financial sustainability, integration of innovations and

environmental compliance. The content analysis method was used to process and systematise information in scientific publications, reports of international organisations and government documents. Special attention was paid to the assessment of specific mechanisms for the restoration of infrastructure in conditions of limited resources. The system analysis method allowed integrating the results of research on various aspects of transport infrastructure (economic, technical, organisational) into a single methodological base, providing a holistic view of the restoration process as an interconnected set of measures. The generalisation method was used to synthesise the best practices and recommendations identified in the international experience of the restoration of transport infrastructure, which allowed formulating approaches to restoration adapted to Ukrainian conditions. The modeling method was applied to develop a methodological approach to reducing the level of chaos in the transport system through prioritisation of key facilities, optimisation of resources, and implementation of stabilisation mechanisms.

The application of these methods provided a comprehensive analysis and integration of theoretical and practical aspects necessary for the formation of a strategy for the restoration of Ukraine's transport infrastructure. Information for the analysis was obtained from international databases, such as Scopus, Web of Science, JSTOR, reports and documents of Ukrainian government bodies (Ministry of Infrastructure, Ukrzaliznytsia), analytical materials of international organisations (European Commission, UN), data from studies that covered the assessment of damage to Ukraine's transport infrastructure after 2022. The transport systems of countries such as China, the USA, Germany, France, Sweden and Ukraine were studied, with an emphasis on their economic models, approaches to financing and management of infrastructure projects. The main indicators included: project implementation time, volumes of resources involved, efficiency of restoration of critical facilities and the degree of integration of innovative solutions. Particular attention was paid to problems related to the management of limited resources, the implementation of stabilisation mechanisms and the adaptation of international experience to post-conflict conditions.

## Results and Discussion

The war in Ukraine since 2022 has led to large-scale destruction of transport and engineering infrastructure, which is critical for the recovery of the economy. According to Resolution of the Cabinet of Ministers of Ukraine No. 940 (2024) as of December 1, 2023, 1.4 million residential premises were damaged, including 135 thousand individual residential buildings, a significant part of which is located in regions where active hostilities were taking place, such as Donetsk, Luhansk and Kherson regions. As of the end of March

2024, 3,282 educational institutions were damaged, of which 391 were completely destroyed, and in Donetsk region almost all educational institutions were affected. The scale of infrastructure destruction, including damage to 1,675 facilities in 663 healthcare facilities, is unprecedented for modern Europe.

Military conflict significantly increases the level of entropy in the transport infrastructure, the functioning of the infrastructure becomes less orderly, which is manifested in the form of damage to key elements, the complication of logistical routes and the lack of coordination in the recovery processes. For effective management of these processes, special stabilisation mechanisms are required that would allow to reduce recovery times and increase the efficiency of resource use. Firstly, centralised management: for countries with mixed or command economies, centralisation of management of recovery projects helps to establish a clear hierarchy in the coordination process, which contributes to the stability of the transport system. For example, in China, during natural disasters, state authorities quickly mobilise resources for recovery, which allows to reduce the level of disorganisation. Secondly, information monitoring systems: the introduction of digital platforms for monitoring the condition of transport facilities and their damage helps to ensure clear control over the recovery process. In Germany, such a system is used to manage road infrastructure in real time. Third, prioritisation of critical nodes: focusing efforts on the reconstruction of the most important transport nodes for the economy (transport hubs) allows for faster restoration of logistical connections and ensuring economic stability.

The destruction of key infrastructure elements significantly complicates logistics and coordination of restoration work, creating chaos and reducing the efficiency of the transport system. According to preliminary estimates, 25.4 thousand kilometers of roads and 344 bridges were damaged as a result of the fighting. A significant part of the destruction falls on the regions where active fighting took place: Donetsk, Luhansk, Kherson and Zaporizhia regions, which together account for more than 70% of the total damage to the infrastructure. The destruction of the railway infrastructure is also critical: 2862 objects were damaged, and 2891 were destroyed (Resolution of the Cabinet of Ministers of Ukraine No. 940, 2024). Centralised management of recovery processes is important, since in conditions of high risk, such approaches allow for a reduction in recovery times (Chervyakova, 2024). Analysis of damage to the transport sector raises concerns about the limited financial resources available for project implementation (Galushko, 2017; Martseniuk *et al.*, 2021; Shevchenko & Ivashchenko, 2024). Another pressing issue is the integration of international standards, which is one of the main aspects of the country's post-war economic recovery. Transport infrastructure development can be carried out according to several

models: anticipatory, synchronised, catch-up, and combined (Puseva, 2023).

For Ukraine, the most acceptable is the combined model, which integrates both state regulation and market mechanisms. In the post-war period, this model will play an important role, as it provides for significant support from international organisations and investors, which is consistent with the approaches characteristic of open economic systems. The aviation sector has also suffered significant losses, which indicates the need for an adaptive economic strategy to support such sectors in market systems oriented towards a competitive environment. In centralised economic models, stabilisation of air transport could be carried out through direct grants or state subsidies, while market models are forced to look for other instruments, such as foreign investment and partnerships (Chornogor *et al.*, 2024). Therefore, comprehensive mechanisms for the restoration of transport infrastructure in general are needed, in particular, synergies between public and private investments, which could be effective for other transport sectors.

Infrastructure stabilisation is possible through the implementation of managed restoration processes aimed at rebuilding critical nodes of the transport system and reducing the level of entropy. This approach allows creating sustainable development centers around which the process of reconstruction of infrastructure facilities is formed. This process concerns not only the transport network, but also the energy infrastructure, where 47% of facilities were destroyed due to rocket attacks (Resolution of the Cabinet of Ministers of Ukraine No. 940, 2024). In general, clear planning and effective allocation of resources to ensure the functioning of the most important elements of the infrastructure will allow to streamline and accelerate the restoration of economic stability in Ukraine.

Compared to countries with more centralised economies, Ukraine demonstrates limited opportunities for rapid infrastructure reconstruction due to high levels of privatisation and limited state control. Countries such as China or the former Soviet republics can often mobilise significant state resources for strategic reconstruction, while Ukraine faces labor outflows, falling investments, and high defense spending. This situation requires the development of an effective strategy for the reconstruction of transport infrastructure that takes into account limited resources and a high level of destruction. One promising tool for this is the public-private partnership (PPP), which has demonstrated high efficiency in implementing large-scale infrastructure projects in different countries around the world. Comparing PPP models in market, mixed, and centralised economies allows us to identify best practices that can be adapted to the needs of Ukraine. Important aspects of such an analysis are investment incentives, risk sharing between the state and the private sector, and the vector for economic development, which is

especially important for countries with post-conflict challenges, such as Ukraine.

By its nature, PPPs are an important mechanism for attracting private capital for infrastructure development in conditions of limited public resources. PPPs have their own characteristics and effectiveness in different economic systems (Table 1). For example, in the USA, a predominantly market economy, infrastructure projects are financed by private capital through concessions, and their share of implementation is from 1% to 3% of total transport infrastructure spending since 1990 (Congressional Budget Office, 2020). About 60% of large transport projects have been implemented thanks to PPPs, in particular, the construction of highways (Virginia I-495 Express Lanes), where the use of tax breaks and government guarantees contributed to attracting more than \$2 billion in investment (United States Department of Transportation (2024). In Canada, the state actively supports RAP in the transport sector through special agencies. The model involves risk sharing: the state assumes initial financing, and private investors

are responsible for operation. As a result, 40% of new infrastructure facilities in the country were built within the framework of RAP, which provided an annual increase in economic activity of 1.2% of GDP (Government of Canada, 2021). In Germany, where a mixed economic model is used, RAP has also proven its effectiveness, especially in road construction. For example, 35% of autobahns were modernised through RAP. The German government actively uses tax incentive mechanisms that reduce investor costs by 15-20% and provide long-term guarantees of profitability. Thanks to this, the growth rate of investment in the transport sector increased by 8% in 2020-2023 (Statista, 2024). China, with China, a centrally planned economy, has a high level of state intervention in the RAP, which focuses on large strategic projects such as high-speed railways. The state finances more than 50% of the project through state-owned banks, which reduces financial risks for the private sector. As a result, China develops more than 60% of its infrastructure through RAP, providing an annual GDP growth of 1.5% (Export-Import Bank of China, 2022).

**Table 1.** Comparison of the experience of PPP in different economic systems

| Country | Economic model | Key features of PPP                      |
|---------|----------------|------------------------------------------|
| USA     | Market         | Tax incentives, concessions              |
| Canada  | Market         | Risk sharing, government support         |
| Germany | Mixed          | Tax incentives, long-term guarantees     |
| China   | Centralised    | State-owned banks, centralised financing |

**Source:** developed by authors based on (OECD, 2023; Asian Development Bank, 2024; Housing, infrastructure and..., 2025)

Based on the analysis of the above models of private-public partnership, it can be argued that their adaptation to the conditions of the Ukrainian economy requires taking into account the high level of risks and limited access to financial resources. In this context, it is advisable to integrate elements of mixed models with the involvement of state guarantees and tax incentives, which can significantly increase the country's investment attractiveness. The introduction of such mechanisms will create conditions for a synergistic combination of public and private sector resources, which will contribute not only to the rapid restoration of transport infrastructure, but also to its sustainable development. The transport infrastructure of Ukraine includes railway and aviation networks, inland waterways, seaports, highways, as well as warehouse and repair facilities and cargo terminals. In 2021, the share of different modes of transport in the total volume of transported goods was distributed as follows: rail transport – 51%, road transport – 32%, water transport – 1%, pipeline transport – 16%, aviation – 0.02% (European Business Association, 2021). To ensure the balanced development of all these modes of transport, a modern and efficient infrastructure is necessary.

The creation, expansion and modernisation of transport infrastructure are necessary conditions for the economic growth of Ukraine. Global trends are

aimed at reducing carbon emissions and switching to more environmentally friendly modes of transport, and Ukraine shares these aspirations. The development of rail and water infrastructure is one of the strategic priorities, which corresponds to the global movement towards sustainable development and decarbonisation. Despite the difficult conditions, rail transport and its infrastructure in Ukraine require constant development. Investments in this sector can contribute to the introduction of high-speed passenger services and increase the efficiency of freight transportation. At the same time, the development of water transport, especially river transport, requires significant state support. The construction of new ports and the expansion of transportation along the Dniester can become an important stimulus for the national economy.

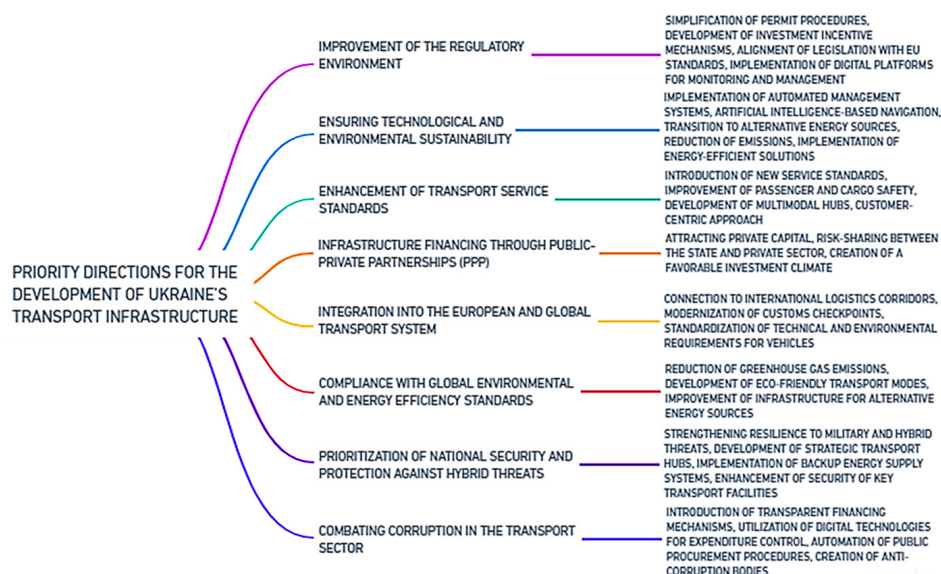
The integration of new technologies is an important aspect of the modernisation of transport infrastructure. The introduction of modern navigation systems and autopilots into vehicles can significantly reduce the number of accidents and increase the overall efficiency of the transport system. This technological evolution reflects global trends towards digitalisation and automation, demonstrating the adaptation of economies to modern challenges. The restoration of transport infrastructure occurs in synergy with other sectors of the economy, such as energy and technology. Combining public and

private investments in transport with investments in energy efficiency and renewable energy sources is necessary for sustainable development and is in line with global economic trends. Despite the ongoing armed conflict, the strategic directions of Ukraine's infrastructure development remain consistent, although achieving the set goals is becoming a more difficult task. Strategic priorities are determined based on the functions performed by transport infrastructure, including:

- ▲ ensuring the basic needs of society;
- ▲ increasing economic productivity;
- ▲ supporting national security;
- ▲ regulating economic processes;

- ▲ stimulating economic activity;
- ▲ social integration and development;
- ▲ development of foreign economic relations.

In defining the main strategic directions, Ukraine should focus on the restoration and development of transport infrastructure to meet domestic needs and meet international standards. This includes adaptation to modern economic challenges and trends, such as environmental sustainability and technological innovation, which are critical for the country's economic stability and growth. The development of transport infrastructure should include the following priority areas (Fig. 1).



**Figure 1.** Priority areas for the development of Ukraine's transport infrastructure

**Source:** developed by the authors based on (Mekh, 2023; Resolution of Cabinet of Ministers of Ukraine No. 940, 2024; European Business Association, 2021)

In the context of global economic trends and their impact on the restoration of Ukraine's transport infrastructure, it is worth considering different models of infrastructure project development and opportunities for attracting international cooperation. Each of the types of economic systems – market, command, mixed, traditional – offers its own approaches to the

implementation of infrastructure projects, which are reflected in the degree of state intervention, levels of private investment and integration with other sectors of the economy. Currently, the development of Ukraine's transport infrastructure is focused on strategic directions that correspond to global trends in greening and digitalization (Table 2).

**Table 2.** Comparative analysis of strategic areas for the development of transport infrastructure in different economic systems

| Strategic directions                                  | Description                                                                                                            | Example of implementation in economic systems                                               |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Development of multimodal transport and interchanges  | Integration of different modes of transport into the logistics system to support international trade                   | In market economies: private capital is used to create interchanges and logistics centers   |
| Expanding international transport corridors           | Improving logistics connections or cross-border trade, which is important for open economies                           | In open economies: the EU is developing the TEN-T network to facilitate transport corridors |
| Attracting investment from public and private sources | Ensuring the sustainable infrastructure development with the support of international financial institutions and funds | In mixed economies: public support for strategic projects together with private investments |

Table 2. Continued

| Strategic directions                                           | Description                                                                            | Example of implementation in economic systems                                                        |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Optimisation of tariff policy                                  | Increasing competitiveness through effective pricing to attract international carriers | In market economies: flexible tariff policy attracts new carriers and investors                      |
| Implementation of information systems and digital technologies | Automation of processes and integration with global digital networks to reduce costs   | In mixed economies: government digitalisation programs supported by private IT companies             |
| Modernisation of border crossing points                        | Increasing capacity and efficiency at borders to facilitate international trade        | In EU countries: financing of border crossing point modernisation through European development funds |

**Source:** developed by the authors based on S. Dominguez-Amarillo & O. Mykhailovska (2024), Y.V. Pichuhina *et al.* (2024), K. Bagatska (2024)

A comparative analysis of global approaches shows that in developed market economies (e.g., the United States, Great Britain), infrastructure projects are mainly financed by private capital, which allows for the rapid implementation of projects. The private sector provides flexibility and adaptation to market conditions, while the state performs a regulatory function, attracting investors through favorable tariffs and concessions. In such economies, the main criteria are financial stability and competitiveness. Command economies (e.g., China) use centralised planning, which provides the ability to quickly mobilise state resources for the development of strategic facilities – high-speed railways and seaports. This approach allows you to concentrate resources on key projects, but limits the participation of the private sector, which can reduce flexibility. In command economies, strategic importance and centralised management are the priority criteria. For Ukraine, which is moving towards integration with the EU, a mixed approach is optimal, combining state support and investments from international organisations and the private sector, in particular in strategic sectors: rail and water transport. Such an approach ensures resilience in responding to economic challenges, adapting the best practices of other economic systems for post-war recovery. For the successful development of transport infrastructure, it is important to apply a comprehensive strategy that takes into account risks and opportunities and is based on detailed analysis. Using the synergy of international investments, modern technologies and best practices will reduce the risks of infrastructure projects and ensure adaptation to global challenges, in particular in the field of environmental sustainability and technological innovation.

Given the numerous global macroeconomic challenges, strategic infrastructure development is becoming even more relevant. Transport infrastructure is a fundamental part of the economic policy of countries, allowing them to maintain competitiveness in the world economy. Modern trends, such as globalisation and digitalisation, stimulate states to optimise transport systems. In their study, H. Seng *et al.* (2019) propose to

include the following in the main models of transport infrastructure development:

#### 1. Market model

In market economies, private capital plays a major role in financing large infrastructure projects, such as the development of ports, airports, highways and multimodal hubs. The USA and the UK are examples of countries where private investment is the main source of financing, and the role of the state is reduced to regulation and stimulation of competition.

