

The Main Systemic Engineering Problems of Using Computer and Digital Technologies in Legal Activities in the Context of Ensuring Security



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ABSTRACT

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The relevance of the research topic is accompanied by a great demand for digital and computer technologies and their rapid growth in the activities of any organization. Legal activity and security have changed a lot in recent years and also feels the impact of modern digital and computer technologies. The main purpose of the article is to study the main systemic engineering problems of using digital and computer technologies in the legal activities of firms in terms of ensuring security. To achieve this goal, we used the methodology of hierarchical ordering using information and mathematical tools of the theory of graphs and relationships, which allows you to streamline and form a connection between the main systemic engineering problems of using digital and computer technologies in the legal activities of firms. Based on the results of the analysis, we have formed an information model of the hierarchical ordering of the influence of the main systemic engineering problems of using digital and computer technologies in the legal activities of firms in terms of ensuring information security. Our study has a number of limitations, and they are related to the inability to cover all types and types of problems of using digital and computer technologies in legal activities due to a large amount of data and limited work. Further research will require the question of analyzing the impact of Industry 4.0, which is already practically here and with us, in the legal activities of firms.

1. INTRODUCTION

Legal activity, like any other activity, also uses a number of technical means in its work and strives to ensure technical safety. This is especially important in conditions of total digitization. Digital technologies are constantly developing and require new skills to master them and, along with this, new measures to ensure security.

“Digital” jurisprudence should be considered the introduction of computer technology, special computer software, and mathematical methods into law-making and law enforcement. Such implementations are necessary for the collection, storage, and processing of legal information for the most efficient receipt of various information legal services.

Today in the legal field there is practically no such type of legal activity, wherever computerization, computer technology, and the Internet are used. The automation of many social processes is gaining momentum. This also applies to the legal profession. Digital and computer technologies in the legal field are developing in the following areas: automation of typical legal services, the use of online legal services, the digital and computerization of public services and their provision online, the transition to an e-justice system, modeling legal decisions based on artificial intelligence. With the advent of digital and computer technologies, jurisprudence is being rationalized. Automation of jurisprudence is widely used: web bots, template constructors, scripts, and search engines for monitoring registration data and judicial registry data, electronic databases of legislative acts, intelligent

information systems, and much more. For example, more and more often legal consultations switch to online chat mode, in a few minutes you can conclude an agreement using the algorithms of an online constructor, etc. Thus, a real "LEGAL TECH" revolution is taking place today. It certainly makes the work of lawyers and lawyers, as well as their legal services accessible, and fundamentally changes the very work of lawyers.

The combination of law and digital technologies is achieved to a greater extent through the intelligent automation of those actions that need to be performed by a living person (who, as a rule, has a legal education and/or relevant work experience). These actions include search, text editing/replacement, matching, identifying inconsistencies, translation into another language, analysis, interpretation, selection, decision-making, etc. As a result of such automation, the speed is guaranteed to increase, and the accuracy and quality of the work performed are likely to increase. This leads to a reduction in the cost of such legal services since the main pricing factors in legal practice are the complexity of the work performed and the time spent on this.

One of the most important factors influencing the formation of modern innovative societies, and Ukrainian in particular, is the availability of information technology. This state of communication systems was preceded by a long and thorny path. The only means of accumulation and storage of information for many generations of our ancestors was the spoken word. The 20th century is the century that gave humanity a wireless telegraph, color, cable, satellite television,

and communication satellites. In the twenty-first century, the Internet has penetrated all spheres of society much faster than the above inventions; today an unprecedented global wireless network of high-speed Internet is already being created, etc. With the deepening of ideas about the nature and patterns of computer information technologies and the development of the Internet, it becomes clear that they pose complex problems for states. Computer information technologies are not a tool of destruction, but they are not a tool of creation either. In many ways, the results of their use depend on whom, how, and for what purpose they will be used. In this regard, informatization is open, open registers of information can bring with them not only new opportunities but also new dangers and threats, including when modeling legal situations or in lawmaking. But along with this come a number of engineering problems and contradictions that hinder the effective use of technology in legal activities and can become a real threat to security.

