

DOI: 10.37930/2782-6465-2026-5-3-99-107

Victor S. Voronov

Russian State Academy of Intellectual Property (Moscow, Russia)

Veronika R. Smirnova

Russian State Academy of Intellectual Property (Moscow, Russia)

Sergey V. Tchernyavsky

Russian State Academy of Intellectual Property (Moscow, Russia)

DIGITAL TRANSFORMATION OF INVESTMENT OPPORTUNITIES IN THE ERA OF NOOTRANSITION

Abstract. This paper examines the digital transformation of investment opportunities in the context of the transition to noonomy, taking into account the growing priority of exploiting the results of intellectual activity. Due to the extremely high uncertainty of investment returns on digital intellectual assets, their circulation on photostock platforms is examined within the framework of the concept of real options. The specifics of photostock platforms functioning as digital option generators are analyzed, facilitating the creation and realization of investment opportunities for authors, investors, and end users. The study found that the investment potential of a digital platform is determined by the current balance of digital options (assets) and digital debt (liabilities), which are formed through the management of the results of intellectual activity (RIA) of platform ecosystem participants. RIA should be understood as not only digital intellectual assets in the form of creative content, but also elements of the digital platform's software and information architecture.

Keywords: debt, digital intellectual asset, digital platform, ecosystem, investment, noonomy, option, photostock.

For citation: Voronov V. S., Smirnova V. R., Tchernyavsky S. V. (2026). Digital Transformation of Investment Opportunities in the Era of Nootransition. *Noonomy and Noosociety. Almanac of Scientific Works of the S. Y. Witte INID*, Vol. 5, No. 3, pp. 99–107. DOI: 10.37930/2782-6465-2026-5-3-99-107

沃罗诺夫V. S.

俄罗斯国立知识产权学院(俄罗斯, 莫斯科)

斯米尔诺娃V. R.

俄罗斯国立知识产权学院(俄罗斯, 莫斯科)

切尔尼亚夫斯基S. V.

俄罗斯科学院中央经济数学研究所(俄罗斯, 莫斯科)

向智慧经济过度时期投资机会的数字化转型

摘要: 本文致力于研究向智慧经济过度条件下投资机会的数字化转型过程, 并考虑到日益增长的利用智力活动成果的重要性。数字知识资产投资回报的不确定性极高, 因此本文从实物期权理论的角度

度,探讨了其在微图库平台上的流通机制。文章分析了微图库作为数字期权生成器的运作特点,这些期权为作者、投资者和终端用户创造了投资机会。研究发现,数字平台的投资机会由数字期权(资产)与数字债务(负债)的当前平衡决定,而这两者是在平台生态系统参与者管理其智力活动成果(RID)的过程中形成的。在这里,智力活动成果不仅指以创意内容形式存在的数字知识产权资产,还包括数字平台软件与信息架构的组成部分。

关键词: 债务、投资、智慧经济、期权、数字平台、数字知识产权、图片库、生态系统。

引用注释: 沃罗诺夫 V. S., 斯米尔诺娃 V. R., 切尔尼亚夫斯基 S. V. (2026). 向智慧经济过度时期投资机会的数字化转型//智慧经济与智慧社会. 维捷新兴工业发展研究所论文选, Vol. 5, No. 3, pp. 99–107. DOI: 10.37930/2782-6465-2026-5-3-99-107

Introduction

The digital transformation of investment processes observed today includes, among other things, opportunities to invest in intellectual assets, which are, by definition, the most promising resources of the noonomy. Specifically, such opportunities are provided to users by modern digital stock photography platforms (photostocks), which develop flexible business models for the commercial turnover of ready-made digital images, videos, audio files, and 3D models [Voronov, Viktorov, 2025, p. 89]. Photostocks are an example of successful representatives of the creative sector of the digital economy, whose accelerated development is characteristic of the current state of transition to the noonomy – the noo-transition [Bodrunov, 2025, p. 26]. Nevertheless, the theoretical foundations for investing in digital intellectual assets remain nascent, and the business practices of these digital platforms rely primarily on trial-and-error approach.