#### 2. Command model

Command economies, such as China, use centralised planning and public financing to develop strategically important projects. The central role belongs to state-owned companies, which allows for the implementation of large-scale infrastructure initiatives quickly and purposefully, in particular high-speed railways and ports.

#### 3. Mixed model

Mixed economies (France, Germany, Ukraine) develop infrastructure through a synergy of public and private resources, which provides a balance between flexibility and sustainability. This approach allows the state to finance strategic facilities by involving the private sector in the development of logistics, ports and transport networks. For example, in France, railway and air connections are actively developing through public-private partnerships.

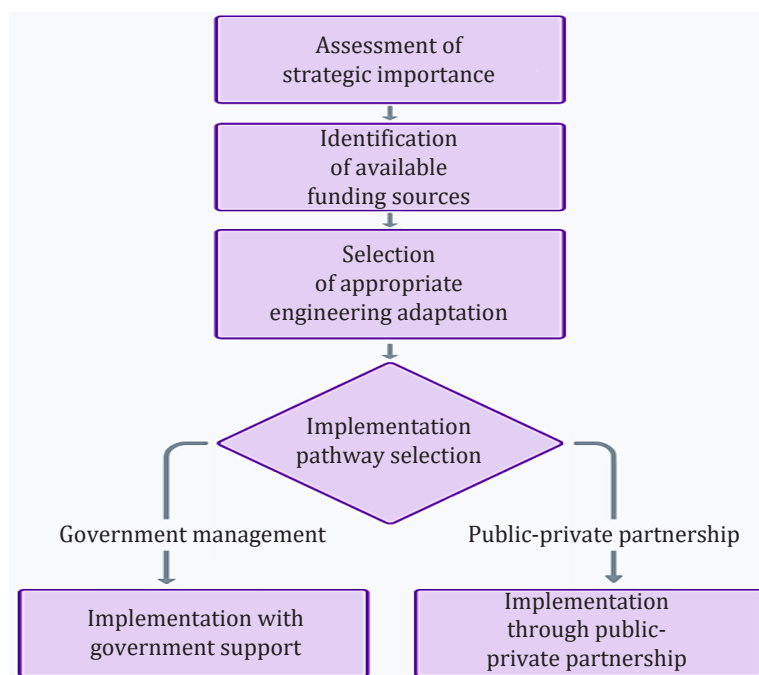
To optimise project selection, it is recommended to consider the following criteria (Pichuhina *et al.*, 2024):

▲ strategic relevance: priority of projects for the restoration of economic activity, especially in combat zones;

▲ financial capabilities: availability of financing from state and international sources;

▲ engineering characteristics: simplification of design to accelerate implementation and ensure the functionality of the infrastructure.

These criteria allow creating a transparent mechanism for making decisions on the selection and prioritisation of infrastructure projects, which is especially relevant in conditions of limited resources and the urgency of restoration work (Fig. 2).



**Figure 2.** Scheme for selection and prioritisation of transport infrastructure projects

Source: developed by the authors

Analysis of transport infrastructure development models indicates differences in approaches inherent in market, command and mixed economic systems (Table 3). Mixed models, similar to the model used in Ukraine, provide high stability by integrating public administration with private capital. This approach

becomes important for the country's post-war recovery, since the involvement of international financial institutions, the adaptation of best practices, as in Germany and France, allows to strengthen the stability and competitiveness of the Ukrainian economy in the context of global challenges.

**Table 3.** Models of transport infrastructure development in different economic systems and stabilisation mechanisms

| Country | Infrastructure development model | Key characteristics                                                            | Examples of projects and stabilisation mechanisms                                                 |
|---------|----------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| USA     | Market                           | Private financing, competition in attracting investors                         | Construction of airports by private companies, implementation of digital monitoring systems       |
| UK      | Market                           | Predomination of private capital, emphasis on competition among investors      | Investments in multimodal hubs, automation of transport processes                                 |
| China   | Command                          | centralised management and rapid mobilisation of public resources              | Development of high-speed railways, centralised management of restoration works                   |
| France  | Mixed                            | Public-private partnership for strategic projects                              | Development of railway connections through a partnership between the state and the private sector |
| Germany | Mixed                            | Integration of public and private resources                                    | Expansion of transport corridors, automation of processes                                         |
| Ukraine | Mixed                            | Public financing of critical facilities, involvement of international partners | Modernisation of border infrastructure, integration of digital monitoring systems                 |

Source: developed by authors based on M.O. Volodovska (2020), H. Unnikrishnan & T.P. Kattukaran (2024), O. Suntsova (2024)

To achieve successful infrastructure restoration in Ukraine, it is recommended to implement a mixed development model, attracting international investments and best practices. The use of criteria of strategic importance, financial accessibility and simplified

engineering solutions will help optimise the restoration process. A comprehensive approach based on global standards will allow Ukraine to reduce infrastructure risks, adapt to new technologies and maintain economic stability in the long term. The article proposes a new

approach to assessing and comparing economic models used for the restoration of transport infrastructure in the context of crisis recovery, with a special focus on the post-war development of the national economy of Ukraine. The innovation of the study lies in the development and implementation of a comprehensive set of criteria that take into account the specific challenges of restoration, in particular, resource constraints, the complexity of process management and the need for international coordination. The study also emphasises the value of mixed economic models that create synergy between public and private resources, increasing the efficiency of infrastructure restoration. These criteria provide a universal basis for prioritising infrastructure projects and ensuring their compliance with post-conflict recovery requirements and conditions. The main criteria include:

1. Speed of project implementation. This criterion determines the ability of the economic model to quickly implement large-scale infrastructure projects, which is a critical factor in crisis conditions.

2. Financial sustainability and availability of resources. It is possible to assess the sources of financing for projects, including public, international and private investments.

3. Engineering and environmental standards. The integration of innovative solutions allows for shorter project duration and lower costs, while meeting modern environmental standards.

4. Socio-economic impact. The contribution of projects to the socio-economic development of the region and their strategic relevance are assessed.

The selected criteria allow for a detailed comparative analysis of economic models, focusing on the advantages and limitations of each model in recovery conditions. The proposed methodological approach has universal significance and can be used to assess and prioritise infrastructure projects in different countries with different economic structures, for example:

- ▲ India is an example of the successful use of private-public partnerships in the transport sector, in particular in the expansion of the railway network and the construction of airports, which contributes to the growth of investment potential and international competitiveness (Unnikrishnan & Kattukaran, 2024).

- ▲ South Korea demonstrates a centralised approach to infrastructure development, integrating digital technologies and safety standards in high-speed rail. This contributes to the innovativeness of projects and ensures high environmental efficiency (Suntsova, 2024).

- ▲ Sweden pays significant attention to environmental standards in water and rail transport, actively developing green technologies and electrified networks, which meets the requirements of sustainable development and can become an example for Ukraine in the context of integration into the European Union (Volodovska, 2020).

The examples of these countries show how it is possible to adapt their economic models to modern challenges, such as globalisation, digitalisation and environmental sustainability. Ukraine can effectively use this experience by developing a post-war recovery strategy that combines the adaptability of market models with the strategic advantage of centralised management to ensure long-term economic stability.

## Conclusions

Restoration of Ukraine's transport infrastructure is a necessary condition for ensuring economic stability and creating a basis for the country's sustainable development. The conducted research allowed us to establish that the most effective approach in modern conditions is to use a mixed model that combines state regulation with private investments. Such a model ensures a rational distribution of financial and material resources, rapid restoration of priority facilities and the introduction of innovative technologies.

The results of the analysis of international experience indicate the feasibility of attracting private-public partnerships for the implementation of large-scale infrastructure projects. In particular, the examples of Germany and Canada demonstrate the effectiveness of combining state guarantees with private investments to achieve high socio-economic results. In addition, the use of digital platforms for monitoring and managing restoration processes allows for transparency and control in the implementation of projects, which is an important factor in conditions of limited resources. It is advisable for Ukraine to adapt these approaches to the realities of the national economy, taking into account the scale of destruction, limited finances and the need to integrate into international standards. The proposed approach involves the creation of a balanced strategy that will contribute to attracting investment, modernising transport infrastructure and ensuring the effectiveness of the country's post-war development.

Further research should focus on the development of mechanisms for private-public partnerships that will contribute to attracting foreign investment. Attention should also be paid to the integration of digital platforms for monitoring the state of infrastructure and managing recovery processes. These aspects are critically important for the effective implementation of infrastructure projects and ensuring Ukraine's competitiveness in the global economic environment.

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## Conflict of interest

The authors declare that no conflict of interest arose in the process of writing this scientific article. All stages

of the study were carried out independently, and the results obtained are objective and were not subject to influence by third parties or organisations.

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# Відновлення транспортної інфраструктури України в умовах війни: порівняльний аналіз економічних моделей та стабілізаційних механізмів

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**Анотація.** Актуальність дослідження зумовлена нагальною потребою у відновленні транспортної інфраструктури України, яка зазнала масштабних руйнувань внаслідок війни, оскільки саме транспортна система відіграє ключову роль у забезпеченні економічної стабільності, логістичної безперервності та інтеграції країни у глобальні економічні процеси. Метою дослідження стала розробка методичного підходу, що дозволить мінімізувати рівень ентропії в транспортних системах та пришвидшити процес відбудови шляхом використання елементів змішаної економічної моделі. Для досягнення мети і вирішення поставлених завдань використано порівняльний аналіз світових моделей управління інфраструктурою в умовах кризового відновлення. Результати дослідження підтвердили ефективність інтеграції різних підходів до оцінки економічних моделей, що дозволило сформулювати практичні рекомендації для відновлення транспортної інфраструктури в кризових умовах. Зокрема, було встановлено, що найбільш прийнятною моделлю для відновлення транспортної інфраструктури України є змішана економічна модель, яка забезпечує синергічне поєднання державних та приватних ресурсів. У рамках дослідження запропоновано пріоритети відбудови ключових вузлів інфраструктури, які сприятимуть стабільності економічних процесів і підвищенню упорядкованості транспортної системи. Також розроблено методичний підхід, що інтегрує найкращі практики країн із різними економічними моделями, адаптуючи їх до специфічних умов і потреб України. Запропоновані рішення забезпечують комплексний підхід до інфраструктурного відновлення, враховуючи обмеженість ресурсів та високий рівень ризиків. Отримані результати мають важливе практичне значення для розробки державної стратегії повоєнного відновлення й розбудови інфраструктури країни, що дозволить знизити витрати, оптимізувати використання ресурсів та підвищити швидкість реалізації інфраструктурних проєктів у післявоєнний період, забезпечуючи довготривалу економічну стабільність.

**Ключові слова:** транспортна система; економічна система; інфраструктурні проєкти; повоєнне відновлення; моделі розвитку інфраструктури



## The impact of cybersecurity and crime on national security

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**Abstract.** The rapid daily growth of cybercrime makes research on this topic extremely relevant. It poses a serious threat to digital infrastructure, citizens' rights and state stability, requiring the development of effective approaches to ensuring national security. The purpose of the article was to study the current state of crime in countries around the world and the impact of various cyber threats on the national security system. The research used the methods of analysis, synthesis, evaluative and situational, comparative, graphical and generalisation. The article showed that the analysis of crime data enables the government and law enforcement agencies to develop effective strategies to combat crime, helps to better understand the problem of crime and take measures to protect the rights and freedoms of every citizen and the security of the entire state. Cybersecurity is a significant priority for Ukraine's national security system. Reliable protection of the national cybersecurity system and counteraction to any cyber threats must be ensured on an ongoing basis and using the practical experience of other leading countries in this crucial issue. The state of crime has a significant impact on the threat to Ukraine's national security and is one of the factors that negatively affects the efficiency of public authorities, the stability of the country's development and the law and order system, and the protection of citizens' rights and. The practical significance of the results obtained is that they contribute to the development of research on the level of crime and cybercrime to ensure an effective level of protection against threats to national and global security, which will be effective only under the conditions of international cooperation of states in the field of combating cybercrime. The findings of the research can be used by the Cyber Police Department and law enforcement officials to prevent crime and implement effective solutions to reduce cybersecurity in Ukraine

**Keywords:** state security; economic development; fraud; personal data; crime prevention

### Introduction

The country's modern information space is constantly under the influence of various risks, among which cybercrime occupies a special place. Cybersecurity is one of the key factors of information security, which is aimed at ensuring the protection of information, confidentiality, integrity and availability of data in the digital environment. However, cybercrime significantly affects

the effectiveness of the implementation of the basic principles of cybersecurity. Such principles of cybersecurity are confidentiality, integrity and availability, which are significantly affected by criminal acts.

There has been a significant increase in cyberattacks aimed at state critical infrastructure, the media, and attacks on information networks, which negatively

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affects the level of national security of Ukraine. The analysis of the scientific literature shows that there are still many unresolved issues on this topic that require scientific research. In 2024, the implementation of malware in emails increased by 349% compared to the previous year worldwide (Department of Cyber Police..., 2024). At the same time, the number of detections of malicious and phishing URLs decreased by 27 % compared to last year. Access to cloud applications posed the greatest risk, as the Attack Surface Risk Management (ASRM) Trend recorded almost 83 billion access attempts (Dovhan *et al.*, 2024).

It is noted by A.N. Poliakov (2021) that Ukraine's international cooperation in the field of cybersecurity is aimed at strengthening the protection of cyberspace. Cyberespionage and cyberterrorism in the economic sphere of the state are no less dangerous, as they are aimed at undermining economic relations and provoking social discontent. Thus, the priority task of forming a modern and effective system of countering cyber threats in the country is a guarantee of ensuring an integral component of Ukraine's national security – information security at the proper level (Kolosovskiy, 2023). The North Atlantic Treaty Organisation (NATO) plays a key role in ensuring cybersecurity as a component of national security, and partnership with it is a priority for Ukraine in its foreign policy activities (Gorlynskyi & Gorlynskyi, 2019).

During the war in Ukraine, fundamentally new cyber threats have emerged that are aimed at national and international security and are divided into external, targeted and internal cyber threats (Kuzmenko *et al.*, 2022). Due to the growth of cyber risks and cyber threats, it is considered necessary to monitor the current state of cybersecurity in Ukraine and analyse measures to protect computer and telecommunications networks from cyber attacks (Vyshnivskiy & Pampukha, 2022). The impact of major cyber threats on information systems highlights the necessity of ensuring reliable and effective financial and economic security in the face of cyber risks (Trzonkowski & Khalina, 2023). To develop an effective cybersecurity counteraction mechanism, international cooperation with leading global countries is proposed to adopt international legal norms that will enhance Ukraine's cybersecurity legislation (Geer *et al.*, 2020; Nikonenko & Khalina, 2024).

Criminal acts such as identity theft and information leakage significantly undermine the principle of confidentiality (Sverdlyk, 2022). Attacks such as phishing or malicious exploitation of software vulnerabilities lead to unauthorised access to sensitive information, which is a violation of this principle. Attacks on databases with personal information of users pose a threat to its confidentiality, as the information obtained can be used for criminal activities with the possibility of obtaining material savings. Crime is spreading significantly in cyberspace and significantly affects the integrity of data

by modifying or damaging it. In the banking and financial sectors, criminals can change personal data contained in public documents, which is a significant risk. Attacks involving the use of malware and program errors aimed at compromising data integrity can change information without the user's knowledge. Attacks can also be aimed at disrupting the availability of information resources, which is a type of criminal activity. As a result of such attacks, users lose access to the necessary resources. In addition, criminals may use ransomware to block access to systems and servers in order to obtain a monetary reward.

Theft of credentials and their use by criminals leads to a breach of the authentication principle. It is unauthorised access to user accounts, the use of stolen passwords and biometric data that is becoming the most common phenomenon among cybercriminals. The article was devoted to the numerous problems of crime prevention that have reached a new level, and the threats facing society have been rethought.

## Materials and methods

The methodology of the study was based on the use of such methods of analysis as the evaluative and situational method, which analysed crime statistics in different countries of the world obtained from open sources and identifies the highest and lowest indicators; the graphical method was important for visualising the results of the study of crime rates in countries of the world and for better perception of information presented in the form of graphs and tables; the method of generalisation was used to formulate conclusions, fulfil the task and achieve the goal in this work.

The article analysed national and international cybersecurity legislation, its effectiveness and application. Particular attention was paid to the global crime trends in countries and the consequences that occur and affect the country's security. Crime indices in the countries of the world and the factors that affected their growth were presented. The European Union Directive on Network and Information Security (NIS2) and the operation of the domain name system DNS (The European Union Directive on Network..., 2022), the Convention on Cybercrime (2005), which is the first international treaty aimed at combating Internet crime and cybercrime are being studied. As part of the research methodology, an analysis was conducted of Ukraine's legislative acts in the field of cybersecurity, including the Law of Ukraine No. 2163-VIII (2017), which established the legal framework for the functioning of the state cybersecurity system and defines its fundamental principles. Additional regulatory act was also reviewed, such as the Decree of the President of Ukraine No. 447/2021 (2021). This analysis enabled an evaluation of Ukraine's regulatory framework in the cybersecurity domain and its alignment with international standards.