The main purpose of the article is to study the main systemic engineering problems of using digital and computer technologies in the legal activities of firms in terms of ensuring information security.

2. LITERATURE REVIEW

A review and study of the literature show that the issue of digital and computer technologies in legal activity is not new. Cano-Kollmann et al. [1], Aalbers et al. [2] reduce their ideas to the opinion that significant changes in the legal system of many countries of the world are due to the formation of digital and computer reality, which is a determining factor in the development of modern society, which affects the mechanism of legal regulation and the activities of various legal institutions. The life of modern society is becoming more and more dynamic, its space is expanding, and technologies are changing. Under the influence of globalization, the paradigm of thinking is being transformed, and the institutions of civil society, bodies and state authorities, and the system of legislation are being improved. The digital and computer world requires the construction of a model of legal regulation that would be adequate for the new technological reality. At the same time, the adaptation of the traditional legal picture to the digital and computer conditions of society requires serious attention.

According to Kryshchanovych et al. [3], today it is impossible to achieve sustainable development and form an effective public policy if there is no digital and computerization of the legal system and the country as a whole.

Lainjo [4] and Nwaiwu et al. [5] argue that digital and computerization processes related to the legal regulation of the economy play a significant role in the legal system. To achieve positive results, it is planned to create modern management of the socio-economic sphere that meets the global trends of an efficient economy. Of particular importance is the identification of problems, challenges, threats, and possible negative consequences of the digital and computerization of the economy.

We partially agree with their theses and, we believe, through globalization and digital and computerization, today we simply cannot ignore the impact of digital and computer technologies on legal activities. But along with this, new problems come and complicate and hinder activities.

The extent to which digital and computer technologies affect legal activity is determined by their necessity and need.

As some scientists and practitioners note [6, 7], the digital and computerization of legal reality implies the need to immerse in the virtual legal space of numerous state functions, areas of activity of municipal bodies, electronic participation of citizens in law-making, and examination of draft regulatory legal acts. The public need for the digital and computerization of public administration has increased based on the formation of algorithms for public decisions both at the state and regional levels. With digital and computerization, the sphere of law should be assessed as the basis for the emergence of a modern form of relations between state power and civil society in accordance with the moral principles of public life management.

Along with digital and computer technologies, a new need to strengthen information security comes into professional activity. Višinskis et al. [8], Godlewska et al. [9], Abbasi et al. [10] clearly emphasize that along with the digital and computerization of legal activity comes a number of new problems for information security. Arguing at the same time that the digital and computerization of real legal reality contributes to the formation of new civilizational phenomena and processes, the emergence of a new legal understanding, worldview, and legal culture, and this is all-new for the information security system. Digital and computer reality put forward requirements for information security and its components related to the improvement of the mechanisms of legal regulation of various spheres of life based on modern digital and computer technologies. The authors propose a mechanism to ensure the timely application of such norms. In order to keep up with the rapid development of processes within the framework of digital and computer transformations, formed by the authors, the mechanism must also be digital and computer. That is, the process of norm-setting and law enforcement should become digital and computer to strengthen information security. The technologies required for this already exist, it is only necessary to ensure the correct application in the design of digital and computer regulatory processes and effectively counter the new, educated problems.

So, summing up the analysis of the literature, we conclude that the situation with digital and computer technologies in legal activities has two sides: We have both positive growths in the process of providing legal services but at the same time the emergence of new obstacles and engineering problems. That is why we chose this research topic, which still requires new ideas.