According to the authors, among numerous studies dedicated to the analysis of modern digital platforms, the most interesting approaches are those utilizing elements of the real options concept. In one such approach, in accordance with the double entry system, it is proposed to balance digital (real) options created within a platform ecosystem (as assets) by digital debt (as liabilities). In doing so, the authors define the essence of digital debt starting from the concept of technical debt, which emerged in the fields of software engineering and information systems [Rolland et al., 2018]. However, it should be noted that in the aforementioned approach, issues of digital platform management are considered without regard to the economic turnover of intellectual assets in any form.

In this study, given the substantial uncertainty surrounding the return on digital intellectual assets, it is proposed to analyze them within the framework of the concept of real (digital) options, whose economic turnover is contingent upon the development of liabilities typical for the investment environment of modern digital platforms.

Research Results and Discussion

As it is well known in financial theory, an option represents the right to exercise or decline an investment opportunity in the future. The holder of a financial option gains a preferential right to choose when making investments [Black, Scholes, 1973]. Furthermore, the concept of options has also been adapted for the processes of implementing strategic opportunities of an organization or a creator to participate (or not to participate) in future actions through sequential investments in any resources [Bowman, Hurry, 1993].

Option thinking, in a broader sense, helps managers develop strategies by generating investment variants that arise from (1) current opportunities, (2) future opportunities within the investment environment, and (3) associated uncertainties. For example, applying this concept to the management of information system capabilities, Sambamurthy and colleagues suggested that an organization's investment in information technology, combined with changes in its technological environment, can be viewed as digital options for competitive actions [Sambamurthy et al., 2003].

Thus, digital option thinking helps managers consider IT investment without firm commitments to its yields, develop and combine variants in order to evaluate alternative investments, and ultimately make selective investments in specific information technology capabilities [Sandberg, Mathiassen, Napier, 2014]. In the context of digital platforms, *digital options* represent opportunities to invest in new technical and information functions that increase the platform's value proposition for both business partners and end users.

A modern digital platform offers users access to a continuous stream of products, services, and applications produced by creators within the platform's ecosystem. Each such offering helps managers understand whether accepting the proposal will generate benefits for the business of organization. Consequently, digital platforms can be interpreted as *generators of digital platform options* within an organizational context. Identifying probable digital options basically implies nothing other than recognizing new investment, information, technical, and other platform functions. Developing new options includes, among other things, evaluating and combining new functions into desirable and feasible competitive actions, while exercising selected options involves integrating new functions into the organization's infrastructure and business processes.

Digital Intellectual Asset as a Real Option

Photostock companies provide users with platform technologies and facilitate various services – to authors/investors on one hand, and to licensees on the other. License sales are influenced by numerous factors, including the artistic merit of the image, thematic focus, prevailing seasonal and fashion trends, color schemes, execution quality, physical dimensions, and even the author's reputation. These and other factors introduce extremely high uncertainty into the process of generating investment yields from these assets. This uncertainty is reflected not only in the number of licenses sold but also in the potential for certain assets to fail to secure any market demand, thereby yielding no investment return. Furthermore, this situation can persist for quite a long time – sometimes for many years.

As a result, almost any average portfolio contains images for which use licenses have never been sold. Even successful images can be categorized into groups based on sales volume: those with only a few licenses sold (up to ten), those with dozens (up to a hundred), or finally, those with hundreds or thousands of sales. The latter are the so-called “record-breaker” assets that have captured the attention of the global graphic design market [Voronov, Viktorov, 2024]. The evident probabilistic nature of this process allows this *class of digital intellectual assets* to be considered as *real options*. These options provide (1) authors/investors, (2) platform managers, and (3) end-licensees with the opportunity to undertake specific actions to improve or modify the terms for exercising such options in the future.