The study used widely recognised ratings, in particular: Global Cybersecurity Index (GCI), Global Cybersecurity Outlook, Cyber Europe, U.S. Cyber Command, National Cyber Security Index (NCSI), Crime and Safety Indexes from Numbeo, The National Cyber League and others. First, the above rankings were analysed, and then graphs were created for better data visualisation. The authors also searched for and analysed previous studies on the topic. The conclusions and prospects for further research were drawn.

## Results and Discussion

Issues related to international cooperation in the field of cybersecurity and countering cybercrime have been studied by scholars V. Bykov *et al.* (2019) and V. Savchenko & O. Maklyuk (2024). Author A. Poliakov (2021) in his work, studied the issues of cybersecurity protection and cooperation between Ukraine and NATO (2021). The study of important mechanisms for ensuring cybersecurity was considered by scientists O. Khalina & Y. Sydorenko (2023), as well as V. Emelianov & H. Bondar (2019). With the development of information technologies, it is necessary to create a reliable international cybersecurity system that will become an effective and efficient legal mechanism in the fight against cybercrime. It is proposed to involve international cooperation in cyber defence, which will allow the ratification of international treaties and regulations in the field of cybersecurity into the national legislation of Ukraine (Zhyla, 2023). Other authors have studied issues related to financial and economic security in the field of cybersecurity (Trzonkowski *et al.*, 2023).

Ukraine, along with European countries, is implementing a number of laws that regulate cybercrime in the country. One of these documents is the European Union Directive on Network and Information Security (NIS2), which aims to establish security requirements in the digital ecosystem and create cybersecurity measures (The European Union Directive on Network..., 2022). The Convention on Cybercrime, which is the first international treaty to combat cybercrime, stipulates the importance of cooperation between states and private enterprises in the use and development of information technology to combat cybercrime (Convention on Cybercrime, 2005). The Law of Ukraine No. 2163-VIII (2017) establishes that all essential conditions, directions, and principles of state policy in cybersecurity are implemented in cyberspace to safeguard the vital interests of individuals, citizens, society, and the state, as well as the national interests of Ukraine. Ensuring cybersecurity is a priority in the national security system of Ukraine. This priority will be implemented by strengthening the capabilities of the national cybersecurity system to counter cyber threats in the modern security environment (Decree of the President of Ukraine No. 447/2021, 2021).

An analysis of the published scientific works of these experts showed that ensuring cybersecurity for Ukraine is an important and priority area of international activity that will strengthen the state of cybersecurity in Ukraine country (Cybersecurity: Global trends..., 2011; Kuzmenko *et al.*, 2022). Scientists have confirmed that the development of partnerships in the field of cybersecurity, the development of joint measures, legislation and mechanisms of international cooperation will become a priority in protecting the information cyberspace of Ukraine and all countries of the world. According to Ukraine's cyber police, since 2018, the attackers have targeted the world's most powerful companies in France, Norway, Germany, the Netherlands, Canada and the United States. The offenders used self-developed malware, including several ransomware viruses, to carry out the hacking attacks. The Joint Investigation Team (JIT) was set up, which included colleagues from Europol (the EU law enforcement agency for combating international organised crime) and Eurojust (the agency that coordinates the EU judiciary).

The attackers hacked into user accounts using information from open sources and social engineering techniques. The hackers used the accounts to spread malicious software code, access servers and steal information from them. During the investigation, it was established that over several years of criminal activity, the criminals encrypted more than 1, 000 servers of global enterprises and caused losses of more than UAH 3 billion in national currency. Subsequently, the police, together with their foreign colleagues, found crypto assets worth more than UAH 24 million in equivalent, apartments, houses, nine luxury cars and 24 land plots with a total area of almost 12 hectares belonging to members of the hacker group. At the request of the investigation, the court seized the relevant property (Department of Cyber Police..., 2024).

The social conditionality of crime in the world is explained by the fact that it is created by society and has social consequences. Crime is a special type of social behavior of certain categories of the population that oppose the interests of society and create their own individual manifestations, which thereby cause harm and problems to state institutions, law enforcement agencies, certain categories of the population, disrupting the normal existence of society. Crime is a historical phenomenon and is a threat to the country. Interestingly, the nature of crime can change dramatically with the development of society. Changes in the legislation regulating the level of crime in the country change the types and consequences of crimes.

Ukraine's legal framework for cybersecurity is based on both international commitments and national legislation. The country has adopted several laws regulating cybersecurity, forming its national legal foundation in this area. This framework includes legislation on state secrets, personal data protection, the

Security Service of Ukraine, and information security, among others. The Law of Ukraine No. 2163-VIII (2017) defines the legal and organisational foundations for protecting national interests in cyberspace, as well as the key directions and principles of state cybersecurity policy. According to Article 106 of the Constitution of Ukraine, the President plays a crucial role in ensuring national security, including cybersecurity. Additionally, Ukraine's Cybersecurity Strategy identifies various cyber threats and assigns responsibility for addressing them to the relevant government agencies.

For the first time, the Cybersecurity Strategy of Ukraine developed a system of cybersecurity status identifiers that will identify and indicate the state of threats to the critical infrastructure of state information resources and the compliance of their protection. The Cybersecurity Strategy of Ukraine has developed relevant models of cyber troops and cybersecurity event monitoring and management systems (SIEM) (Order of the Cabinet of Ministers of Ukraine No. 1163-r, 2023). The European Union, the United Nations, the OSCE, Interpol and other international organisations play a special role in creating international efforts and building fruitful cooperation in the fight against cybercrime.

Cybersecurity is a key priority in the EU's long-term budget for 2021-2027. Through the Digital Europe program, the EU aims to support cybersecurity research, innovation, infrastructure development, cyber defense, and the growth of the European cybersecurity industry. Discussions are currently underway on the draft UN Convention against Cybercrime, approved on 8 August 2024, which raises issues of human rights protection, international cooperation, information and communication technology security, and more. The OSCE is actively working to combat cybersecurity threats and challenges, constantly adapting to such threats as terrorism, organised crime, and cybercrime. In accordance with OSCE Resolution 1202, member states invest in defence cyber capabilities, conduct trainings and activities to improve cybersecurity between states, deepen international cooperation, and create conditions for effective response to cybersecurity events and crises. The Department of International Cooperation, which is responsible for the activities of Interpol's National Central Bureau and ensuring compliance with international standards in the field of criminal policing and combating cybercrime, is also working hard to prevent threats and ensure an adequate level of security at the global level.

Ukraine's cooperation with the world's leading countries in the field of cybersecurity is based on cooperation in countering cyber threats and cyber attacks, implementing cybersecurity standards, and exchanging experience in the functioning of national cybersecurity systems. Ukraine has adopted a number of national standards in the field of cybersecurity and information protection, combined with international standards such as Order of the Ukrainian Research and Training Centre

for Standardisation Problems No. 210 (2023), biometric information protection, privacy, security and data protection assessment, information technology, risk management, etc. To create a reliable cybersecurity system, Ukraine has fruitful cooperation with the United States, the United Kingdom, Germany, Israel, and France. Ukraine's international cooperation, gaining experience in legal support in the field of cybersecurity, and improving the current legislation are a priority for improving the effectiveness of the national cybersecurity system.

The most advanced cybersecurity system is created in the United States, which has also developed security standards (NIST Cybersecurity Framework) and international standards for information security (DSTU ISO/IEC 27001:2022, 2023). The National Institute of Standards and Technology has developed the PCI DSS and ISO 2700 security standards, which are used worldwide and are effective in detecting and preventing cyber incidents. The NIST cybersecurity system is based on the main approaches to information security (IS). Germany has adopted a significant number of cybersecurity regulations that provide for liability for cybersecurity offences. In France, the basic regulatory act defining strategic directions in the field of security are the White Paper on Defence and National Security, which was implemented in 2013, and the National Digital Security Strategy of 2015. Ukraine has created a standard – the General Data Protection Regulation (GDPR) of the European Union, which regulates the protection of personal data in the territory of member states (Regulation of the European Parliament..., 2016). Within the EU and in countries such as the United Kingdom, Australia and the United States, the ISO/IEC 27001 standard is in place, requiring organisations to establish, implement, maintain and continuously improve an information security management system (European Union Agency..., n.d.).

Since January 2024, the European Union has had new cybersecurity regulations in place that define measures to improve the security of institutions, organisations and agencies. They establish internal management rules for cybersecurity risks, management and control for each EU entity, and provide for monitoring of their implementation (Cyber Europe, 2024). The most common types of cybercrime are cyberattacking, which cybercriminals and hackers use to gain access to a computer network to steal or destroy private information. Cybercriminals also often use malicious software, including ransomware, spyware, Trojans, worms and rootkits, phishing, vishing, account attacks, and more. Considering international cooperation to strengthen cybersecurity around the world, the United States has established a partnership with the EU in the field of cybersecurity and cyberspace, developed a joint Cybersecurity Action Plan of the US Department of Homeland Security and the Department of Public Safety Canada, the US-Estonia Partnership for Cybersecurity and Internet Freedom, and more (Statement

of Anthony J. Cotton..., 2024).

One of the key organisations regulating cyberspace in the European Union is the European Network and Information Security Agency (ENISA), founded in 2004. ENISA has enhanced network and information security across the EU and fostered a strong cybersecurity culture. Its efforts have contributed to safeguarding citizens, consumers, businesses, and public organisations throughout the European Union. NATO operates the Cyber Defense Committee, the NATO Cyber Defense Center of Excellence (CCDCOE) and the NATO Cooperative Cyber Defense Center of Excellence (The NATO Cooperative..., n.d). The International Cyber Security Alliance (ICSPA), INTERPOL, and the International Multilateral Partnership Against Cyber Threats (IMPACT) were also established. In the United States of America, the National Security Agency is responsible for cybersecurity (Fedchenko, 2018). States are increasingly paying attention to the development and protection of their own information resources, as well as the ability to influence the information resources of other countries.

International cooperation focuses on developing effective strategies to combat cyber threats, prevent cybercrime, and restrict the use of cyberspace for illegal activities (Poliakov, 2021). Considering the Euro-

pean Union's experience in enhancing cybersecurity mechanisms across member states, Ukraine should actively engage in these security processes. On one hand, Ukraine's participation aligns with its integration ambitions and contributes to strengthening the country's international reputation. On the other hand, it plays a crucial role in shaping the organisational and legal framework for national cybersecurity (Kyva, 2022). To effectively counter cyber threats, it is essential to establish a robust defense system against both current and potential risks by employing highly skilled professionals and utilising advanced software solutions.

According to research, the largest number of crimes as of the beginning of 2023 was committed in Venezuela, Papua New Guinea, and South Africa. Ukraine ranked 57<sup>th</sup> in the ranking of 136 countries with 47.42 crimes per 100 thousand inhabitants. The United States ranked 56<sup>th</sup> with 47.8 crimes per 100 thousand people (The Independent, 2024). When examining the Top 10 countries with the highest crime rates in the world in 2022, it should be noted that Venezuela took the first place. Here, there are 83.76 crimes per 100 thousand people (Table 1).

Comparing the crime index in the world in 2023, the highest level remains in Venezuela, Papua New Guinea,

**Table 1.** Countries with the highest crime rates in the world

| No | Country             | Number of crimes per 100 thousand people |
|----|---------------------|------------------------------------------|
| 1  | Venezuela           | 83.76                                    |
| 2  | Papua New Guinea    | 80.79                                    |
| 3  | South Africa        | 76.86                                    |
| 4  | Afghanistan         | 76.31                                    |
| 5  | Honduras            | 74.54                                    |
| 6  | Trinidad and Tobago | 71.63                                    |
| 7  | Guyana              | 68.74                                    |
| 8  | El Salvador         | 67.79                                    |
| 9  | Brazil              | 67.49                                    |
| 10 | Jamaica             | 67.42                                    |
| 56 | United States       | 47.8                                     |
| 57 | Ukraine             | 47.42                                    |

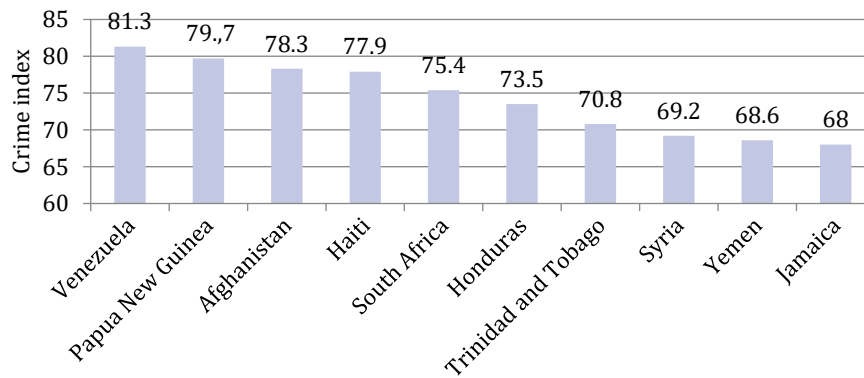
**Source:** compiled by the authors according to The Independent (2024)

Afghanistan, and other countries, although it has slightly decreased compared to 2022. Syria, Jamaica, and Yemen have the lowest crime rates among the countries in this index (Fig. 1). This situation in the countries indicates a high level of crime, which has a significant impact on the life of the population, its security, development and protection from possible threats. Of particular concern is Venezuela, where murders, torture, violence and disappearances are common, as well as high levels of poverty and unemployment. The countries with the lowest crime index in the world in 2023 include: Andor-

ra, the United Arab Emirates, Qatar, Taiwan, Oman, and others (Fig. 2). These countries have effective law enforcement agencies, strict gun laws, and a high level of economic development and protection of human rights. They are also among the safest countries in the world.

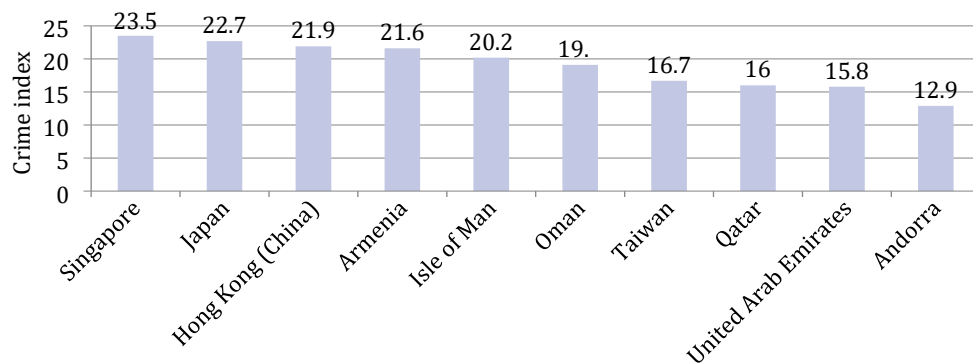
The global trend in crime analysis for 2022-2023 is interesting (Fig. 3). The lowest crime rates, according to the 2023 ranking, are in Japan (22.7), China (24.9) and Poland (30.5).

A high level of poverty and unemployment often leads to an increase in a country's crime rate. Converse-



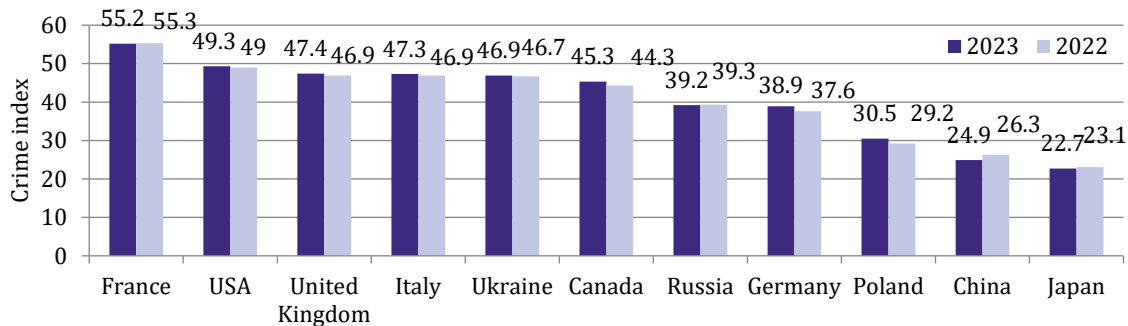
**Figure 1.** The highest crime index in the world in 2023

Source: compiled by the authors according to The Independent (2024)



**Figure 2.** The lowest crime index in the world in 2023

Source: compiled by the authors according to Global Cybersecurity Outlook (2024)



**Figure 3.** Comparison of crime rates in countries around the world in 2022-2023

Source: compiled by the authors according to Global Cybersecurity Outlook (2024)

ly, strict law enforcement and severe penalties tend to reduce criminal activity. There is a strong correlation between age and crime, with most offenses, particularly violent ones, being committed by individuals between the ages of 20 and 30. In the United States, the overall crime rate is 47.70. While violent crime has declined significantly over the past 25 years, its prevalence varies greatly across states. Alaska, New Mexico, and Tennessee have notably higher violent crime rates compared to Maine, New Hampshire, and Vermont. Globally, the lowest crime rates are observed in Switzerland, Denmark, Norway, Japan, and New Zealand.

