
New Legal Horizons: Hybridization of Law in the Era of Industry 4.0

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Abstract

The evolution of modern society towards digital society with the usage of digital technology affects the transformation of the legal system, predisposing the adaptation of traditional legal norms to the needs of the digital economy. It is precisely the concept of hybridization of law that refers to the current transformation of the legal framework so that law, i.e. legal rules adequately responded to the needs and challenges of digital transformation. The authors research and discuss the scope of the hybridization of law, that is how traditional legal rules are adapted to the modern needs of science and practice, with an emphasis on legal certainty. The subject of the research is the interaction of the traditional legal system and Industry 4.0, with a focus on the adaptation and transformation of legal norms in the digital environment. Indirectly, the process of hybridization of law is in focus, which is demystified through the mutual influence of legal principles and digital innovations. The purpose of the research is to provide a comprehensive insight into the phenomenon of legal hybridization, identifying the key challenges and opportunities that Industry 4.0 brings to the legal system. Analyzing the model of law hybridization contributes to a better understanding of the development of law in the digital era and the establishment of a framework for the application of best practices in modern legal systems. To that end, the research includes an analysis of key approaches to the hybridization of law, as well as the identification of the basic elements of this process and the key legal, technological, sociological and economic factors that enable or limit its development.

Keywords: digital society; hybridization of law; Industry 4.0; digital economy

Introduction

The digital revolution initiates radical reforms in business and communication, determining the transformation of the legal system that would adequately regulate new technological solutions. We are witnessing fundamental changes in the business processes, in the management and accessing information, trends that create new challenges for the legal system. The rapid development of artificial intelligence and big data analytics requires legal adaptability that enables real-time monitoring of these technologies. Traditional legal principles, which rest on material and physical presence, that is, which we can label as "analog" in nature, face the challenges brought by Industry 4.0. The question of compatibility between the promotion of innovation and the preservation of legal certainty becomes central in all discussions on the regulation of digital technologies. New areas are emerging that require legal regulation, in which digital and traditional elements, norms and practices would work synchronously in order to preserve legal security, through a model of hybridization of law or legal rules.

The hybridization of law represents the process of combining traditional legal institutes, practices and principles with new trends brought by the digital society, with the aim of adapting to the modern needs of regulating social trends and challenges (Vasić, Petrović, 2024, pp. 694). For example, traditional institutions of property law, such as property, title, pledge, require adaptation to the context of the emergence of digital assets, and in order to redefine the ownership and control of virtual objects, such as cryptocurrencies, non-fungible tokens (NFT) and digital assets in the virtual world. New forms of property

introduce the need to regulate new risks, hitherto unknown, and the need for their incorporation into new or redefined institutes within traditional legal areas, through innovative legal solutions. The European Union provides an example of this approach through the General Data Protection Regulation (2016), and the regulation on digital assets, which represent a framework for member states in adapting their systems to the digital economy. However, despite such efforts in legal creation, practice often exceeds legislation, which opens up space for legal uncertainty. The legal framework related to smart contracts and blockchain technology is still insufficiently defined, which can cause difficulties in international business transactions.

In this paper, the authors start from the assumption that the process of legal hybridization, which implies the integration and modification of traditional legal norms and digital innovations, can improve the adaptability and efficiency of legal systems in the digital era. Today, law and technology merge into a hybrid legal system that includes both analog and digital spheres. It is assumed that hybrid approaches to legal regulation will enable more effective application of law in the digital environment, increase legal certainty and enable innovative legal models that meet the needs of the digital society.

This paper analyzes the broader context of the hybridization of law, including the possibilities and limitations of different approaches to this topic. The focus is also on the question of how legal systems can achieve an optimal balance between flexibility and stability, enabling legal certainty and promoting sustainable innovation.

Methodological approach

The methodological approach in this work is based on an interdisciplinary research of the relationship and interaction between the concept of the traditional legal system and Industry 4.0, with a focus on ways of adapting and transforming legal norms in the digital environment. The research includes a conceptual and objective analysis of the process of hybridization of law through the permeation of legal principles and digital innovations.

Within the methodological approach, a systematic review of relevant literature, including key theoretical concepts and empirical studies, was conducted to provide a comprehensive insight into previous research. In accordance with the objectives and subject of the research, different general scientific methods were used: analytical-deductive for the analysis of existing legal principles and theories, hypothetical-deductive for testing hypotheses about the influence of digital technologies, and comparative method for comparing the approach of different legal systems in the regulation of digital innovations.

Special emphasis is placed on the integration of interdisciplinary insights from legal theory, technology and economics, which enables a holistic view of the challenges and opportunities brought by the hybridization of law. The work is structured according to the IMRAD principle, enabling a logical flow of research and a clear presentation of the results.