For example, a stock photography platform provides buyers with the right to choose the specific license type they need: standard, extended, editorial, etc. In turn, by purchasing a license, the

buyer acquires the right, but not the obligation, to utilize all the limits in the license. Specifically, the limits regarding the maximum print run of a publication in which the image will be used are typically set at 250,000 units for a standard license. On the other hand, if a buyer requires a larger print run, they purchase two or more licenses for the use of the same image. Thus, option logic allows buyers to manage their production needs.

On the photostock side, option thinking is also embedded in offering buyers a wide range of so-called “subscriptions.” These allow buyers, by paying in advance (a direct analog of an option premium), to obtain the right – but not the obligation – to purchase on favorable terms a fixed large volume of licenses for any images in the following period, such as 500 or 1,000 units daily. Such options are extremely beneficial for professional actors in the graphic design, advertising, and marketing markets, i.e. all those who purchase ready-made digital images in large quantities on a daily basis as part of their professional activities.

When these buyers, intentionally or otherwise, single out a particular image (video or audio file), an avalanche in growth of license sales begins. Specifically, there are cases known of record-breaking sales involving tens of thousands of licenses for individual photographs or video clips. As a result, the investment return on such assets increases exponentially, providing the opportunity to partially or fully compensate for the lack of returns from other assets in the portfolio of both the author/investor and the photostock platform as a whole.

Finally, from the author/investor perspective, the preparation and uploading of each asset to a photostock platform – considering the preliminary costs – basically represents the acquisition of a real (digital) option to receive investment income from the platform’s sale of licenses. Given the probabilistic nature of this process discussed above, it is easy to understand the reasons behind the accumulation of extra-large asset portfolios by photostock platforms, particularly by industry leaders (Table 1).

Table 1
Leading stock photography platforms as of Q2 2026

No.	Company	Image and Video Collection, million units	Stock Ticker
1	Shutterstock	< 600	NYSE: SSTK
2	Adobe.Stock	< 900	NASDAQ: ADBE

Source: Compiled by the authors based on company data

Thus, in the context of photostocks, digital platform options can represent investments in platform expansion through:

- populating the platform with visual, video, audio, and other digital content;
- integrating applications related, for example, to the generation of digital images, video and audio content, 3D models using the integrated AI version;
- offering other technological or information resources by members of the platform ecosystem.

Investments in platform functions can be directed toward all levels of the modular architecture. As Yoo et al. define it, “the layered modular architecture is a hybrid between a modular architecture and a layered architecture, where the degree by which the layered architecture adds the generativity to the modular architecture forms a continuum” [Yoo et al., 2010].

In fact, it is the generativity inherent in the platform's layered modular architecture that potentially provides a plenty of digital options. Furthermore, an important characteristic feature of digital technology is its self-referential nature, which implies that the introduction of innovations opens up additional opportunities for subsequent innovations [Kallinikos et al., 2013]. Thus, the development and exercise of each digital platform option can facilitate the emergence of *additional new digital options*.

On the other hand, numerous options increase the managerial complexity of the platform. This is particularly relevant when a company's infrastructure includes multiple platforms. For instance, in the case of photostocks, investment opportunities are represented by separate platforms for digital images, video, and audio. Nonetheless, the management of digital platforms and infrastructure cannot be separated from the broader platform ecosystems. Consequently, an author/investor using, for example, Shutterstock's services will be dependent on how its platform ecosystems evolve.

Digital Liabilities (Debt)

The concept of technical debt has long been utilized in software engineering practice. It was first introduced as a symbolic (even "metaphorical") notation to describe writing "fast but not necessarily high-quality" code as a commitment (debt) to be fulfilled later [Tom, Aurum, Vidgen, 2013]. Interest in technical debt has intensified recently, as the failure to manage it properly can negatively impact the long-term development and quality of any software system. Although technical debt was originally associated with code and software architecture, its modern concept has expanded to include lack of testing, poor documentation, and other software development artifacts [Li, Avgeriou, Liang, 2015]. However, it should be noted that *technical debt is not inherently negative*; accepting a manageable amount of debt can accelerate development and allow a company to bring new services and products to market faster.