These countries have highly effective law enforcement, and Denmark, Norway, and Japan enforce some of the world's strictest gun control laws. A 2023 study by the Institute for Economics and Peace identified the safest countries in the world, ranking Iceland, Denmark, Ireland, New Zealand, Austria, Singapore, Portugal, Slovenia, Japan, and Switzerland among the top.

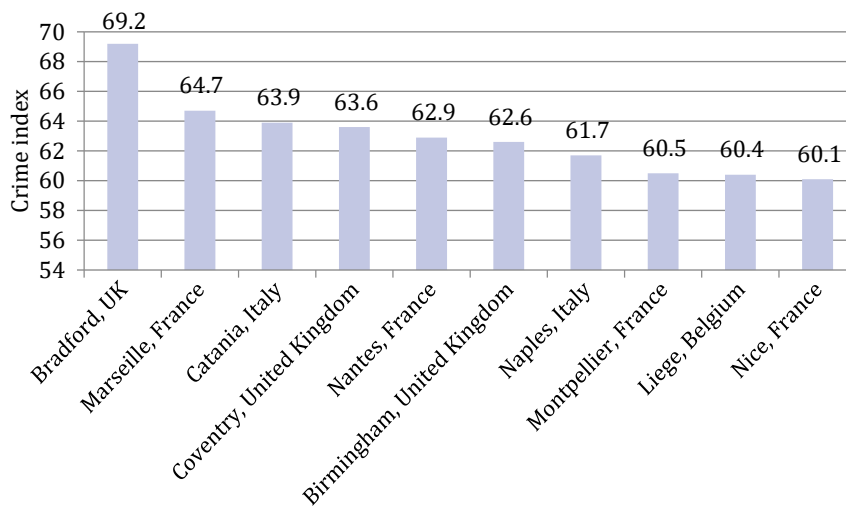
Finland is ranked 13<sup>th</sup> in this ranking, but it is one of the best, happiest and safest places to visit in 2023. Finland also has a low crime and violence rate, the lowest mortality rate, and a reduced risk of natural disasters among the Scandinavian countries, making it the

best place to travel. In addition, Finland is the country with the highest level of joy and happiness in the world. The indicators used to measure this indicator are: gross domestic product per capita, level of freedom, healthy life expectancy, social support, generosity, and corruption. Ukraine was ranked 157<sup>th</sup> out of 163 in this rating, down 14 positions. The Democratic Republic of Congo is ranked 159<sup>th</sup>, South Sudan 160<sup>th</sup>, Syria 161<sup>st</sup>, Yemen 162<sup>nd</sup>, and Afghanistan 163<sup>rd</sup>. The most dangerous countries to visit in 2024 are South Sudan, Afghanistan, Syria, Libya, and Somalia. These countries include Ukraine (The Independent, 2024).

According to Eurostat, the crime rate in Ukraine is generally higher than in most European countries. The most common crimes in Ukraine are theft, fraud, bribery, and hooliganism. The murder rate in Ukraine

is also higher than in most European countries. The factors that influence the crime rate include low economic development, social inequality, ineffective law enforcement and lack of trust in the government. The study of crime in some European cities in 2023, conducted by Numbeo (Numbeo..., 2023). The most dangerous cities in Europe were Bradford (UK), Marseille (France), Catania (Italy), Nantes (France), Birmingham (UK), and others (Fig. 4). The Swiss city of Bern was recognised as the safest city in Europe, followed by Munich (Germany) and The Hague (Netherlands), which took third place, tied with another city in Switzerland – Zurich (Numbeo..., 2023). This ranking includes 127 of the most dangerous and safest cities in Europe as of 2023.

In 2023, the efficiency of solving serious and especially serious crimes by police increased (The National



**Figure 4.** Crime index in European cities in 2023

Source: compiled by the authors according to Numbeo... (2023)

Police of Ukraine, 2023). The list of the most dangerous cities in Ukraine in 2023 includes: Dnipro (17<sup>th</sup>), Odesa (20<sup>th</sup>), Kharkiv (35<sup>th</sup>), Kyiv (45<sup>th</sup>), and Lviv (67<sup>th</sup>).

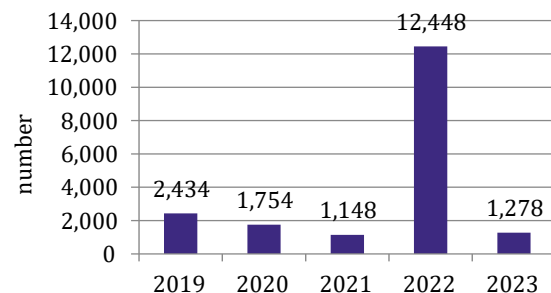
The following indicators were taken into account and included in this rating:

- ▲ general perception of the crime rate;
- ▲ responses from residents and visitors to the city regarding the feeling of safety while walking during the day and at night
- ▲ concerns about specific crimes;
- ▲ assessment of the scale of property crimes and assessment of the perception of violent crimes, including assaults, murders, sexual crimes, etc.

Analysing the number of car thefts by region in 2019-2023, it should be noted that the highest level occurred in 2022, where the number of car thefts amounted to 12448 (Fig. 5). Dnipropetrovska oblast was among the three leaders of the anti-rating for car theft (Dnipro is operational, 2023). 1278 car thefts were recorded in Ukraine in 2023. This is almost 90% less than in 2022, when a record number of car thefts were recorded – 12,448 cars.

For comparison, in 2021, this figure was 1148 stolen cars.

Half of the car thefts in 2023 were in the three frontline regions. For the second year in a row, Donetsk



**Figure 5.** Number of stolen cars in 2019-2023 in Ukraine

Source: compiled by the authors according to Dnipro is operational (2023)

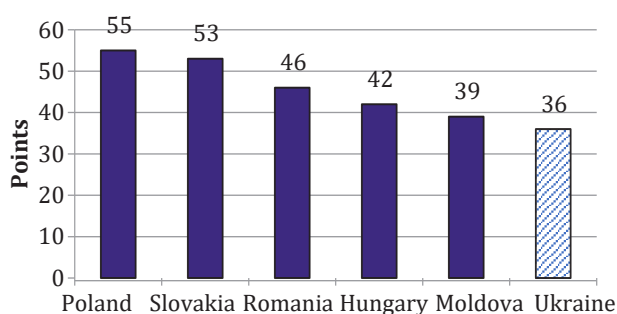
region is the leader with 375 thefts, followed by Kherson region with 178 vehicles. Dnipropetrovs'k region rounds out the bottom three with 168 car thefts.

The most frequently stolen vehicles were cars (59%), trucks (15%), and scooters (less than 1%). The most popular car among car thieves was VAZ – 206 cars (16%) of the total, GAZ – 60 (4.7%), Volkswagen – 46 (3.6%), Renault – 42 (3.3%) and Hyundai – 30 (2.3%). In 2023, the most frequently stolen models were: VAZ 2107, 21063, 2121, 2106, and Daewoo Lanos (Dnipro is operational, 2023).

It should be noted that Italy is recognised as one of the countries in Europe with the highest number of pickpockets, whose victims are tourists. Some experts inform tourists on how to protect themselves from pickpockets in crowded tourist cities such as Rome, Milan, Naples, and other cities when visiting major attractions. Italy topped the anti-rating for several popular tourist attractions that have become real magnets for pickpockets – the Colosseum, Trevi Fountain and Pantheon in the capital Rome. The Duomo di Milano in Milan and the Galleria dell'Uffizi in Florence are also popular targets for pickpockets. France ranked second on the list with all five major attractions, including the Eiffel Tower in Paris. It is followed by the Netherlands and Germany.

The top 10 countries in Europe with the highest number of pickpocketing incidents in 2023 are as follows: Italy, France, the Netherlands, Germany, Greece, Spain, Portugal, Turkey, Ireland, and Poland. The most common crimes in Germany are theft and fraud, in France there are theft and robbery, and in Poland there are theft and fraud. Theft can occur anywhere, and tourist hotspots provide an ideal opportunity for criminals to target travelers' wallets and bags. While visitors are distracted by popular attractions, pickpockets take advantage of the dense crowds to commit their crimes. Another crime indicator is corruption. In 2023, Ukraine ranked 104<sup>th</sup> out of 180 on the Corruption Perceptions Index. This means that Ukraine received 36 out of 100, compared to 2022, which is an increase of three points. To compare Ukraine with other European countries, it should be noted that Ukraine is one of the most corrupt countries (Fig. 6). There are many unresolved issues that need to be addressed.

Thus, the crime rate in Ukraine is higher than in majority of European countries. The structure of crime



**Figure 6.** Level of corruption in European countries and Ukraine in 2023 (points)

Source: compiled by the authors according to Numbeo... (2023)

in Ukraine is similar to that of other Eastern European countries. The crime rate in Ukraine is influenced by various factors, such as the level of economic development, the level of social inequality, the effectiveness of law enforcement and the level of trust in the government. When examining the ITU Global Cybersecurity Index (2024) among European countries, it should be noted that in 2023, Belgium topped the ranking with a score of 95 points, ranking 1<sup>st</sup> in the ranking. Lithuania is in second place (94 points), and Estonia is in third place (93.5 points). They are followed by: Czech Republic (90 points), Germany (85.9 points, 5<sup>th</sup> place), Romania (89 points), Greece (88.5 points), Portugal (88.3 points), United Kingdom (89.1 points), Spain ranked 10<sup>th</sup> (88.5 points), Poland 11<sup>th</sup> (88.2 points). Ukraine was ranked 24<sup>th</sup> (76 points) among 176 countries. After Ukraine became a candidate for EU membership in 2023, the issue of harmonising personal data legislation with European Directives became even more urgent. When processing personal data for law enforcement purposes, there should be a requirement to clearly differentiate and store information on different categories of individuals - suspects, convicts, victims, and other participants in criminal proceedings - in separate databases, as well as to strengthen liability for violations or unauthorised disclosure.

## Conclusions

Thus, effective work to reduce crime requires cooperation between law enforcement agencies, courts and correctional institutions, which must work together to prevent, investigate, punish and rehabilitate crimes. It should also be noted that in order to ensure reliable protection of Ukraine's information space, it is necessary to increase the state's capacity in the security and defense sector to create reliable and strengthen existing measures to avoid possible threats and negative information influences by conducting awareness-raising activities among citizens on cyber hygiene in the information space, protecting personal data from cyber attacks, and effectively responding to internal and external threats to protect the national security of the state. Conducting cybersecurity monitoring with the involvement of international experience and training of highly qualified cybersecurity specialists will help reduce the level of cyber threats to citizens and increase the country's cyber resilience.

It should be emphasised that an effective level of protection of the information space from cyber threats requires the training of highly qualified cybersecurity specialists among managers and employees of enterprises and institutions. This is the only way to ensure that businesses are prepared to meet new challenges and threats arising in the digital environment. Prospects for further research include the analysis of criminal activity related to economic fraud, the use of artificial intelligence technologies to strengthen cyber defence systems, and the deepening of international partnerships with NATO, the European Union, Inter-

pol, the OSCE and other organisations to develop and implement new strategies for protecting national and international cybersecurity systems.

### Conflict of interest

None.

### Acknowledgements

None.

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## Вплив кібербезпеки та злочинності на національну безпеку

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**Анотація.** Стрімке щоденне зростання кіберзлочинності робить дослідження цієї тематики надзвичайно актуальними. Вона становить серйозну загрозу цифровій інфраструктурі, правам громадян та стабільності держави, що вимагає розробки ефективних підходів до забезпечення національної безпеки. Метою статті було дослідження сучасного стану злочинності в країнах світу та впливу різних кіберзагроз на систему національної безпеки. У дослідженні використано методи аналізу, синтезу, оціночно-ситуаційний, порівняльний, графічний та узагальнення. У статті показано, що аналіз даних про злочинність дає можливість уряду та правоохоронним органам розробляти ефективні стратегії боротьби зі злочинністю, допомагає краще зрозуміти проблему злочинності та вжити заходів для захисту прав і свобод кожного громадянина та безпеки всієї держави. Кібербезпека є важливим пріоритетом для системи національної безпеки України. Надійний захист національної системи кібербезпеки та протидія будь-яким кіберзагрозам мають забезпечуватися на постійній основі та з використанням практичного досвіду інших країн-лідерів у цьому надважливому питанні. Стан злочинності має значний вплив на загрози національній безпеці України та є одним із чинників, що негативно впливає на ефективність діяльності органів державної влади, стабільність розвитку країни та системи правопорядку, захист прав і свобод громадян. Практичне значення одержаних результатів полягає в тому, що вони сприяють розвитку досліджень рівня злочинності та кіберзлочинності для забезпечення ефективного рівня захисту від загроз національній та глобальній безпеці, що буде ефективним лише за умови міжнародного співробітництва держав у сфері протидії кіберзлочинності. Результати дослідження можуть бути використані Департаментом кіберполіції та працівниками правоохоронних органів для запобігання злочинності та впровадження ефективних рішень щодо зниження рівня кібербезпеки в Україні

**Ключові слова:** державна безпека; економічний розвиток; шахрайство; персональні дані; запобігання злочинам



## Neutrality in international law: Formation and development of the concept

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**Abstract.** The purpose of the study was to identify the main stages of development of the concept of neutrality to assess its effectiveness in the 21<sup>st</sup> century. The legal analysis of the Hague Convention of 1907 and the Geneva Convention of 1949, the content analysis of Politico, and the analysis of materials in the Digital Encyclopaedia of European History were used. The results of the study demonstrated that the concept of neutrality was formed in the times of ancient Greece and Rome. However, the rapid development of the concept is associated with the wars of the 18<sup>th</sup> and 19<sup>th</sup> centuries, especially the War of Independence and the American Civil War. In 1780, the League of Armed Neutrality was created, and in 1856, the Treaty of Paris was signed, which codified neutrality as a mechanism for ensuring international security. In the 19<sup>th</sup> century, there were also precedents that cemented the importance of neutrality, such as the Alabama Covenants. In 1907, important international conventions were adopted in the Hague, which emphasised the importance of neutrality and the rights of neutral countries in international conflicts. During the First World War, the concept of neutrality was adhered to by the US government. During the 1930s, the United States adopted legislation that regulated trade and economic relations with belligerent states. In the 21<sup>st</sup> century, the concept of neutrality is losing its relevance. Changes in the geopolitical situation, geographical proximity to Russia, which pursues an aggressive policy and does not respect international law, prompted the governments of Sweden and Finland to abandon the principles of neutrality and join the North Atlantic Alliance. The results of the study can be used to improve the international legal mechanisms governing neutrality and to develop foreign policy strategies of states in the current geopolitical environment

**Keywords:** neutrality; sovereignty; international security; international law; war

### Introduction

Neutrality in international law is an important and complex institution, the content of which has been transformed in accordance with the challenges and threats that have arisen at certain stages of historical development. For a long time, neutrality has played an important role in ensuring the security of states that, in accordance with their own national interests, have refrained from participating in international conflicts. The relevance of the study of the problem of neutrality in the 21<sup>st</sup> century is conditioned by several factors. Modern interstate conflicts are taking on new forms that call into question the effectiveness of neutrality as a

means of ensuring national security. Hybrid wars, which should be considered as a type of escalation of conflicts characteristic of the 21<sup>st</sup> century, combine the use of state and non-state, conventional and unconventional strategies, means and methods of subversive activities, cyber warfare mechanisms to achieve certain military, political and, economic goals. Hybrid wars can also be carried out against states that adhere to the principles of neutrality. In some cases, the state may be drawn into a certain conflict, even when it is not directly involved in a military confrontation. As a result, neutral states, as well as states intending to acquire neutral status,

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face the question of the expediency of observing neutrality as an effective means of ensuring their security.

In the modern world, which is characterised by geopolitical and geo-economic instability, the role of universal (United Nations (UN) and regional (primarily, the Organisation for Security and Co-operation in Europe and the North Atlantic Treaty Organisation (NATO)) in maintaining international peace and security is also changing. This, in turn, requires a review of the role and significance of neutrality in this activity. Russia's extremely aggressive policy, which for the first time since the Second World War unleashed a full-fledged war in the centre of Europe, threatening not only Ukraine, but even the leading NATO member states with nuclear weapons, poses a serious security risk to neutral European countries (Moldova, Finland, Sweden).