3. METHODOLOGY

Our methodology is compiled by applying time-tested and practiced mathematical and informational methods. Their composition includes the methodology of the hierarchical ordering of certain phenomena (in our case, these are just the main systemic engineering problems of using digital and computer technologies in legal activities in terms of ensuring security). This methodology, through the use of graph theory and connections, will allow us to determine which of the problems we have identified will have the greatest impact on the law firm, and which ones will have less. Graph theory, by its very nature, is designed to determine the level of influence of each of the factors in a certain set. Thus, in order to use this methodology, the choice of a clear set of factors with a significantly high magnitude of influencing is a prerequisite for its use. Given this, according to the authors, the factors we

have chosen are the most significant.

It should be noted that the law firm chosen by us for the study is a law operating organization in which most of the authors of the article work. This will highlight the engineering problems that we discovered during our legal activities in the process of our organization's transition to modern digital and computer technologies. By applying the hierarchical ordering methodology, we will be able, using the example of our law firm, to determine which systemic problems today need an immediate response from the top management and to prevent a decrease in the level of security.

The process of hierarchical ordering itself involves the following ways:

- determination of factors of influence and construction of the graphical model of connections between identified engineering problems;
- filling in the dependency and reach matrices;
- determination of the hierarchical level of each of the factors;
- formation of a directly model of factors of influence.

The following list of systemic engineering problems of using digital and computer technologies in legal activities in the context of security was formed based on professional experience while working in a law firm and using the method of interviewing colleagues in our own firm. The interview process was carried out in stages. Thus, the first step was to identify those individuals who had the most experience in the field under study. Yes, all the workers we interviewed are professionals in the field with at least 5 years of experience. The next step was the interview process itself, during which the survey was carried out in compliance with all ethical standards. In order to protect the right and maintain confidentiality, we will not disclose the name of the law firm where we currently work, but we will only say that this is a Ukrainian company and therefore today, due to the political-military conflict on the territory of Ukraine, it is necessary to maintain the status of anonymity (Table 1).

Table 1. The list of systemic engineering problems of using digital and computer technologies in legal activities in the context of security

№	Informational designation	Process
1	D ₁	The outdated technical equipment in the company
2	D ₂	Problems of litigation in the application of digital and computer technologies
3	D ₃	Lack of a full-fledged security engineering department
4	D ₄	The outdated vision of legal activity among clients
5	D ₅	Low level of "digital and computer literacy" of employees
6	D ₆	Lack of large-scale "digitization" of materials
7	D ₇	Low experience in introducing security engineering

Since our study is aimed at demonstrating a methodical approach to responding to new systemic engineering problems, we focus more on the model itself; however, it is necessary to briefly describe each of the systemic problems that we have identified for the application of digital and computer technologies in our legal law work:

D₁ – Outdated technical equipment in the company. Our law firm has a significant technical systemic problem. Whatever budget is allocated for it, technology is moving forward and equipment is aging very quickly.

D₂ – Problems of litigation in the application of digital and computer technologies. The systemic problem of not accepting the fact of the existence of digital and computer technologies during court hearings. The practice of the pandemic and COVID-19 should have solved this problem, however, our company is still facing it.

D₃ – Lack of a full-fledged security engineering department. The systemic nature of this problem is that the management cannot mentally or psychologically accept the fact that a law firm is not only departments with professional lawyers, it should also be other specialists. One "computer engineering technician" in today's conditions is not enough.

D₄ – Outdated vision of legal activity among clients. Not all clients are ready to enter legal cases through digital and computer technologies and means. COVID-19 has somewhat reduced this problem, but its systemic nature can be traced almost daily, as practice shows. The main reasons for this problem are the existence and active use of outdated digital technologies and the implementation of irrelevant digital policies at the state level. The judicial system still cannot carry out a qualitative digital transformation of its activities.

D₅ – Low level of "digital and computer literacy" of employees. The systemic nature of this problem takes its "roots" from the education system in the country. Digital technologies are studied only at the beginning of the student body, and then not in all specialties. A lawyer enters the job with a high level of legal training and a low level of digital and computer awareness.

D₆ – Lack of large-scale "digitization" of materials. Law firms handle hundreds of cases and even more, this is always huge paperwork, which, even with the advent of digital and computer technologies and tools, still exists, as our practice of legal activity shows.