Many researchers have expanded the definition of technical debt to include both evolvability issues related to technological gaps in software architecture and features, and maintainability issues related to code quality. Thus, technical debt is not merely the result of initial flaws, but rather the outcome of an evolving context over time – a result of choices that appear suboptimal in retrospect. In this sense, technical debt is driven by external events:

- technological obsolescence and the emergence of superior technologies;
- environmental changes;
- rapid commercial success.

Particularly in the context of digital platforms, understanding the evolutionary nature of debt is crucial. Successful platform ecosystems constantly introduce innovative solutions and opportunities (options) for resource investment, provided they are not hindered by existing (accumulated) debt.

Based on these ideas, a broader concept of *digital liabilities (debt)* has been proposed. This encompasses the accumulation of financial, legal, technical, and informational obligations that impact the development of the platform as a component of the user's digital infrastructure. Collectively, these liabilities increase risks for the relationship between the platform and other ecosystem players, as well as between the infrastructure elements and processes that the platform facilitates. Thus, digital debt essentially embodies the obligations that arise from the platform's continuous implementation of new capabilities and innovations into its digital infrastructure and processes.

Photostock platforms not only maintain and develop the software associated with their digital platforms but also, as noted above, accumulate massive volumes of creative content. Therefore, a multitude of obligations is linked to the management, structuring, and storage of this content.

Specifically, financial liabilities arise because the license fee for an individual asset (e.g., a digital image) is a very small amount. It is extremely inefficient to pay royalties to the author/investor immediately after a license sale; consequently, all photostocks accumulate royalties until a certain threshold is reached – usually \$100 – before transferring the funds to the recipient. As a result, the total current liabilities for unpaid royalties can amount to hundreds of millions of dollars.

The legal obligations of photostock platforms are related, first, to the necessity of complying with the copyrights of the digital asset owners who upload to the platform. Second, photostocks assume the obligation to monitor buyers' compliance with the licensing terms for these assets. In this regard, the high market reputation of leading photostock companies plays a significant role.

Finally, debt associated with information functions can result from decisions on structuring of content within databases and on how users interact with that content. From the perspective of layered platform architecture, purely technical debt pertains to the service, network, and device layers, whereas *informational debt* (in practice – a distinct concept) relates to the content layer.

In accordance with the concept of digital options, one can identify a lifecycle of practices through which digital debt manifests and evolves during digital platform management – progressing from creation to the evaluation and resolution of said debt (see Table 2). The creation of digital debt involves the formation of all types of obligations that must be fulfilled during the future operation, maintenance, and development of the platform. Evaluation includes examining and prioritizing these obligations. Finally, resolution (settlement) involves fulfilling the platform's commitments to partially or fully repay the digital debt.

The concept of digital debt is also linked to the concept of the installed base – the aggregate of deployed systems and associated business processes within a digital infrastructure. While the installed base refers to the entire set of disparate systems and associated processes, the notion of digital debt provides a refined conceptualization of those specific elements that require significant maintenance and reduce the capacity for evolution in particular contexts. Moreover, in accordance with the concept of digital options, the development and utilization of a platform can also introduce digital debt into the digital infrastructure as a result of intimate interdependencies. Table 2 summarizes the core concepts explaining the idea of the digital transformation of the balance between options and debt.

The influence of digital options and digital debt on platform management is not an expression of dualism where options are inherently “good” and debt is “bad.” Some options may be so complex and uncertain that their exercise becomes unlikely, while digital debt can be introduced strategically to improve platform management. Thus, digital options and digital debt are interdependent; while they may limit one another during the platform management process, they are not necessarily in opposition.