M. Abbenhuis & I. Tames (2021), studying the specific features of the neutrality policy of the First World War, concludes that until 1917, none of the neutral countries could avoid questions about how neutral countries would participate in international relations after the end of the war. K. Livingston (2024), based on a study of the neutrality policy conducted by the US government during the Second World War, concludes that this policy was relevant during 1939-1940, after which the United States began to adhere to the so-called "qualified neutrality", which allowed providing assistance to states that were victims of German aggression. R. Allison (2022) evaluates the effectiveness of the neutrality policies of Austria and Finland during the Cold War, as well as Moldova and Finland in the 21<sup>st</sup> century. Special attention is paid to the consequences for the concept of neutrality of Russian aggression against Ukraine. As a result, the researcher comes to the conclusion, although the author of the present study cannot agree with it, that if the military and political ambitions of the Russian government are contained, neutrality can be considered as a means of resolving the Russian-Ukrainian conflict.

The features of the concept of neutrality were the subject of research by A.P. Hetman & I.V. Yakovyuk (2020). Thus, researchers pay attention to the more benevolent neutrality of Sweden and Denmark towards Germany, and Norway's neutrality was more focused on Great Britain in 1914. The study by S. Radojević *et al.* (2023) argues that neutrality does not imply a complete abandonment of a country's own armed forces. Thus, Switzerland adheres to the policy of armed neutrality, aspects of which are also implemented by Austria. It is necessary to agree with the opinion of researchers who believe that regardless of changes in international relations, investment in defence and security is essential to ensure the sustainability of neutral states. I. Mudriievska (2023) points to the fact that after prolonged fluctuations, the Swiss government, which has been neutral for almost 500 years, eventually joined the economic sanctions against Russia imposed for its military aggression against Ukraine. J. Heibach (2024)

draws attention to the fact that some governments are actually pursuing a policy of neutrality in the context of a full-scale Russian invasion of Ukraine. For example, Saudi Arabia, whose government, on the one hand, publicly condemned Russian aggression as contrary to the principles and norms of international law, and on the other – refused to join the anti-Russian economic sanctions. Such a dual position, according to the official Riyadh, is conditioned by the national interests of the state.

R. Zajęcki *et al.* (2020) draws attention to the fact that the policy of neutrality can have a positive impact on attracting investment to the state. The phenomenon of neutrality affects the activities of international organisations in a certain way. B. Ucaray-Mangitli (2021) points to the fact that depoliticisation in the activities of international organisations supports their daily activities. I.V. Yakovyuk & E.M. Bilousov (2022), based on an analysis of the positions of modern politicians and researchers, conclude that in recent years, the policy of neutrality as a means of ensuring effective security is rapidly losing its supporters. This conclusion is supported by the position of the governments of Sweden and Finland, which abandoned the traditional policy of neutrality in favour of collective security mechanisms within NATO. Based on the above, the purpose of the study was to consider the development of the concept of neutrality as a means of maintaining national security.

## Materials and methods

In the course of the research, the author used materials from the online platform The Diplomacy, Law, and Policy Forum (Nasu, 2022). To investigate the content of the concept of neutrality of the Middle Ages, an analysis of materials from the Digital Encyclopaedia of European History (Schnakenbourg, 2024) was conducted. Information about the League of Armed Neutrality was collected and analysed from the websites of American Foreign Relations and the Oxford Reference (Armed Neutralities..., 2024; League of Armed Neutrality, 2024). The above-mentioned resources were used to reveal the features of neutrality in the 19<sup>th</sup> century (Treaty of Paris, 1856; Neutrality – The nineteenth century, 2024). The subject of careful analysis was the Declaration Respecting Maritime Law (1856) prior to the Treaty of Paris of 1856. The evolution of the concept of neutrality in the 19<sup>th</sup> century was studied using materials from the Emerging Civil War resource (Chate-lain, 2022) and The Office of the Historian website (The Alabama Claims, 1862-1872, 2024). Materials from official government websites were used to reveal the specifics of Switzerland's neutrality (Politics and History of Switzerland..., 2024).

As part of the study of the development of the concept of neutrality in the 20<sup>th</sup> century, a significant array of acts of international law was processed (Hague Convention (V) Respecting the Rights..., 1907; Convention (XIII) concerning..., 1907; Convention (I) for the

Amelioration of..., 1949; Convention (II) for the Amelioration of..., 1949; Convention (III) relative..., 1949; Convention (IV) relative..., 1949; Geneva Conventions, 1949), and blogue materials from the Peace Research Institute Frankfurt (de Vries, 2022). The subject of the study was also the ratification of the Convention (V) respecting the Rights and Duties of Neutral Powers and Persons in Case of War on Land (1907). In the context of the development of neutrality in the United States, materials from the web portal Digital History and American Foreign Relations (Declaration of Neutrality, 1914; Neutrality Acts of 1930s, 2024; Neutrality – the twentieth century, 2024) and materials from the Office of the Historian (Sama, 2024) were analysed.

Investigating the development of the concept of neutrality in the 21<sup>st</sup> century, the materials presented in the Diplomacy, Law, and Policy Forum were considered. In the context of new challenges and threats, a case study was conducted on the Charter of the United Nations and Statute of the International Court of Justice (1945). A content analysis of the non-partisan organisation Politico (Shkolnikova, 2024) was also used. In addition, in the context of drastic geopolitical changes, changes in the approach to neutrality of some European governments were investigated (NATO member countries, 2024). In addition to the above, a publication from the Federal Department of Foreign Affairs (FDFA) of Switzerland on neutrality was investigated. A publication by Babel further explored aspects of the development of neutrality in Switzerland.

The synthesis method was used to integrate findings from different sources, forming a coherent picture of the evolution of the concept of neutrality. The combination of historical, legal and political perspectives helped to bridge the gaps between different interpretations of neutrality in the Middle Ages, 19<sup>th</sup> and 20<sup>th</sup> centuries and modern days. The method of generalisation helped to draw conclusions about the applicability of the principles of neutrality in modern conflicts, including in cyberspace and outer space. The method of systematisation was crucial for organising and structuring the large number of legal documents, academic sources and case studies considered in the study.

## Results and Discussion

### Development of the concept of neutrality before and during the 19<sup>th</sup> century

The concept of neutrality has its roots in antiquity (Nasu, 2022). E. Corse & M. Cabrera (2023), and U. Serçe (2022) note that the concept of neutrality was not something new even in the time of ancient Greece. The concept was based on the idea that individual states can refrain from participating in military conflicts, and therefore not assume obligations of the parties conducting military operations among themselves. Initially and until the late Middle Ages, the concept of neutrality was not used in a political context.

The situation began to change due to the establishment of the concept of sovereignty (Reginbogin & Lottaz, 2020). International tension, which became a defining feature of the US War of Independence (1775-1783), led to the adoption of the Declaration on the Creation of the First League of Armed Neutrality of naval powers consisting of Austria, Denmark, the Kingdom of both Sicilies, Portugal, Prussia, the Russian and Ottoman empires, and Sweden (1780-1783) (League of Armed Neutrality, 2024). The fact is that the actions of the British Navy regarding the unlimited search for neutral vessels to search for French contraband during the US War of Independence and the Anglo-French War, in contrast to the actions of the American side, repeatedly gave rise to complaints from the Dutch, Danes, Norwegians, Prussians, and Swedes. The creation of the league involved combining the ships of the participating states into convoys and declaring that their cargo was not contraband. Members of the league did not participate in the war, but threatened to jointly avenge each of their ships searched by the warring party.

The league defined new principles of navigation of ships of neutral states, namely: the right of neutral states to trade with warring countries; the preservation of neutral navigation along the coasts of warring countries; the property of subjects on neutral ships had to be free, except in cases where it was classified as smuggling in the sense of the Anglo-Russian Treaty of 1766; military smuggling is recognised as cargo intended directly for conducting military operations (weapons, ammunition); ports are considered blocked if the aggressor state stopped its ships and made access to the port unsafe (Armed Neutralities..., 2024). The United States of America, Spain, and France, which were at war with Britain, declared their commitment to the new principle of free neutral trade, while the British ignored it. Armed neutrality, created within the framework of the league, was the first organised attempt by neutral states to ensure freedom of navigation on the high seas.

The principles of military neutrality developed by the First League were expanded and supplemented during the conclusion of the Russo-Prussian treaty (1800) on the establishment of the Second League or League of the North with the participation of Denmark-Norway, Prussia, Sweden, and Russia (1800-1801). The creation of the second league was also aimed at protecting neutral navigation during military operations. The analysis of the activities of both leagues gives grounds to conclude that armed neutrality in international law in the late 18<sup>th</sup> and early 19<sup>th</sup> centuries meant the declared readiness of a neutral state or group of neutral states to protect their maritime trade from warring states by means of armed force, primarily by escorting neutral merchant ships with warships (Van der Burg, 2021).

One of the sources of neutrality law is customary international law (Nasu, 2020). However, customary law is an unwritten set of certain rules of conduct that,

although necessary to comply with, are not an officially approved pattern of behaviour of governments or other subjects of international law. One of the first attempts to codify certain aspects of the principle of neutrality was made in the Treaty of Paris (1856) and Declaration Respecting Maritime Law (1856), signed as a result of the Crimean War. The treaty was aimed at ensuring the neutrality of the Black Sea, so that its waters were open to merchant ships of any states and simultaneously closed to warships. The treaty stated that a certain uncertainty of the law and obligations during periods of war in the context of the law of the sea can lead to disagreements between neutral and belligerent parties, which can lead to additional conflict situations. The Treaty of Paris had a positive impact on the development of the concept of neutrality (Neff, 2022). The Treaty of Paris had a positive impact on the outcome of the American Civil War, although neither the South nor the North were parties to it (Chatelain, 2022). Therewith, A. Mahmutovic (2023) points out some shortcomings of the Paris Treaty, such as the lack of obligations of neutral parties and the existence of only their rights.

The American Civil War (1861-1865) shook the American government's position on neutrality. The fact is that the Confederation was not declared war, and therefore was not granted the status of a belligerent party (Neutrality – the nineteenth century, 2024). Administration of the president of the United States A. Lincoln viewed its military operations as aimed at suppressing insubordination on the part of the rebels through the use of police means. In view of this, decision by A. Lincoln to blockade of Confederate ports in April 1861 was an exclusively domestic political decision. Despite this, in May 1861, the government of the British Empire declared its status as a neutral party. This, in turn, meant that the Confederation was actually recognised as a belligerent party. As a result, the blockade by the Confederation Ports by the Union will continue to be considered by official London in accordance with the norms and customs of international law (Schnakenbourg, 2024).

During the American Civil War, a number of precedents were set that influenced the development of international law and the concept of neutrality. This refers primarily to the Alabama Claims (1862-1872) – a diplomatic dispute between the governments of the United States and Britain in the context of the Civil War. The reason for the conflict is the conclusion by the Confederation of an agreement with a British shipbuilding company to build warships disguised as merchant ships in order to circumvent the laws of Britain, which declared its neutrality in relation to the American Civil War. One of the most successful vessels was the cruiser Alabama, launched in 1862, which captured 58 northern merchant ships before being sunk in 1864. In addition to Alabama, British shipyards built the cruisers Florida, Georgia, Rappahannock, and Shenandoah for

the Confederate Navy, which together sank more than 150 northern ships and forced much of the U.S. merchant fleet to adopt a foreign registry. This situation provoked a strong reaction from American officials, who raised the issue of London paying compensation for non-compliance with neutrality and assistance in building a fleet for the Confederacy (Slinger, 2023; The Alabama Claims, 1862-1872, 2024).

As for the neutrality of other states, in 1815, during the work of the Congress of Vienna, 4 documents were signed (Act of the Congress of Vienna, appendices to Act of the Congress of Vienna no. 90, Declaration of States on the Affairs of the Helvetic Union, and the Act on the Recognition and Guarantee of the Permanent Neutrality of Switzerland and the Inviolability of its Territory), which created the legal framework for the recognition and implementation of the neutrality of Switzerland, which became the core of foreign policy, prohibiting state intervention in any armed conflicts and joining military-political alliances (Politics and History of Switzerland..., 2024). However, Switzerland took the first steps towards neutrality back in the 16<sup>th</sup> century, when Confederate forces were defeated at the Battle of Marignano (1515) and the following year signed an eternal peace with France, which forced the Confederation to permanently abandon the idea of territorial expansion. However, the end of aggressive wars, according to T.Q. Marabello (2023), did not yet mean the transformation of the state into a neutral one. In fact, the Westphalian peace treaty was an important milestone in the process of turning Switzerland into a permanently neutral state. For the first time in the international arena, Switzerland acted as a neutral state in connection with the post-war settlement of the consequences of the war of the Spanish succession. It was at this stage of state and legal development that the accumulated domestic and foreign policy experience was transformed into a single national concept of neutrality.

Thus, the idea of neutrality was known long before it was fixed in the norms of international law. The original forms of mutual non-interference, which were rather customary in nature, gradually developed into more precise forms, especially in the modern era. Conflicts between European powers in the 18<sup>th</sup> and 19<sup>th</sup> centuries, which led to the creation of the First and Second Armed Neutrality Leagues, contributed to the recognition of neutrality as a way of ensuring national security both at the level of individual governments and the international community. The precedents of the American Civil War have shown the difficulty of observing neutrality by individual states, and demonstrated the harmful consequences of violating it.

### **Development of the concept of neutrality in the 20<sup>th</sup> century**

Favourable conditions for further development of the concept of neutrality developed in the 20<sup>th</sup> century.

During the Hague Conference, initiated by the United States in 1907, the codification of international law (two conventions were signed) regulating relations of sovereignty was carried out. The Hague Convention (V) Respecting the Rights and Duties of Neutral Powers and Persons in Case of War on Land (1907). According to the provisions of the Convention, the territory of neutral states is recognised as inviolable, and therefore, the belligerents may not use them for their own purposes (movement of personnel or ammunition, creation or use of military facilities in the interests of the belligerents). Neutral states were obliged to respect equal

treatment of all parties to the conflict; in addition, they were recognised as having the right to repel attempts on their neutrality, even with the help of armed forces, which did not qualify as a hostile action. The final provisions of the convention emphasised that its rules should be applied only when all belligerents were parties to it, and that it should be ratified as soon as possible (Table 1). The Hague Convention was the first international treaty to regulate neutrality. Although the convention was signed by leading European countries, some of them, unfortunately, did not ratify it (Convention (V) Respecting the Rights..., 1907).

**Table 1.** Signatures and ratifications of the Convention on the Rights and Responsibilities of Neutral States and Persons in Case of War on Land

| Country        | Signature | Ratification |
|----------------|-----------|--------------|
| Finland        | -         | 1918         |
| France         | 1907      | 1910         |
| Germany        | 1907      | 1909         |
| Italy          | 1907      | -            |
| Switzerland    | 1907      | 2010         |
| Sweden         | 1907      | 1909         |
| Spain          | 1907      | 1913         |
| United Kingdom | 1907      | -            |

**Source:** created by the author based on Convention (V) respecting... (1907)

The second codified Act adopted at the conference was the Convention concerning the Rights and Duties of States in Naval War, which defined the position of military vessels of belligerent states in the ports of neutral countries (Convention (XIII) concerning..., 1907; Schmid, 2024). Article 6 of the Convention prohibited the supply of ammunition and any military goods by a neutral state to belligerent states. This Article, although it regulates relations in the event of a naval war, has become a generally accepted norm of international law and has had a positive impact on the development of the concept of neutrality in the 20<sup>th</sup> century (de Vries, 2022).

The First World War was a serious test of the concept of neutrality. President W. Wilson declared U.S. neutrality in military conflict (Declaration of Neutrality, 1914). In his address to Congress, the president expressed concern about the possible violation of neutrality and stressed the need to respect the spirit of impartiality, justice, and friendliness towards all participants in the war (Neutrality – The twentieth century, 2024). Wilson's Declaration demonstrated a commitment to the isolationist tradition of the United States, which provided for the rejection of permanent political alliances with European states and non-interference in European affairs.

The US administration's departure from the policy of neutrality was conditioned by the deepening of the conflict between the United States and Germany, whose government was dissatisfied with supplies to England across the Atlantic, and therefore, decided to declare certain waters around the island a war zone.

In the future, Germany threatened to sink even neutral ships in the designated zone. A landmark event was the sinking of the British liner *Lusitania*, which killed almost 1,200 people, of whom 128 were Americans. This prompted the American government to declare war in April 1917 (Sama, 2024). According to S. Byas (2024), the sinking of *Lusitania* was just an excuse to abandon neutrality. Maintaining neutrality in the context of the Second World War was contrary to the national interests of the United States. In turn, E.D. Tillman (2022) notes that although the U.S. government declared its neutrality in 1914, it has become increasingly interventionist over time to strengthen U.S. trade opportunities in the Caribbean. In this regard, it should be noted that the claim that the principle of neutrality has changed and allows neutral states to discriminate in favour of victims of aggression dates back to the period after the First World War (Clancy, 2023).

The implementation of the concept of neutrality in the United States peaked in the 1930s (Neutrality Acts of 1930s, 2024). The first Neutrality Act was published in 1935. Its provisions imposed a general embargo on the trade in weapons and other military materials with all warring parties. The law also stated that American citizens travelling on ships of warring parties do so at their own risk. The provisions of the law were first applied in 1935 during the war between Italy and Ethiopia. The next Neutrality Act was passed in 1936. Its provisions supplemented the previous law and extended it for another 14 months; in addition, a ban on loans and credits for warring countries was established.