Research and analysis

The omnipresence of digital technologies, as well as their mass application, represents a significant challenge for existing legal frameworks. Legal systems, created for application in the "analog age", and which today we call "traditional", must now respond to the challenges of the digital society. Digitalization of business, e-commerce, cryptocurrencies, smart contracts and artificial intelligence raise new legal questions that require innovative answers. The authors based their research on the currently achieved degree of hybridization of

law, analyzing new legal trends and the evolution of new hybrid regulations.

The process of digital transition creates numerous challenges, but also opportunities, imposing the need for traditional legal doctrines to adopt new principles in order to more effectively regulate digital resources (Stojšić Dabetić, Mirković, 2024, pp. 183). Digital innovations create numerous ethical dilemmas, especially in relation to users' rights and the preservation of privacy in the digital space, which is a key ethical issue today (Albrecht, 2016, pp. 287-289). Artificial intelligence and big data analytics enable the collection of huge amounts of information about users, often without their explicit consent. This practice leads to ethical dilemmas regarding the rights of users and the transparency of digital platforms (Kabir, Alam, 2023, pp. 1778-1779). The ubiquity of artificial intelligence raises the question of the responsibilities that AI systems bring to legal sectors. The social impact of these technologies is reflected in the broader context of equality – how to ensure that digital resources are accessible to marginalized groups. For developing countries, the postulates of the modern digital society create new challenges where the lack of infrastructure, technical knowledge and professional staff can limit the implementation of modern legal solutions. Also, global technology companies often take advantage of regulatory loopholes, while local legislation lags behind due to weak resources and training of regulatory bodies, and stagnates in the process of harmonizing with international standards. The development of innovative legal regulation also includes addressing the issues of security and sustainability of the so-called digital ecosystem.

The key challenge is the creation of sustainable and secure legal solutions that can be adapted to the dynamic requirements of the digital environment, while respecting international standards and enabling global development (Bjelajac, Bajac, 2022, pp. 21-22). The application of technologies such as encryption and anonymization in legal frameworks can increase user trust in digital transactions, establishing a balance between the right to privacy and transparency. The question of digital inclusion becomes crucial – how to ensure that digital laws do not deepen social inequalities, as the digital transformation poses challenges related to access to justice and equal legal opportunities.

Digital transformation, which affects awareness, ideas, behavior and business, has created a completely new business model that requires adaptation of existing legal norms (Čelik, 2021, pp. 7). In order to achieve a sustainable balance, it is necessary to continuously adapt legal frameworks in order to respond to changes in the digital landscape. Legal hybridization provides a tool to achieve that goal, but it requires a commitment to building a flexible and dynamic legal framework that will enable a sustainable balance between legal certainty and innovation.

The hybridization of law is positioned as a key mechanism for solving legal doubts predisposed by digital transformation. The process of hybridization of law involves combining traditional legal principles with new technologies, creating more flexible and dynamic legal frameworks that can respond to rapid technological changes and contemporary challenges of the digital society.

Discussion: Hybridization of law – the concept and scope in the modern digital society

The process of hybridization of law implies an interdisciplinary approach, combining jurisprudence, theory and practice with economics, informatics and sociology. For example, the work to create legislation on digital tokens involves collaboration between lawyers, economists and experts in blockchain technology.

It is the inclusion of technological experts in legislative processes that enables the creation of legal norms that are practically applicable in the rapidly evolving digital environment.

As Industry 4.0 continues to transform society, legal frameworks must evolve to address the implications of the digital age at the intersection of traditional and digital law (Habrát, 2020, pp. 938-939). The hybridization of law, as a process of adapting traditional legal norms to the challenges and opportunities of the digital era, is emerging as a new legal paradigm, opening up new legal horizons, and at the same time raising new complex questions. Legal systems, faced with the accelerated technological progress of Industry 4.0, must adopt flexible and innovative approaches to ensure legal certainty, transparency and adaptability.

The hybridization of law, which combines traditional legal norms with technological solutions, emphasizes the need for investments in modern technologies such as encryption, anonymization and pseudonymization. The integration of legal and technological approaches enables more effective protection of personal data and better compliance with the requirements of modern regulations such as GDPR (Ullagaddi, 2024, pp. 29-30). However, the key dilemma in the process of hybridization of law remains the question of compatibility between legal certainty and flexibility. Legal certainty requires clearly defined norms and predictability in their application, which is the basis for user and market trust in the digital environment. Conversely, flexibility is essential to adapt the legal framework to Industry 4.0, which conceptualizes rapid technological changes. Both goals are often in conflict, as an emphasis on rigid norms can be an obstacle to innovation, while too much flexibility can create legal uncertainty (Gromova, Koneva & Titova, 2022, pp. 188-189).