It is important to emphasize that the interaction between options and debt can occur during various phases of (1) the identification, development, and exercise of digital options, as well as (2) the implementation, evaluation, and resolution of digital debt. When a company develops and exercises new options—for instance, to update a platform—the generation of digital debt may be incurred to strategically accelerate the process. Conversely, digital debt can hinder the develop-

Table 2
Options and Liabilities Associated with Digital Platforms

No.	Concept	Definition	Examples	Processes
1	Digital Option (Asset)	The opportunity to invest in new assets, technical, and information functions that enhance the platform's value proposition	New digital (intellectual) assets. Improvements through platform updates. Development of new platform functions.	Identification and Development of new options. Exercise: Integrating new content, technical and information functions into platform's infrastructure and processes.
2	Digital Debt (Liability)	The accumulation of various obligations related to management, maintenance, and development of the platform. All that increases operational risks.	Financial liabilities (royalty payments to authors/investors). Legal obligations (copyright compliance). Lack of updates of platform configurations.	Planning future obligations. Evaluation: Examining and prioritizing debt by type. Resolution: Fulfilling commitments to settle digital debt partially or fully.
3	Platform management based on a balance of options and debt	The interaction between digital options and digital debt during platform utilization, accounting for reactions to both internal and external events.	Digital options can increase or decrease the ability to resolve debt. Debt can facilitate or hinder the exercise of digital options.	Platforms may incur digital debt to exercise attractive options. Platforms may use digital options to reduce existing digital debt.

Source: compiled by authors

ment and exercise of digital platform options. For example, it may make the transition to a new software version more costly. On the other hand, digital debt can facilitate the identification, development, and exercise of new digital options.

Conclusion

The conducted research has allowed for the development of approaches to comprehensive understanding of the digital transformation of investment opportunities within the sphere of the noonomy. Noonomy is viewed as a fundamentally new social order that transcends the boundaries of the traditional knowledge economy and is based on the priority of reason, the free dissemination of knowledge, and collective creative activity.

In the theory of the noonomy, the noo-transition is interpreted as a management paradigm where priority is given to human decision-making, ethical norms, and the public benefit. In the context of this noo-transition, digital assets and platforms take on special significance; they become tools for collective creation rather than just profit-making. This requires a rethinking of evaluation criteria, shifting the focus from short-term financial returns toward contributions to the development of collective intelligence and sustainable public benefit. Digital platforms are integrating in ecosystems where knowledge and assets circulate freely, and risks are distributed in light of ethical and social imperatives.

The interconnection between the noonomy and digital investment processes is manifested in the necessity of accounting for a global ethical context (e.g., the principle of "a person does

not harm a person or the environment”) and adapting asset management models to the logic of cognitive cooperation rather than competition. It is essential to integrate technology – including artificial intelligence – into systems oriented toward the fair distribution of benefits and the minimization of destructive consequences.

This study has shown that the successful development of investment opportunities in the era of noo-transition requires a systemic approach to managing digital assets and liabilities. It demands taking into account the specifics of the noonomy (the free distribution of knowledge, the priority of creative activity, and ethical imperatives) and the integration of technological, social, and cultural aspects into a unified management paradigm.

The theoretical significance of this work lies in advancing the methodology for evaluating the investment opportunities of digital platforms through the lens of the option-based approach, as well as in the conceptualization of “digital debt” as a complex of financial, legal, technical, and informational liabilities. The findings may be utilized both in the academic community – to deepen the theories of noonomy and the digital economy – and in practical applications – to optimize investment processes on digital platforms while accounting for global challenges and ethical norms.

Promising directions for further research include the development of risk assessment methods for investing in digital intellectual assets based on noonomy principles, the study of how technological innovations influence digital debt dynamics in the context of cognitive cooperation, and the adaptation of the proposed concept to other sectors of the digital economy within the ethical framework of the noo-transition.

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The research was conducted as part of the research project entitled “Development of a Concept for Investment in the Field of Intellectual Property Based on Project and Equity Financing and Tax Incentives,” in accordance with the State Assignment for the Federal State Budgetary Educational Institution of Higher Education “Russian State Academy of Intellectual Property” (2-GZ-2025).