D₇ – Low experience in introducing security engineering. As such, our law firm does not conduct experience acquisition, and therefore self-training and own practice of mastering modern security engineering systems is a systemic problem for every lawyer.

The above problems, according to the majority of respondents, are the most representative of the totality of all of the systemic engineering problems of using digital and computer technologies in legal activities in the context of security.

Consequently, the set of systemic problems we have chosen will be $D = \{D_1, \dots, D_7\}$.

The application of the methods described in this section, which together form our research methodology and its results will be presented below in the text.

4. RESULTS OF RESEARCH

In order to form a graph according to our methodology and visually depict the connection, it is necessary to form a calculation table of the D₁ dependence. Such a table will include elements 1 or 0, depending on the following requirement: 1 if the node of conditional *i* depends on the node of conditional *j*; 0 if there is no such dependence (Table 2). This dependence is estimated according to the methodology. So, our matrix should have a value of 1 or 0. Thus, it is

determined where the dependence exists and where it does not. While dependency is assessed by a qualitative method.

Table 2. Calculation table of the D dependence

	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
D ₁	0	0	0	0	1	0	0
D ₂	1	0	1	0	1	0	0
D ₃	0	0	0	0	0	0	0
D ₄	0	0	0	0	1	0	0
D ₅	0	0	0	0	0	0	0
D ₆	1	1	1	0	0	0	0
D ₇	0	0	1	0	0	0	0

So, we visualize our dependence on the subset D₁ and possible connections with it through a graphic image (Figure 1).

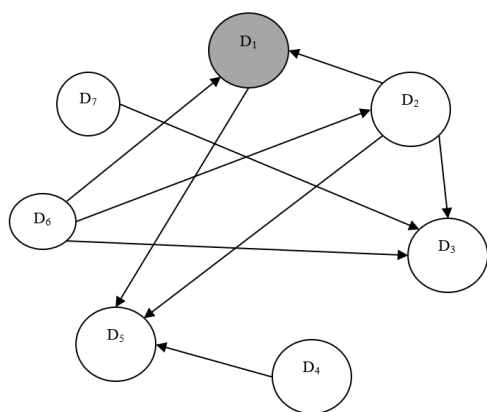


Figure 1. Graphical model of connections between identified engineering problems

The next step is to build a reach matrix on the basic data of the dependency matrix. At the same time, in the reach matrix, the following condition must be achieved: 1, when it is possible to get from conditional *i* to conditional *j*; 0 if not possible. So, our reach matrix for systemic engineering problem D is presented in Table 3.

Table 3. The reach matrix for systemic engineering problems D

	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
D ₁	1	0	0	0	1	0	0
D ₂	1	1	1	0	1	0	0
D ₃	0	0	1	0	0	0	0
D ₄	0	0	0	1	1	0	0
D ₅	0	0	0	0	1	0	0
D ₆	1	1	1	0	0	1	0
D ₇	0	0	1	0	0	0	1

Thus, we are moving on to a direct determination of which of the systemic engineering problems we have identified today need a prompt response from the leadership of our law firm to strengthen security.

To do this, according to the generated graph, we must determine which of the D_i has a fixed direction with D_j. These will be available to D. We will designate such as Q(D_i). If the conditional vertex D_i reaches the conditional vertex D_j, then it is its predecessor, and therefore we denote this type as H(D_i). The so-called section of subsets Q(D_i) and subsets H(D_i) will form the following (1):

$$A(D_i) = Q(D_i) \cap H(D_i) \quad (1)$$

It should be noted that here we begin the stage when those peaks that are not reached at all from peak D₁ remain and form the lowest level of negative impact for our law firm. According to the methodology, it is impossible to quantify the level of this effect, since we are modeling the ordering of problems that act as phenomena and do not have a clear numeric form. Here it should also be established that a certain additional condition of Eq. (2):

$$A(D_i) = H(D_i) \quad (2)$$

Therefore, following the implementation of the above processes, we can present the results of calculations to determine the main levels of the negative impact of the identified systemic engineering problems of using digital and computer technologies for our law firm in terms of ensuring security (Table 4).