Blockchain and smart contracts symbolize the two-way interaction of law and technology. The integration of smart contracts into blockchain technology becomes crucial for further development, as it enables direct peer-to-peer transactions, while at the same time allowing the database to be stored publicly and securely in a trust-based environment (Mohanta, Panda & Jena, 2018, pp. 2-3). Based on blockchain technology, smart contracts symbolize the potential to improve legal practice through automation and decentralization, but their implementation requires additional attention regarding data integrity and legal liability (Stojšić Dabetić, Mirković, 2023, pp. 36-37). The concept of smart contracts that work for people and machines implies a hybrid approach, where the textual flexibility of traditional contracts is combined with coded elements for automation (Hazard, Haapio, 2017, pp. 425-426). The harmonization of human and algorithmic understanding of contractual provisions further emphasizes the need for hybrid approaches that overcome discrepancies between legal and technological frameworks. Hybrid contracts, which combine traditional textual flexibility with the digital precision of programming code, enabling harmonization between human and algorithmic understanding and enforcement of contractual provisions, represent a potential solution to balancing human and algorithmic understanding (Cvetković, 2020, pp. 94-96).

Conclusion

The meeting of traditional and digital law opens the way to a new legal paradigm, in which legal systems face the constant challenges brought by Industry 4.0. As technologies such as artificial intelligence, blockchain, Internet of Things and automation are increasingly integrated into business processes, legal frameworks must evolve to respond to the implications of the digital age. The hybridization of law provides an opportunity to improve legal efficiency, transparency and adaptability in the era of digital

transformation. The integration of traditional legal norms with digital innovations enables the creation of flexible and stable legal systems that meet the needs of modern society.

The research showed that the majority theoretical views go in favor of the fact that the process of hybridization of law, through the integration and modification of traditional legal norms and digital innovations, can improve the adaptability and efficiency of legal systems in the digital era. Hybrid models have shown the potential to improve the application of law in the digital environment, increase legal certainty and create new legal mechanisms that meet the needs of modern society. However, legal uncertainty and different levels of regulation between national jurisdictions, particularly with regard to data protection and digital assets, remain key challenges that require further normative adaptation.

The paper analyzes the hybridization of law through an interdisciplinary approach that includes legal, technological, economic and sociological aspects. A special focus is placed on the adaptation of legal norms to digital innovations, with the identification of key factors that enable or limit this process. Through the synthesis of theoretical and empirical insights, the work contributes to a better understanding of legal transformation in the digital era and provides a basis for further improvement of legal frameworks that meet the challenges of Industry 4.0.

However, the key challenge remains to strike a balance between legal certainty and flexibility. While security ensures trust and predictability, flexibility is necessary to adapt legal frameworks to rapid technological changes. Interdisciplinary approaches, which include the cooperation of lawyers, technological experts and economists, as well as the harmonization of national and international standards, are key to reducing legal uncertainties and encouraging sustainable development.

Examples like GDPR and smart contracts illustrate how legal systems can evolve through hybrid models that integrate best practices from traditional and digital frameworks. The future development of legal systems must rely on innovative models of regulation that take into account the needs and challenges of the digital society. The hybridization of law is not only an opportunity to improve legal efficiency, but also a key mechanism for preserving social justice, sustainability and transparency in the era of the digital economy. Digital transformation requires a legal framework that will enable flexibility and adaptability, but also preserve the basic legal principles on which the legal system rests. In this context, legal systems must actively work to improve regulations that will ensure security and predictability in the digital environment, while at the same time encouraging innovations that shape the future of the digital economy.

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Novi pravni horizonti: Hibridizacija prava u eri industrije 4.0

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Sažetak

Evolucija savremenog društva u digitalno društvo kroz upotrebu digitalne tehnologije utiče na transformaciju pravnog sistema, predisponirajući adaptaciju tradicionalnih pravnih normi potrebama digitalne ekonomije. Upravo koncept hibridizacije prava se odnosi na aktuelnu transformaciju pravnog okvira kako bi pravo tj. pravna pravila adekvatno odgovorila na potrebe i izazove digitalne transformacije. Autorke istražuju i polemišu o dometima hibridizacije prava odn. kako se tradicionalna pravna pravila prilagođavaju savremenim potrebama nauke i prakse, sa akcentom na pravnu sigurnost. Predmet istraživanja je interakcija tradicionalnog pravnog sistema i Industrije 4.0, sa fokusom na prilagođavanje i transformaciju pravnih normi u digitalnom okruženju. Posredno, istražuje se proces hibridizacije prava, koji se demistifikuje kroz međusobni uticaj pravnih principa i digitalnih inovacija. Svrha istraživanja jeste pružanje sveobuhvatnog uvida u fenomen hibridizacije prava, identifikujući ključne izazove i prilike koje Industrija 4.0 donosi pravnom sistemu. Analizom modela hibridizacije prava doprinosi se boljem razumevanju razvoja prava u digitalnoj eri i uspostavljanju okvira za primenu najboljih praksi u savremenim pravnim sistemima. U tom cilju, istraživanjem je obuhvaćena analiza ključnih pristupa hibridizaciji prava, kao i identifikacija osnovnih elemenata ovog procesa i ključnih pravnih, tehnoloških, socioloških i ekonomskih faktora koji omogućavaju ili ograničavaju njen razvoj.

Ključne reči: digitalno društvo, hibridizacija prava, Industrija 4.0, digitalna ekonomija