References

- Bodrunov S.D. (2025). Noonomy as a Paradigm of Global Development // Noonomy and Noosociety. Almanac of Scientific Works of the S.Y. Witte INID Vol. 4, No. 2. P. 13–33. DOI: 10.37930/2782-618X-2025-4-2-13-33
- Voronov V.S., Viktorov E.I. (2025). The Digital Investment Environment of Platform Ecosystems as a Factor in the Transformation of the Nature and Role of Labor in the Context of Noonomy // Noonomy and Noosociety. Almanac of Scientific Works of the S.Y. Witte INID Vol. 4. No. 2. P. 85–94. DOI: 10.37930/2782-618X-2025-4-2-85-94
- Voronov V.S., Viktorov E.I. (2024). The Digital Platform as a Tool for Managing the Commercialization Process of an Intellectual Asset Portfolio // Fundamental Research. No. 11 P. 10–14. DOI: 10.17513/fr.43706
- Black F., Scholes M. (1973). The pricing of options and corporate liabilities // Journal of Political Economy. Vol. 81(3). Pp. 637–654. DOI: 10.1086/260062
- Bowman E.H., Hurry D. (1993). Strategy through the option lens: An integrated view of resource investments and the incremental choice process // Academy of Management Review. Vol. 18(4). Pp. 760–782. DOI: 10.5465/amr.1993.9402210157

- Kallinikos J., Aaltonen A., Marton A. (2013). The ambivalent ontology of digital artifacts // MIS Quarterly. Vol. 37(2). Pp. 357–370. DOI: 10.25300/MISQ/2013/37.2.02
- Li Z., Avgeriou P., Liang P. (2015). A systematic mapping study on technical debt and its management // Journal of Systems and Software. 101 (March). Pp. 193–220. DOI: 10.1016/j.jss.2014.12.027
- Rolland K.H., Mathiassen L., Rai A. (2018). Managing Digital Platforms in User Organizations: The Interactions Between Digital Options and Digital Debt // Information Systems Research. Vol. 29(2). Pp. 419–443. DOI: 10.1287/isre.2018.0788
- Sambamurthy V., Bharadwaj A., Grover V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms // MIS Quarterly. Vol. 27(2). Pp. 237–263. DOI: 10.2307/30036530
- Sandberg J., Mathiassen L., Napier N. (2014). Digital options theory for IT capability investment // Journal of the Association for Information Systems. Vol. 15(7). Pp. 422–453. DOI: 10.17705/1JAIS.00365
- Tom E., Aurum A., Vidgen R. (2013). An exploration of technical debt // Journal of Systems and Software. Vol. 86(6). Pp. 1498–1516. DOI: 10.1016/j.jss.2012.12.052
- Yoo Y., Henfridsson O., Lyytinen K. (2010). Research commentary – The new organizing logic of digital innovation: An agenda for information systems research // Information Systems Research. Vol. 21(4). Pp. 724–735. DOI: 10.1287/isre.1100.0322

Information about the authors

Victor S. Voronov

Professor of the Department of Innovation Management and Intellectual Property Commercialization, Russian State Academy of Intellectual Property, Doctor of Economics, Associate Professor (55a Miklukho-Maklaya ul., Moscow, 117279, Russia).

E-mail: voronov.v@rgiis.ru

Veronica R. Smirnova

Chief of the Department of Innovation Management and Intellectual Property Commercialization, Russian State Academy of Intellectual Property, Doctor of Economics, Associate Professor (55a Miklukho-Maklaya ul., Moscow, 117279, Russia).

E-mail: Smirnova@rgiis.ru

Sergey V. Chernyavskiy

Central Economics and Mathematics Institute of the Russian Academy of Sciences, Doctor of Economics, Professor (47, Nakhimovsky Prospekt, Moscow, 117418, Russia)

E-mail: vols85-85@mail.ru