The disadvantage of these laws was that they did not apply to cases of civil war. That is why during the Spanish Civil War (1936-1939), American companies freely sold trucks and oil on credit to Spain. During the Second World War, oil supplies to Spain continued, although there was speculation that this oil was transported further to the Reich.

R. Seltzer (2022) draws attention to the fact that only 19% of Americans wanted changes to the neutrality legislation to allow the supply of weapons to loyalists in Spain. Despite this, in 1937, the Neutrality Act was passed, which did not have a final validity period, and its provisions extended to civil wars (Neutrality Acts of 1930s, 2024). U.S. ships were prohibited from carrying both passengers and goods for warring parties. However, the law contained a provision according to which the president could allow the sale of goods to warring countries in Europe, provided that they organised logistics and paid for the goods in cash. According to the president's entourage, the United States in this case will not be directly involved in a military conflict. However, Japan's invasion of China did not leave the US Congress aside, as isolationists began to argue that the spirit of legality was beginning to erode. In the autumn of 1937, the appeal of T. Roosevelt announced the transition from neutrality to "quarantine" of all aggressors and also imposed an embargo on the supply of American aircraft to the Japanese Air Force.

A radical change in the position of the US government on the issue of neutrality occurred with the beginning of the German invasion of Czechoslovakia, Poland, and the declaration of war between Great Britain and France. In a speech to Congress, President F.D. Roosevelt said that a policy of neutrality could lead to passive assistance to the aggressor (Patel, 2020). Accordingly, the Neutrality Act adopted in the fall of 1939 lifted the embargo on the supply of weapons and other military materials to the countries of the anti-Hitler coalition. The next step was the adoption of the Lend-Lease Act in March 1941 to lease and provide military materials to those parties to military conflict that the US government would like to help (Neutrality Acts of 1930s, 2024).

The next stage in the development of the concept of neutrality was made after the end of the Second World War, when four Geneva Conventions were signed in 1949: Convention (I) for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field (1949); Convention (II) for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea (1949); Convention (III) relative to the Treatment of Prisoners of War (1949); Convention (IV) relative to the Protection of Civil Persons in Time of War (1949). The Protocol Additional to the Geneva Conventions (1977) was published on the protection of victims of international armed conflicts. This was a clear confirmation of the continued codification of international law on the issue of neutrality.

### **Difficulties in implementing the concept of neutrality in the 21<sup>st</sup> century**

The new century has brought significant developments in information and communication technologies, and with-it innovations in international conflicts. As aspects of conflict evolved, the concept of neutrality could be criticised due to the existence of a new concept of cyberspace and aspects of non-international military conflicts. Cyberspace is a mechanism that can create problems for the concept of neutrality. This may be in view of the fact that from time to time there is a need to ensure the best possible observance of neutrality aspects when it comes to the cyber infrastructure of a neutral state. In this context, the location of physical devices such as computers or servers is unimportant, since cyberspace has an intangible structure, and therefore, aspects of the previously studied Hague Conventions are not always applicable in the 21<sup>st</sup> century. A belligerent party can carry out malicious cyber-attacks in such a way that its guilt will not be proven, since cyber activity will be directed through the servers of another, neutral state. In this context, Article 8 of the Hague Convention (1907) is important, which states that a neutral state is not obliged to restrict the use on behalf of belligerents of telegraph or telephone cables or wireless telegraph machines owned by it or companies or individuals. Aspects of cyber threats in the context of neutrality policies are being raised by N. Neuman (2021). The researcher came to the conclusion that in the modern world it is extremely difficult to apply neutrality rights to cyberspace, since there are no relevant international legal provisions and state practice.

It should be accepted that the provisions of the conventions of the early 20<sup>th</sup> century were intended to codify the behaviour of states in international military conflicts. However, in the 21<sup>st</sup> century, such a form as non-international military conflict has become widespread. In addition, in the 21<sup>st</sup> century, there are non-governmental military groups whose assistance may mean direct intervention and departure from neutrality, but it is necessary to fully understand whether providing economic assistance to such groups will be considered acts of departure from neutrality. Against this background, there are some contradictions. For example, if one state provides only humanitarian support to another, but these resources are unfairly distributed, should the helping state stop sending humanitarian aid, because it actually becomes a party helping one of the parties to the conflict. All this gives relevance and practical significance to the issue of revising the norms and principles of previously adopted conventions. Given the complexity of the geopolitical situation in the 21<sup>st</sup> century, as evidenced by the Russian aggression against Ukraine, the aggravation of relations between the US and Chinese governments, the implementation of nuclear programmes by the Democratic People's Republic of Korea and Iran, it is necessary to recognise the growing threat of a nuclear war.

In the mid-1990s, the International Court of Justice held discussions on the threat of the use of nuclear weapons (Legality of the..., 2024), the conclusions of which remain relevant today. In particular, the decisions of the International Court of Justice did not define the scope of neutrality in the case of the use of nuclear weapons. This is conditioned by the very nature of such weapons, since the consequences of their use will obviously go beyond their primary use, and therefore, the very concept of neutrality loses its meaning. The use of nuclear weapons will also have a negative effect in the event of a “nuclear winter”, deterioration of the quality of soil and groundwater, and the environment as a whole. This gives grounds to recognise radioactive fallout along with nuclear weapons as a means of warfare. This means that any indirect damage caused that was not intended for a neutral state indicates a gross violation of the state’s status as a neutral, as noted by I. Mingashang & C.T. Banungana (2024).

Important from the standpoint of implementing the concept of neutrality in the 21<sup>st</sup> century is also outer space, which is considered “rescommunisomnium”, that is, the property of all mankind. This means that since the right of neutrality applies exclusively to sovereign territories, it cannot be applied to outer space. However, when it comes to space objects that a sovereign state can use for its own purposes, they are recognised as the territory of the state, the sovereignty over which must be respected by other states. This statement comes not even from the right of neutrality, but from the Charter of the United Nations (1945). Only if the belligerent uses certain neutral space objects to perform certain military purposes, the other party will have the right to destroy such objects without fear of violating the principles of neutrality. In addition to the above, it should be noted that the laws of neutrality also prohibit the launch of any military facilities from the territory of a neutral state, since this would violate the content of the concept of neutrality. Transit of aircraft, unmanned aerial vehicles, or missiles through the territory of a neutral state is also added to this list (Shkolnikova, 2024).

The concept of neutrality has been the core of the foreign and security policies pursued by the governments of Sweden and Finland for a long time. However, the changing geopolitical situation, in particular Russia’s large-scale invasion of Ukraine, has forced the governments of these countries to abandon neutrality in favour of collective security mechanisms, as noted by A.B. Kaynak (2023). During 2022, the governments of Sweden and Finland applied for membership in NATO, and in 2023-2024, both countries became its full members (NATO member countries, 2024).

In the 21<sup>st</sup> century, approaches to implementing neutrality have also evolved in Switzerland. During the Iraq War (2003-2011), Switzerland invoked neutrality laws, since the invasion of the Armed Forces of the international coalition led by the Armed Forces of the

United States of America and Great Britain was carried out without obtaining an official mandate from the UN Security Council. Accordingly, coalition warplanes were not allowed to fly over Swiss territory, and the government banned any export of military goods to states that were involved in the conflict. However, the Swiss government has allowed flights over its territory for humanitarian and medical purposes. The Swiss government took a similar position during the military intervention against Yugoslavia in 1999, according to M. Rodriguez (2022). After Russia’s annexation of the Crimean Peninsula, the Swiss government focused its efforts on making it impossible for the Russian government to use its territory to circumvent the sanctions that were imposed on it. After another Russian aggression against Ukraine in 2022, the Swiss government decided to apply sanctions against Russia, with regard to both its neutrality status and national interests. T. Greminger & J.-M. Rickli (2023) point to the fact that after Russia’s full-scale invasion of Ukraine, support for neutrality fell in Switzerland for the first time in 20 years, which indicates a more critical perception of the concept and openness to international cooperation.

In summary, the implementation of neutrality in the 21<sup>st</sup> century faces significant challenges due to the evolution of conflict dynamics, particularly in cyberspace, non-international military conflicts, and nuclear threats. Traditional legal frameworks, such as the Hague Conventions, struggle to address modern complexities, necessitating a reassessment of neutrality norms. Additionally, geopolitical shifts have prompted historically neutral states like Sweden, Finland, and Switzerland to reconsider their stance in favor of collective security. The evolving nature of warfare, including cyberattacks and space militarization, further complicates the application of neutrality, highlighting the need for updated international legal provisions.

## Conclusions

Historical and legal analysis showed that the concept of neutrality has gone through a long path of its own development, starting from the use of customary norms in ancient Greece and Rome to the codification of international law in the 19<sup>th</sup> and 20<sup>th</sup> centuries. The relevance and practical significance of neutrality began to grow in the Middle Ages, but the concept became most popular after the establishment of sovereignty as an indispensable attribute of state power. One of the key stages in the process of formation and development of the concept was the creation of the first and second leagues of armed neutrality, and the codification of international legal norms of neutrality. The Civil War in the United States and related events, in turn, developed the provisions of the concept of neutrality and showed the importance of their compliance.

The 20<sup>th</sup> century was marked, on the one hand, by the continuation of the process of codification of

international legal norms in the field of neutrality, and on the other – by the spread of doubts about the effectiveness of the status of a neutral state for ensuring security. In the 21<sup>st</sup> century, the concept of neutrality faces the greatest challenges in its history. This is conditioned by the emergence of new challenges and threats in the context of the existence of cyberspace and the presence of non-international armed conflicts. The effectiveness of neutrality is increasingly being questioned, firstly, because of the growing role of outer space and the threats of the use of nuclear weapons, the consequences of which can affect both the object of influence and neutral countries through radioactive fallout, and, secondly, because of Russia's implementation of a neo-imperial aggressive foreign policy.

The rejection of the neutrality policy by Sweden and Finland indicates the emergence of a tendency for neutral states to abandon their status in favour of using collective security mechanisms. Future research on the topic may be based on the medium-term consequences of the withdrawal of the governments of Sweden and Finland from neutrality, and the dynamics of changes in public sentiment in Switzerland due to Russia's full-scale invasion of Ukraine.

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### Conflict of interest

The author declare no conflict of interest.

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## Нейтралітет в міжнародному праві: становлення та розвиток концепції

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**Анотація.** Метою дослідження було визначити основні етапи розвитку концепції нейтралітету для оцінки її ефективності у 21 столітті. Було використано правовий аналіз Гаазької конвенції 1907 року та Женевської конвенції 1949 року, контент-аналіз видання Politico, а також аналіз матеріалів Цифрової енциклопедії європейської історії. Результати дослідження показали, що концепція нейтралітету була сформована ще за часів Стародавньої Греції та Риму. Однак стрімкий розвиток концепції пов'язаний з війнами 18-19 століть, особливо з Війною за незалежність та Громадянською війною в США. У 1780 році була створена Ліга збройного нейтралітету, а в 1856 році був підписаний Паризький договір, який кодифікував нейтралітет як механізм забезпечення міжнародної безпеки. У 19 столітті також були прецеденти, які закріпили важливість нейтралітету, такі як Алабамські пакти. У 1907 році в Гаазі були прийняті важливі міжнародні конвенції, які підкреслили важливість нейтралітету і прав нейтральних країн у міжнародних конфліктах. Під час Першої світової війни концепції нейтралітету дотримувався уряд США. У 1930-х роках Сполучені Штати прийняли законодавство, яке регулювало торговельно-економічні відносини з воюючими державами. У 21 столітті концепція нейтралітету втрачає свою актуальність. Зміна геополітичної ситуації, географічна близькість до Росії, яка проводить агресивну політику і не поважає міжнародне право, спонукали уряди Швеції та Фінляндії відмовитися від принципів нейтралітету і приєднатися до Північноатлантичного альянсу. Результати дослідження можуть бути використані для вдосконалення міжнародно-правових механізмів, що регулюють нейтралітет, та для розробки стратегій зовнішньої політики держав у сучасних геополітичних умовах

**Ключові слова:** нейтралітет; суверенітет; міжнародна безпека; міжнародне право; війна



## Legal values as the basis of the legal culture of society

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**Abstract.** The purpose of the study was to analyse how legal values affect the establishment and development of legal culture and their application in Ukrainian legislation during the European integration process was the aim of the study. The research methodology was based on a comparative study of the legal systems of Ukraine and the EU, as well as a retrospective examination of the phases of Ukrainian legislation's historical adaptation to the European one, particularly through the adoption of institutional and legal reforms. In the context of aligning Ukrainian law with EU legal norms, the study examined the function and importance of legal values as the cornerstone of society's legal culture. The main results of the study showed that despite the long process of integration, there is still a certain discrepancy between Ukrainian and European legal values, in particular, on the issues of guaranteeing freedoms and human rights, independence of the judiciary, ensuring the rule of law, etc. In particular, it was noted that although Ukraine has already implemented many European standards at the level of national legislation, primarily in the field of ensuring human rights, there are some problems with the implementation of these norms in practice, which is conditioned by both socio-political and economic problems, primarily the introduction of martial law due to Russian aggression. The results of the study indicate the need to further strengthen democracy, in particular, the independence of the judicial system, increase the degree of transparency in political decision-making, improve anti-corruption policies, improve social protection under martial law, and raise citizens' legal awareness. The paper also provided specific recommendations for improving national legislation to achieve better compliance with EU legal values

**Keywords:** democracy; rule of law; European integration; adaptation of legislation; European Union

### Introduction

One of the most important aspects of the legal development of modern democratic states is the integration of national legal systems into the European legal space. The significance of this procedure is particularly pronounced in the context of Ukraine, a country which aspires to accede to the EU. The procedure fosters the development of legal culture in general and guarantees that national laws comply with international legal norms. The fundamental principles of the national political and legal systems are grounded in the legal values that constitute the legal culture of each respective community. This factor is particularly important in the context of Ukraine's European integration. This provides a significant practical and theoretical

significance to the research into how these principles affect Ukraine's legal system's modernisation process as a result of national laws being adapted to EU laws.

The need for research is conditioned by several factors. Firstly, full correspondence between Ukrainian and pan-European legal values has not been achieved, which affects the perfection of the legal system as a whole and its individual elements. Secondly, despite Ukraine's noteworthy advancements in legal integration, certain issues pertaining to the cultivation of the legal culture within society, notably that of civil servants, persist as unresolved concerns. These issues have given rise to expressions of dissatisfaction from representatives of civil society, institutions of the European Union, and

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the Council of Europe. It is imperative that a more profound examination be conducted into the correlation between Ukrainian legal values and their alignment with European standards, alongside the formulation of recommendations aimed at enhancing national legislation to ensure its congruence with EU legal norms.

The inherent multidimensionality of this research domain is a salient factor. A proportion of researchers concentrate on the analysis of legal values and their influence on the operation of the legal system. Thus, V. Lomaka *et al.* (2023) focused on studying the Europeanisation process through the prism of analysing changes in the legal systems of EU candidate countries that occur under the influence of the adaptation of Ukrainian legislation to EU legislation. S.G. Melnichenko (2024), in turn, analysed the nature of the impact of European integration on the legal system of Ukraine. Special attention was paid to the legal and institutional changes caused by the need to comply with the Copenhagen membership criteria, in particular, the legal criterion. I.M. Dyachyshyn (2021) examined how globalisation and European integration affected the state of legal culture of Ukrainian society; how the process of adapting Ukrainian law to EU law was facilitated by shifts in citizens' legal consciousness, precipitated by their perception of pan-European legal values. Concurrently, other scholars concentrated on particular facets of the legal system's evolution, such as protecting freedoms and human rights, upholding the rule of law, the court's independence, ideological plurality, etc. For instance, I.P. Andrusiak (2023) examined the challenges faced by the state in implementing European standards to prevent domestic violence, with a particular focus on safeguarding children's rights. Similarly, I.M. Muzychka & O. Rudkovska (2024) highlighted the need to strengthen national mechanisms for protecting human rights in Ukraine, in order to comply with the Copenhagen criteria (a political criterion) of EU membership. In addition, the steps that Ukrainian lawmakers should take to guarantee that national laws more closely adhere to European legal standards in the area of human rights and freedoms were examined. T. Drakokhryst's (2023) research focused on the issues surrounding the legal regulation of Ukraine's executive authorities' operations in light of European integration. In order to enhance the efficacy of governance, the necessity of aligning Ukraine's state authorities' organisational structure and administrative procedures with European legal norms was emphasised. It is worth pointing out a new area of research related to the impact of martial law imposed through Russian aggression on the state of the legal culture of society and the legal system as a whole, and the forecast of possible areas for the transformation of the legal field of Ukraine in the post-war period, for example, the study by N. Goncharuk & A. Cherednychenko (2022).