Table 4. The results of calculations to determine the main levels of the negative impact of the identified systemic engineering problems

	Q(D _i)	H(D _i)	A(D _i)
D ₁	1, 5	1, 2, 6	1
D ₂	1, 2, 3, 5	2, 6	2
D ₃	3	2, 3, 6, 7	3
D ₄	4, 5	4	4
D ₅	5	1, 2, 4, 5	5
D ₆	1, 2, 3, 6	6	6
D ₇	3, 7	7	7

Thus, equality holds for the following system problems: D₄ (Outdated vision of legal activity among clients), D₆ (Lack of large-scale "digitization" of materials), D₇ (Low experience in introducing security engineering). They form the lowest level of influence and require a more strategic response from our company's leadership when using digital and computer technologies. Further, we will extract them from our calculations, and we will get the following Table 5.

Table 5. The results of calculations to determine the main levels of the negative impact of the identified systemic engineering problems

	Q(D _i)	H(D _i)	A(D _i)
D ₁	1, 5	1, 2	1
D ₂	1, 2, 3, 5	2	2
D ₃	3	2, 3	3
D ₅	5	1, 2, 5	5

Further, Eq. (2) holds only for D₂ (Problems of litigation in the application of digital and computer technologies). It forms the level of tactical response of the top management of our law firm. We delete it and get the following Table 6. So, in each table for a certain problem, Eq. (2) is true. In Table 5, Eq. (2) is fulfilled for problem D₂, which will constitute the strategic level. And so we remove the Eq. (2) on the next plate.

The level of operational-tactical measures on the part of the top management of the law firm will include the following systemic problems: D₁ (Outdated technical equipment in the company) and D₃ (Lack of a full-fledged security engineering department). Therefore, removing them will lead to the fact that we get the highest level requiring a prompt response, this

level for the D₅ problem - Low level of "digital and computer literacy" of employees (Table 7).

Table 6. The results of calculations to determine the main levels of the negative impact of the identified systemic engineering problems

	Q(D _i)	H(D _i)	A(D _i)
D ₁	1, 5	1	1
D ₃	3	3	3
D ₅	5	1, 5	5

Table 7. The results of calculations to determine the main levels of the negative impact of the identified systemic engineering problems

	Q(D _i)	H(D _i)	A(D _i)
D ₅	5	5	5

Let's form our information model of the hierarchical influence of systemic engineering problems of using digital and computer technologies in legal activities in terms of ensuring security (Figure 2).

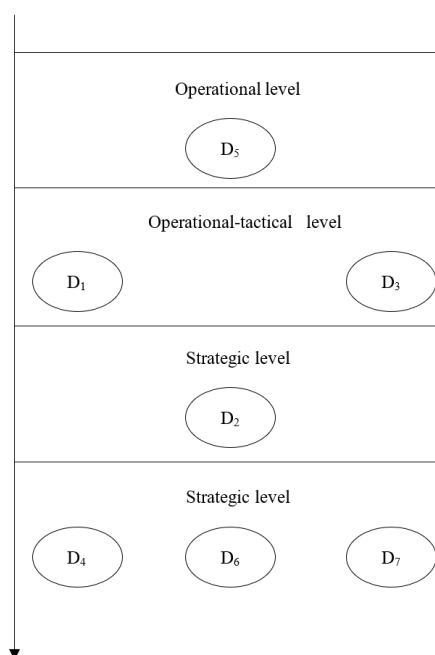


Figure 2. Graphical model of connections between identified problems

So, we agree that today the most critical systemic engineering problem during the use of digital and computer technologies in the legal activities of our company is the low level of "digital and computer literacy" of employees. It is the biggest threat to our security system today.