In order to evaluate the areas of growth of Ukrainian society's legal culture and its conformity to pan-European

culture, it is also required to highlight the small number of studies that concentrate on the methodical comparison of the legal systems of Ukraine and the EU. To ensure the effective functioning of the state in the context of European integration, it is imperative to investigate this issue and identify strategies to expedite the integration of Ukrainian law with EU law. As posited by I.P. Andrusiak (2023) and I. Lisna (2023), there exist certain challenges within Ukrainian society, with particular relevance to civil officials, in comprehending pan-European legal concepts. This has a detrimental effect on the efficiency of law enforcement. According to Ukrainian individuals and European institutions, the primary barriers to European integration are, in particular, a relatively high degree of corruption and a lack of transparency in the approval of certain political and legal decisions. However, other studies highlighted examples of successful implementation of certain European legal standards, in particular, in the field of human rights and the introduction of democratic procedures, which gives hope for further improvement of the situation (Udovyka & Gunya, 2023).

The purpose of this study was to analyse how Ukrainian legal values relate to the values of a united Europe, and to identify problems that hinder the process of modernisation of the Ukrainian legal system, increasing the level of legal culture of society. Within the framework of this goal, the following tasks were defined: to describe the key legal values of a united Europe and determine their impact on legal processes within the EU; to assess how much Ukrainian legislation complies with EU legal standards; to identify problems and prospects for implementing these standards; to develop proposals for improving the legal system of Ukraine and steps to accelerate the legal integration of Ukraine.

## Materials and methods

The stages of the study included: collecting theoretical materials covering issues related to the definition of the concept of legal values and analysing their impact on the development of the legal culture of society; conducting a comparative analysis of Ukrainian and pan-European legal values and investigating the stages of adaptation of Ukrainian legislation to EU legislation; identifying gaps in the current legislation and formulating recommendations for their elimination; The Association Agreement between the European Union and its Member States, of the One Part, and Ukraine, of the Other Part (2014), which provides the legal foundation for converting Ukrainian laws to EU laws, and the Charter of Fundamental Rights of the European Union (2012), whose provisions uphold the fundamental rights of EU citizens, were specifically examined in order to gain a deeper understanding of the issue; European Convention on Human Rights (1950), which defines human rights and freedoms and democratic standards to be implemented in the national legislation of the state's

parties to the Convention; a number of legislative acts, in particular, the Law of Ukraine No. 2866-IV (2005), Law of Ukraine No. 1700-VII (2014), which were aimed at the perception of European legal values; issues related to the implementation of judicial reform, the creation of anti-corruption bodies, ensuring minority rights, gender equality, environmental standards and freedom of speech were considered separately. Particular attention was paid to legal reforms that need to be implemented to bring Ukrainian legal values in line with European values.

Throughout the study, Ukraine's legal values were taken into account in the framework of European legal integration; more specifically, they were contrasted with those of the EU. This was accomplished in two main ways. Firstly, a retrospective examination of the historical stages of Ukrainian legislation's adaptation to EU legislation was conducted. Secondly, the legal systems of Ukraine and individual EU member states were compared using a comparative legal method. The research process began with the investigation of the theory of legal values as the core of the pan-European legal culture formed in the process of integration. For this purpose, documents adopted within the EU were used, in particular the constituent treaties of the EU (Treaty on the..., 1957; Maastricht Treaty, 1992; Treaty of Lisbon, 2007), Charter of Fundamental Rights of the European Union (2012), and European Convention on Human Rights (1950). To this end, a comparative analysis of Ukrainian and pan-European legal ideals was conducted in order to identify issues with modernising Ukraine's legal system and its component legal culture.

The analysis of national legislation was also carried out (for example, Constitution of Ukraine (1996), Law of Ukraine No. 2866-IV (2005), Law of Ukraine No. 1700-VII (2014) for their compliance with international treaties devoted to the legal regulation of human rights. The next stage was a retrospective study of the stages of adaptation of Ukrainian legislation to European standards, in particular, the study of changes in Ukrainian laws after the signing of the Association Agreement between the European Union and its Member States, of the One Part, and Ukraine, of the Other Part (2014) (for example, new editions of Law of Ukraine No. 776/97-VR (1998), which brings the activities of the ombudsman of Ukraine in line with EU standards, and Law of Ukraine No. 2866-IV (2005). The study also examined the influence of EU law on the development of Ukrainian legislation, with a particular focus on the comparison between the main laws that guarantee fundamental freedoms and human rights, democracy and social justice in Ukraine and those in EU Member States. In the course of the study, open sources were used, in particular, research papers, official legal documents, and reports of the European Commission (European Commission Report..., 2024) and United Nations bodies (Periodic Report on..., 2024). The study

covered the period from 2014 (the year of signing the Association Agreement) to 2024, focusing on modern reforms introduced in Ukraine to coordinate with European legal standards.

## Results

### General characteristics of legal values and their significance for the legal culture of society

The fundamental nature of legal culture is determined by the prevailing legal principles, which establish the moral and ethical standards for the rule of law and the legal relations within the state. These legal principles guarantee the growth and stability of the legal system, as well as the maintenance of harmonious relations between citizens and state entities (Wouters, 2020). As articulated in legal documents and international legal instruments, principles such as equality before the law, the rule of law, the inviolability of human rights and freedoms, support for democracy, and social justice possess both theoretical and practical significance (Rossi, 2020). Legal culture is formed through the influence of legal values on legal awareness – knowledge, ideas and beliefs of citizens about the law, which stimulate respect for the law and contribute to effective compliance with legal norms (Ashiagbor *et al.*, 2022). As noted by A. Kwiatkowska & A. Kwiatkowski (2022), societies with a high level of legal consciousness have a higher level of legal culture, which increases confidence in the legal institutions of the state.

The capacity of prevailing legislation to incorporate legal values is conducive to its modification to meet societal demands, as illustrated by the example of the principle of equality. The inviolability of human rights and freedoms must be recognised at the international legal and constitutional levels for this principle to be implemented. The practical application of the standards of the rule of law, as discussed by R. Wacks (2023), is then responsible for implementing fairness and predictability in legal relations. Legal principles define the moral and ethical underpinnings of the state's legal system and serve as the foundation of a social compact, as stated by B. Rothstein (2021) and F. Pirie (2023). The efficacy of legal mechanisms, stability, and the democratic evolution of society are thus dependent upon the interdependence and interrelatedness of legal ideals, legal culture, legal consciousness, and the state's legal system. The construction of a fair legal system and the advancement of the state are heavily reliant on the incorporation of legal ideals into the public consciousness, particularly among civil officials involved in rule-making.

It is evident that the legal principles upon which the EU is based and functions are upheld by three key articles of the European Union's legal framework. These articles include Article 2 of the Maastricht Treaty (1992), the Treaty on the Functioning of the European Union (1957), and the Charter of Fundamental Rights of the European Union (2012). The aforementioned

articles uphold the principles of respect for human dignity, freedom, democracy, equality, the rule of law, inalienability, and respect for human rights, particularly those of members of minorities. The establishment of a legal framework for the harmonisation of national legal standards by EU member states within the framework of the EU rule of law is facilitated by the normative consolidation and application of values shared by all EU member states in a society dominated by pluralism, non-discrimination, tolerance, justice, solidarity, and equality of women and men (Article 3 of the Maastricht Treaty). Notably, pan-European legal values play an important role in the development and implementation of EU foreign policy (in its relations with the world, the union maintains and distributes its values (Article 3 of the Maastricht Treaty); the Union develops special relations with neighbouring countries to create a space of prosperity and good neighbourliness based on the Union's values (Article 8 of the Maastricht Treaty), defining the content of diplomatic strategies and partnership agreements (Hypiak *et al.*, 2022; Coman, 2024).

The rule of law, which guarantees predictability, stability and fairness in legal relations, is the foundation of the legal order in the EU. The European Commission and the EU Court of Justice actively support the same understanding and application of legal norms in all member states, which contributes to the maintenance of stability and integration of legal systems (Silveira *et al.*, 2024). The democratic nature of the organisation and exercise of power in the EU implies the participation of citizens in decision-making, transparency of the activities of its institutions and bodies, and the responsibility of the EU authorities to their citizens (Maastricht Treaty, 1992). EU values also influence the Europeanisation of the national legal systems of EU member states, candidate countries, and neighbouring states. This involves harmonising the national legislation of EU member states in many areas of legal regulation, especially in the areas of human rights, labour relations and combating discrimination, and adapting the legislation of candidate countries and neighbouring states to EU legislation. For instance, the EU's constituent treaties, directives and regulations, which guarantee the right to equality and non-discrimination, form the basis for the creation of pertinent legislation and policies in member states (Coman, 2024). The Court of Justice of the EU, instrumental in the introduction of the principles of the rule of law and the direct application of EU law in 1960-1970, ensures that Member States fulfil their responsibilities to provide effective remedies in areas covered by EU law (Silveira *et al.*, 2024). Despite significant progress, the harmonisation of legal standards is hindered by the constant expansion of the membership of the United Europe at the expense of new states that belong to different legal families, adhere to different legal traditions stemming from national legal cultures, and have a certain lack of democracy. As noted by M. Hypiak *et*

*al.* (2022) and R. Müller *et al.* (2021), these differences require dialogue and compromise to achieve harmony between national and European norms.

Thus, legal values and principles that define the legal culture of a society are key to the stability and development of the legal system. They contribute to the formation of legal awareness of citizens, which, in turn, increases trust in legal institutions and ensures effective compliance with legal norms. The legal ideals enshrined in international and national documents become the basis of the social contract on which a democratic society is built. In the context of European integration, the harmonisation of legal norms among EU member states is an important step towards ensuring stability and the development of the rule of law in Europe, despite the existing differences in legal systems and traditions.

### **Adaptation of Ukrainian legislation to EU legislation**

The adaptation of Ukrainian legislation to EU legislation is a complex multidimensional process that involves not only formal changes in regulatory acts, but also deep structural and socio-economic transformations. This process is part of a broader strategy for Ukraine's European integration, which includes not only legal, but also political, economic, and social components. In this context, it is important to note that the adaptation of legislation is not limited only to the adoption of new laws or regulations, but also provides for changes in law enforcement and interpretation and legal activities, and therefore in the minds of civil servants working in the relevant authorities.

In the field of legal analysis, a predominant methodological approach to the examination of the adaptation process is the comparison of national legal systems with the EU legal order, as asserted by P. De Cruz (2024). This approach facilitates the identification of substantial distinctions between Ukrainian and pan-European law, in addition to the consideration of adaptation issues when analysing the experiences of other EU candidate nations. For instance, Ukraine is actively implementing European standards, particularly in the areas of human rights and the rule of law, in contrast to several Western Balkan nations where the adaptation process is considerably slower. However, Ukraine still needs to complete the reform of the judicial system, because EU legal standards require guarantees of independence and impartiality of courts and ensuring the effectiveness of justice. This is conditioned by the fact that, as noted by T. Komarova & A. Lazowski (2024), the EU's legislative powers in matters of ensuring the rule of law are very limited, and therefore, member states must function in such a way that it complies with the principles of EU law. This, according to the EU Court of Justice, requires member states to guarantee the true independence of national judicial systems.

To assess the effectiveness of the process of adaptation of Ukrainian legislation to the EU *acquis*, it is appropriate to use the comparative legal method, which allows identifying the steps that need to be taken to accelerate the process of adaptation of legislation. Although the signing of the Association Agreement between the European Union and its Member States, of the One Part, and Ukraine, of the Other Part (2014) was an important milestone in the process of Europeanisation of the legal system of Ukraine, some progress in reforming Ukrainian legislation was achieved during the previous and subsequent stages of Ukraine's integration. For example, the following important legislative acts were adopted: Law of Ukraine No. 2680-VIII (2019); Law of Ukraine No. 2510-IX (2022); Law of Ukraine No. 2866-IV (2005); Law of Ukraine No. 1629-IV (2004); Law of Ukraine No. 2494-XII (1992), etc. Ukraine's ratification of the European Charter for Regional or Minority Languages (1992) in 2003 should also be positively assessed.

The progress in the process of approximation of Ukrainian legislation to the EU *acquis* is assessed by the European Commission, which, after Ukraine acquires candidate status, publishes an annual analytical report to the Communication from the Commission to the

European Parliament, the European Council and the Council and the Opinion of the European Commission on Ukraine's application for membership in the EU. These documents assess the situation in Ukraine as of the relevant date, and also define, firstly, recommendations to the Ukrainian government on working on EU-defined clusters in the economic, political and social spheres in order to coordinate them with the EU *acquis*, and, secondly, the range of issues that the government needs to work on as a priority, so that they do not become an obstacle to the successful coordination of national legislation with the EU *acquis*.

As the experience of Eastern European countries shows, progress towards integration into a united Europe directly depends on the perception by the national parliament, courts and the system of law enforcement bodies, and society as a whole in the system of legal values on which the EU legal order is built, and compliance with which is required by the Copenhagen criteria for EU membership (political and legal). In order to ascertain the efficiency with which Ukraine's national legislation is being adapted to the *acquis*, it is necessary to understand the relationship between the Ukrainian and pan-European systems of legal values (Table 1).

**Table 1.** EU core values and Ukrainian legislative values in comparison

| Legal values                               | Ukraine                                                                                                                                                                                                                                                                                                                                                                     | EU                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inviolability of human rights and freedoms | Specified in numerous legislative acts and regulations, in addition to the Ukrainian Constitution, the major international agreements pertaining to freedoms and human rights have been ratified by Ukraine. Nevertheless, certain issues have been identified with regard to the application of these agreements, particularly in instances where martial law is in effect | The Charter of Fundamental Rights of the European Union, prevailing legislation, and EU constituent treaties collectively delineate the fundamental rights and freedoms of individuals. Since the 1960s, the EU Court of Justice has consistently emphasised the imperative for safeguarding human rights, both in the context of unwritten law, grounded in member state legal principles, and within the framework of constituent treaties |
| Rule of law                                | The principle of the rule of law is stipulated in the Constitution of Ukraine                                                                                                                                                                                                                                                                                               | A fundamental principle of the EU is the rule of law, which is upheld by autonomous court systems and efficient enforcement procedures                                                                                                                                                                                                                                                                                                       |
| Democracy                                  | Notwithstanding its status as a multi-party parliamentary-presidential republic, Ukraine is confronted with challenges pertaining to political stability and the pre-eminence of oligarchic systems                                                                                                                                                                         | The EU is founded on democratic ideals, particularly through the European Parliament, which is chosen by the people, and procedures for public participation in decision-making.                                                                                                                                                                                                                                                             |
| Freedom                                    | The Ukrainian Constitution guarantees a number of fundamental liberties, including freedom of expression, freedom of assembly and freedom of movement. However, it should be noted that there are limitations and specific instances in which these rights may be violated                                                                                                  | The EU provides broad freedoms, including freedom of movement, freedom of enterprise, and freedom of information                                                                                                                                                                                                                                                                                                                             |
| Solidarity                                 | In the context of international organisations such as the Organisation for Security and Co-operation in Europe and the United Nations, Ukraine aspires to unity. Nevertheless, the presence of social and political divisions has the potential to compromise internal solidarity.                                                                                          | The EU's fundamental values include a strong emphasis on solidarity. This is exemplified by the adoption of shared policies and the implementation of financial assistance programmes and crisis management measures for member states.                                                                                                                                                                                                      |

**Source:** developed by the author based on O.M. Sakhan & N.V. Shevchuk (2018), I.P. Andrusiak (2023), T. Drakokhryst (2023)

An analysis of the relationship between Ukrainian legal principles and EU core values reveals both similarities and contrasts. Numerous values that are

reflected in the pan-European legal values system have been entrenched at the legislative level in Ukraine. Consequently, the fundamental provisions of the

Constitution of Ukraine (1996) underscore the democratic and legal character of the Ukrainian state, as outlined in Article 3, which stipulates that the sanctity of human life and health, honor and dignity, and inviolability are recognized as the highest social values. Additionally, the document underscores the inalienability and inviolability of human rights, freedoms (Articles 21, 22); the judicial protection of each individual's rights and freedoms (Articles 8, 22, and other articles of Section II of the Constitution); Ukraine adheres to the principle of the rule of law (Article 8, 129); it stipulates that existing international treaties, which the Verkhovna Rada of Ukraine consented to be bound by, are included in the national legislation of Ukraine (Article 9); it guarantees the independence and inviolability of judges (Article 126, 130); and it stipulates that a judge, while administering justice, is independent and guided by the rule of law (Article 129). The ratification of fundamental international legal treaties in the area of human rights protection, particularly the European Convention on Human Rights (1950), by Ukraine was a crucial precondition for the alignment of the national system of values with the legal values of the EU. Should Ukraine wish to join the EU, it will be necessary for its constitution to be amended and supplemented. This process will entail the alignment of the clause stipulating the highest legal force of the Constitution with the EU's principle of the rule of law. Additionally, it will ensure the legal solidification of the transfer of specific sovereign rights and powers to the pan-European level.

The process of adapting Ukrainian legislation to EU norms is multifaceted and complex. Comparative analysis helps to clearly identify gaps and ways to eliminate them, and outline the areas of further reforms. Notwithstanding the noteworthy advancements witnessed, the process remains intricate due to the necessity for further legal, political and economic reforms. In accordance with European standards, Ukraine is obligated not only to promulgate legislation but also to implement it effectively, a task that poses the greatest challenge in the realm of substantive reforms. Significant headway has been made in defending individual rights, judicial reform, and combating corruption as a result of Ukraine's modernisation of its laws following the signing of the Association Agreement with the EU in 2014. However, as S. Pernicka & G. Hefler (2022) point out, the process of Europeanisation is not a linear one and is contingent upon the political will of governments.

One of the most significant components of the process of converting Ukrainian law to EU law is judicial reform. According to A. Paskar (2023), one of the most crucial requirements for Ukraine's successful EU entry is the reform of its judicial system. The experience of Eastern European nations entering the United Europe demonstrates that the EU has to establish genuinely independent courts whose operations are shielded from meddling by the executive branch and other

political and commercial institutions. Ukraine has taken important steps towards judicial reform: established two judicial management bodies – the High Council of Justice and the High Qualification Commission of Judges, which are responsible for implementing judicial reform; adopted the Law of Ukraine No. 3277-IX (2023), Law of Ukraine No. 3304-IX (2023), Law of Ukraine No. 3378-IX (2023) and Law of Ukraine No. 3511-IX (2023); introduced the practice of attracting foreigners to the preliminary selection of candidates for the position of Judge of the Constitutional Court, forming the composition of the High Council of Justice and the High Qualification Commission of Judges (however, some researchers consider this a disadvantage, since it is not provided for by the Constitution and the current legislation of Ukraine). These steps are in line with the EU's recommendations in the Ukraine Progress Report on the 2023 EU Enlargement Package.

However, the following problems remain unresolved: imperfect legislation; the need to restore the efficiency of the High Council of Justice and the High Qualification Commission of Judges; the creation of the High Administrative Court to consider cases concerning higher state authorities with both instances; the completion of the qualification assessment (verification) of acting judges by the High Qualification Commission of Judges; overcoming corruption; improving access to justice; overcoming the shortage of personnel and court overload; resolving the issue of consolidating the network of local courts in accordance with the new administrative structure; optimising the procedures for selecting candidates for judicial positions; the need to increase the level of legal culture of court personnel, and their level of awareness of EU law; preventing indirect control over processes in the justice system (This year, the..., 2023); resolving the issue of judicial law-making; introducing the institution of justices of the peace (Decree of the..., 2021); digitalisation of the judicial system, increasing the level of trust in the court, etc.

The sociological study "Corruption in Ukraine 2024: understanding, perception, prevalence" (Ukrainians have become...), commissioned by the National Agency for the Prevention of Corruption in 2024, found that, according to 79.4% of citizens and 76% of business representatives, corruption is the second most important issue facing Ukraine after Russian armed aggression. Ukraine's efforts to combat corruption have seen modest success. The establishment of the High Anti-Corruption Court of Ukraine, the National Agency for the Prevention of Corruption, the National Anti-Corruption Bureau, the Anti-Corruption Prosecutor's Office, and the National Agency for the Detection, Tracing, and Management of Assets Derived from Corruption and Other Crimes has resulted in the establishment of the institutional framework necessary to effectively combat corruption.

The United Nations Convention Against Corruption (2004) and the Criminal Law Convention on

Corruption (1999) are the two most important international legal treaties on combating corruption that Ukraine has adopted. This served as a legal basis for strengthening the relevant legislative framework by adopting Law of Ukraine No. 3207-VI (2011), Law of Ukraine No. 221-VII (2013), Law of Ukraine No. 224-VII (2013), Law of Ukraine No. 1700-VII (2014) and the adoption of Anti-Corruption Strategy for 2021-2025 (2020) and State Anti-Corruption Programme 2023-2025 (2023). The strengthening of inspections of judges' integrity declarations should be positively assessed and helps to overcome corruption risks in the judicial system.

The practice of improving the skills of employees of state authorities and local self-government bodies, who are responsible for organising work on preventing and countering corruption, developing explanations of the National Agency for the Prevention of Corruption on the application of certain provisions of the current anti-corruption legislation, in particular, on financial control measures, mechanisms for encouraging and forming a culture of reporting possible facts of corruption offences, preventing and resolving conflicts of interest, compliance with restrictions on the prevention of corruption (List of regulatory..., n.d.).

However, Ukraine still needs to take a number of steps to strengthen the effectiveness of the anti-corruption policy and bring it to the requirements of the EU, namely: improving the anti-corruption legislation, in particular, the criminal and criminal procedure codes of Ukraine to ensure a greater ability of anti-corruption bodies to effectively perform their functions (in particular, eliminating gaps in the law on investigation, criminal prosecution, and court decisions in cases of corruption with the participation of high-ranking officials); ensuring a step-by-step and systematic approach to improving the effectiveness of the anti-corruption policy of the state; improving the procedures for selecting the head and officials of anti-corruption bodies; solving problems related to the increase in the number of employees of anti-corruption structures; strengthening cross-border cooperation and contributes to the fight against international crime; implementation of digital transformation of public administration processes;

increasing the level of material and technical support for anti-corruption bodies, etc.

The analysis shows that the process of adaptation of Ukrainian legislation to the European one is complex and multifaceted, which requires an integrated approach and constant attention of competent public authorities, experts from among experts in EU law involved in the implementation of legal reforms. Coordination of the actions of competent state bodies with EU institutions, and civil society institutions, experts in EU law from among scientific and scientific-pedagogical personnel is critical for the success of the process of adaptation of legislation. When adapting the legislation, Ukraine also has to consider the socio-economic conditions in which it finds itself. As noted by P. Müller *et al.* (2021), the socio-economic context significantly affects the effectiveness of adaptation. The introduction of martial law in Ukraine due to Russian aggression in a certain way complicates the perception of European legal standards and their implementation in legislative and law enforcement activities.

The process of approximation of Ukrainian legislation to European standards is complex and multifaceted, requiring not only legislative changes but also significant socio-economic, political and cultural efforts. Progress in reforming the judiciary, fighting corruption and protecting human rights are important steps, but to achieve full compliance with EU requirements, Ukraine needs to continue to improve its legislation, ensure its effective enforcement and take into account the specific conditions created by external threats and internal challenges. Promoting the effective adaptation of European values in Ukraine requires close cooperation between state authorities, civil society and EU experts, as well as due consideration of the current socio-economic context.

### Proposals for updating the system of legal values of Ukraine

A crucial first step towards integration and maintaining legal stability is the process of harmonising Ukraine's legal values with those of the EU. Proposals for updating and supplementing Ukraine's system of legal values in line with European norms need to be developed in order to achieve effective adaptation (Table 2).

**Table 2.** Proposals for updating the system of legal values of Ukraine

| Legal values                                                 | Recommendations                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inviolability and inviolability of freedoms and human rights | Enhance systems for safeguarding human rights both during martial law and throughout the reconstruction phase following the war                                                                                                                                       |
| Rule of law                                                  | Create revisions and additions to the Ukrainian Constitution that would include provisions allowing the transfer of specific sovereign rights and powers of the EU, and deal with concerns regarding the Constitution's supremacy over the EU's rule of law principle |
| Independent and effective court                              | Enhancing the judiciary's independence, guaranteeing judges' actual independence from political influence, and giving them more authority                                                                                                                             |
| Democracy                                                    | Creation of a revised version of Law of Ukraine No. 474-XIV (1999), and Law of Ukraine No. 4061-VI (2012), that would take into account the effects of martial law as well as voter migration, both domestically and abroad                                           |

Table 2. Continued

| Legal values | Recommendations                                                                                                                                                                                                                                               |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Freedom      | Strengthening protections for the exercise of freedom of speech and information during martial law, thwarting Russian information aggression, maintaining media independence, and guaranteeing citizens' access to trustworthy information                    |
| Equality     | Enhancing the legal protections for minority rights and establishing the framework for all social groupings to operate equally and fully                                                                                                                      |
| Solidarity   | Enhancement of laws pertaining to social protection of the populace, particularly socially vulnerable groups and segments; guaranteeing equitable development of all state regions; and minimising socioeconomic disparities in the growth of various regions |

**Source:** developed by the author

The implementation of these and other proposals in the context of the process of adaptation of Ukrainian legislation to EU legislation is impossible without improving the level of legal culture of society and, in particular, civil servants involved in the development of legal norms, their interpretation and application. This, in turn, implies amendments to bachelor's and master's educational programmes in institutions of higher education of legal profile, which provide for an in-depth and comprehensive study of EU law (the entire spectrum of its branches), and the practice of its application.

Since 2022, Ukraine has been under martial law, which makes it extremely difficult to apply European norms to the country's legal system. In addition to having serious socioeconomic repercussions, Russian aggression directly affects the judicial system, specifically: (a) violations of human rights and freedoms, including systematic mass and egregious violations of the 1<sup>st</sup>-4<sup>th</sup> Geneva Conventions by Russia, concerning the treatment of military and naval personnel, the treatment of prisoners of war, the rights of civilians, and the treatment of injured and ill members of the armed forces, as well as challenges in upholding a specific set of rights and freedoms in the area under the jurisdiction of the Ukrainian governments; (b) problems with access to justice: under martial law, the judicial system's ability to function properly is severely hindered, and access to justice is nonexistent in the temporarily occupied areas; (c) the security situation and the large-scale internal and external migration of Ukrainians make it difficult to hold elections for president, people's representatives, and local self-government (both in the temporarily occupied and frontline areas and throughout Ukraine); (d) there are issues with ensuring the transparency of the electoral process and the elections themselves; and (d) the implementation of democratic mechanisms for monitoring the actions of government bodies. Implementing European legal norms is made more difficult by these and other issues (such as the war's prolongation and Moscow's ultimatum demands). Even in the face of martial law, Ukraine's democracy should be preserved and developed. The state's involvement of civil society in the legal integration process is crucial to the success of the transformation of Ukrainian law into EU

law. Platforms for communication, exchange of ideas and initiative between state authorities and public organisations need to be established in order to improve Ukraine's legal culture under difficult circumstances.

## Discussion

Given the background of the study's earlier findings, it can be said that Ukraine has made great strides in aligning its laws with those of the EU, particularly in areas like judicial reform, human rights, the rule of law, and anti-corruption efforts. However, there are still issues to be addressed, such as ensuring the effective independence of the courts, staffing courts and anti-corruption bodies, changing legal education, raising the level of legal culture among government officials, etc. Attention also should be paid to the study by P. Akaliyski & T. Reeskens (2024), who analysed the Ukrainian system of values in the context of the influence of the Slavic-Orthodox heritage and pan-European values on it. Using the index of European values, which included gender equality, individual freedom and liberal democracy, to compare Ukrainian values with Russian and Western European ones, the researchers concluded that although Ukrainian values are closer to Russian than to any EU country, there are noticeable differences, especially among younger age groups. This indicates a gradual reorientation of Ukrainian society to European values.

Similar findings were made by C. Ballieu & R. Schwok (2023), who examined Ukraine's integration process in relation to Belarus and Moldova, contrasting its experience with that of the Western Balkans in the context of European integration. The researchers stress the importance of taking into account the EU's policies in the process of integrating other nations into its structure. In order to adapt laws and restore justice in the temporarily occupied territories, C. Ballieu and R. Schwok underline the importance of strengthening cooperation between Ukraine and the EU. One example would be the establishment of mobile courts and online platforms for filing claims. It was also mentioned that, in addition to Ukraine's efforts to achieve full legal integration, Member States and the EU should continue to support Ukraine on its path towards unification.

The study by E. Jones *et al.* (2022) analysed how various initiatives help countries seeking EU membership, in particular Ukraine. The study assessed the situation in Eastern European countries, including the reform of state institutions, electoral systems, and the fight against corruption. The researchers stated that without the support of member states for democratic processes and the reform of state institutions in candidate countries, the implementation of the Copenhagen criteria (political and legal) would be an extremely problematic task. F. Fabbrini (2022) analysed how the COVID-19 pandemic and Russian aggression against Ukraine have affected the EU's economic and monetary integration from a legal and political standpoint. The researcher concluded that initiatives such as the establishment of the NextGeneration EU Recovery Fund played an important positive role in the process of European integration with profound implications for the constitutional architecture of the EU economic governance and provided significant assistance to Ukraine as a candidate country for EU membership.

The researcher also pointed out the reverse influence of candidate countries on the European integration process. S. Gstöhl & C. Frommelt (2023) pointed this out, stressing the importance of the involvement of candidate countries in various forms of EU cooperation. These researchers suggested going beyond the conventional method of "downloading" (transferring EU legislation to the national level) and emphasised the importance of taking into account the national context and circumstances of Ukraine (martial law) when assessing the effectiveness and quality of Ukrainian legislation adaptation to EU legislation. The EU's involvement in crisis situations, including the pandemic and the war in Ukraine, was also examined by V. Anghel & E. Jones (2023). They underlined how international crises can affect not only the EU's internal operations, but also its ability to modify its policies in order to support countries competing for membership, such as Ukraine. This further illustrates the importance of European support in maintaining stability and growth in Ukraine as it moves towards integration.

## Conclusions

The study identified important areas for the modernisation of the national legal system and examined the question of updating Ukraine's legal values in the light of EU membership. It was found that Ukraine has made great strides in bringing its laws into line with EU standards, particularly in the areas of implementation of democratic norms and protection of human rights and freedoms. However, there are still certain issues that require immediate attention, such as the incompleteness of the process of updating the legislation in

force, shortcomings in the implementation of the rule of law, the incompleteness of the reform of the judiciary, the ineffectiveness of anti-corruption bodies, the lack of confidence in certain state bodies, etc.

The study identified important areas for the modernisation of the national legal system and examined the question of updating Ukraine's legal values in the light of EU membership. It was found that Ukraine has made great strides in bringing its laws into line with EU standards, particularly in the areas of implementation of democratic norms and protection of human rights and freedoms. However, there are still certain issues that require immediate attention, such as the incompleteness of the process of updating the legislation in force, shortcomings in the implementation of the rule of law, the incompleteness of the reform of the judiciary, the ineffectiveness of anti-corruption bodies, the lack of confidence in certain state bodies, etc. The results obtained confirmed that the system of legal values stipulated in the EU constituent treaties has a positive impact on the modernisation of the legal system of Ukraine, particularly in increasing the level of legal culture of society, civil servants, and scientific and pedagogical workers. These positive shifts include a growing understanding of democratic processes, greater respect for human rights, and more robust legal safeguards for citizens' freedoms. However, challenges remain in ensuring full legal harmonisation, particularly concerning the incorporation of EU directives into national legislation and the adaptation of Ukrainian legal practices to meet EU standards. There is also a notable gap in the effective enforcement of laws, which undermines the broader goals of legal reform.

The results obtained confirmed that the system of legal values stipulated in the EU constituent treaties has a positive impact on the modernisation of the legal system of Ukraine, in particular, increasing the level of legal culture of society, civil servants, and scientific and pedagogical workers. Further research should focus on the analysis of the problems of adaptation of various branches of Ukrainian legislation to EU legislation; identification of areas for reforming legal education to train personnel who specialise in mastering knowledge about the relevant branches of EU legislation and are aware of the practice of its application; development of mechanisms for raising awareness of civil servants, public figures, and ordinary citizens of Ukraine about EU law and the system of legal values on which it is based.

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## Conflict of interest

None.

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## Правові цінності як основа правової культури суспільства

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**Анотація.** Дослідження спрямоване на аналіз того, як правові цінності впливають на становлення та розвиток правової культури та їх впровадження в українське законодавство у процесі європейської інтеграції. Методологія дослідження ґрунтувалась на порівняльному аналізі правових систем України та ЄС, а також на ретроспективному аналізі історичних етапів адаптації законодавства України до законодавства ЄС, зокрема через впровадження юридичних та інституційних реформ. В роботі проаналізовано роль та значення правових цінностей як основи правової культури суспільства, зокрема в контексті адаптації законодавства України до правових стандартів ЄС. Основні результати дослідження свідчать, що попри тривалий процес інтеграції все ще існує певна невідповідність між українськими і європейськими правовими цінностями, зокрема з питань гарантування прав і свобод людини, забезпечення верховенства права, незалежності судової влади та ін. Зокрема, зазначено, що хоча Україна вже впровадила на рівні національного законодавства чимало європейських стандартів, насамперед у сфері забезпечення прав людини, існують окремі проблеми з реалізацією цих норм на практиці, що зумовлене як соціально-політичними, так і економічними проблемами, насамперед запровадженням воєнного стану через російську агресію. Результати дослідження свідчать про необхідність подальшого зміцнення демократії, зокрема незалежності судової системи, підвищення рівня прозорості прийняття політичних рішень, удосконалення антикорупційної політики, покращення соціального захисту в умовах воєнного стану, а також зростання правової обізнаності громадян з метою підвищення якісного стану правової культури суспільства як обов'язкової умови сприяння демократичним процесам в державі. Робота також містить конкретні рекомендації щодо вдосконалення національного законодавства з метою досягнення більш повної відповідності правовим цінностями ЄС.

**Ключові слова:** демократія; верховенство права; європейська інтеграція; адаптація законодавства; Європейський Союз

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