5. DISCUSSIONS

When discussing the results of the study, one should compare them with several scientific works of other researchers on similar topics. Kraftova and Kraft [11], Kerikmäe and Rull [12], Slakoper and Tot [13] are focused on the revealed essence of digital and computer technologies and their place in legal activity. They consider the features of

digital and computer technology algorithms in the legal field. With the advent of the error backpropagation algorithm, a period of the wide practical application of neural network technologies for solving a wide variety of problems began, and it became possible to build mathematical models, including the legislative process. Situations of this kind are encountered in a wide variety of fields of knowledge that seem to have nothing to do with law, such as economics, business, money, political science, sociology, and criminalistics.

Antonova and Lavelina [14], Levytska [15], Barzilova [16] believes that if today the traditional paper form of the law remains familiar to us, then in the future the law will acquire a new digital and computer form, and the first attempts to create such mechanisms are already represented by the technology of concluding smart contracts based on the use of blockchain technology. The mechanization of jurisprudence predetermines a new stage in the development of related branches of law. First of all, this concerns civil, criminal, administrative, and financial law, as well as procedural legal branches. A special role in this process is assigned to the development of information law.

An interesting application of digital and computer modeling is the scientific work of Urba et al. [17], who tried to depict the process of introducing these technologies into work through mathematical modeling methods. socio-economic systems

Similar models could be found in the works of Kryshchanovych et al. [18], but there the emphasis shifted precisely to the issue of information security in the socio-economic system, but practical the application of mathematical and informational methods to examine the problems of digital and computer technology and security can be traced.

Considering the scientific results of such works, it should be noted that they have focused their scientific attention on the engineering problems that arise when using digital and computer technologies in legal activities, and because this can damage security. To do this, we proposed, through mathematical methods, our own model for ordering the influence of such engineering problems in order to determine which problems, in our opinion, are the most significant and hinder digital and computerization in legal activity the worst.

6. CONCLUSIONS

Summing up, it should be noted that digital and computer technologies in legal activity are the same as in any other activity. They come and change the whole system of work and form a new information environment within the organization. Digital and computer technologies in law is a legislatively regulated and organized process of application by state bodies and local governments, other subjects of public administration of computer and other electronic computing equipment, software, information and communication networks, and other digital and computer mean to collect, fix, processing, storage, and distribution of legal information, as well as the creation of documents in electronic form.

The role of the lawyer is changing significantly. Now it is not enough just to know the laws. The specialist must know modern technological solutions, and automation methods available for the profession. Day-to-day work will not only include new programs that pave the way for new clients and simplify the service in the legal field. The deceptive simplicity

of the methods of operating modern document management systems will lead to the need to create new laws. Today, a lawyer must study the human factors of cybersecurity, the psychology, and patterns of hacking, and the basic principles of data protection in conditions of heightened risk. The preference will be the specialist who will study the behavior of people, processes, principles of information flow management, and the impact of digital and computerization on legal operations.

Dexterity in mastering technology is likely to contribute to the creation of a new profession at the intersection of IT and law. How could a lawyer who is also technically knowledgeable be useful to business? A person with such expertise can significantly reduce the time required to implement technologies, carefully plan their integration, competently prepare people, and coordinate business digital and computerization processes. A legal department fluent in IT will have carte blanche to implement transformational strategies. Therefore, knowledge of technology provides the lawyer and his clients with the leadership needed to achieve competitive advantages in today's market. Therefore, the future belongs to intelligent systems that transform legal practice, and lawyers who know how to manage them. This could solve many of the above problems.

Based on the results of the analysis, we have formed an information model of the hierarchical ordering of the influence of the main systemic engineering problems of using digital and computer technologies in the legal activities of firms in terms of ensuring security. Our study has a number of limitations and they are related to the inability to cover all types and types of problems of using digital and computer technologies in legal activities due to a large amount of data and limited work. Further research will require the question of analyzing the impact of Industry 4.0, which is already practically here and with us, in the legal activities of firms.

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