Blockchain and the institutional complexity: post-institutionalism vs. neoinstitutionalism

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Abstract

From the point of view of modern neo-institutional economics, blockchain is an institutional technology that minimizes transaction costs and leads to the elimination of intermediation. Using the example of the blockchain, I demonstrate the possibilities of post-institutionalism – a new generation of methodologies and theories of institutional analysis, alternative to neo-institutional economics. Based on the theory of transaction value, I argue that the blockchain technologies will not radically reduce transaction costs, but will reorient intermediaries to improving the quality of transactions and expanding the offer of additional transaction services. Using the theory of institutional assemblages, I argue that it is impossible to form a homogeneous system of blockchain-based institutions associated exclusively with the principles of decentralization, transparency and openness. Blockchain-based institutions will be of a hybrid nature, combining elements of opposing institutional logics – regulatory and algorithmic law, Ricardian and smart contracts, private and public systems, uncontrollability and arbitration.

Keywords: institutions, institutional complexity, transactions, transaction costs, transaction value, post-institutionalism.

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Introduction

Blockchain is a digital technology for keeping replicated distributed ledger. It ensures the implementation of transactions by equal participants in a digital format without the involvement of intermediaries. Typically, the blockchain is associated primarily with cryptocurrencies (primarily with Bitcoin) and their mining. But this technology now goes far beyond the borders of the financial sector and in the future will cover most of the transactions. The key technologies in the blockchain ecosystem — smart contracts, asset tokenization, and decentralized

applications[1] — can cause many changes in the organization of business processes, the activities of government agencies, and people's daily lives. These changes are mainly related to the decentralization of transactions, their automation (more precisely, algorithmization, since the blockchain is based on consensus algorithms) and a drastic decrease in transaction costs.

The blockchain seems to me a good example for demonstrating the obvious limitations and deficiencies of the traditional approaches of institutional analysis in studying phenomena of high complexity. Complexity is an insurmountable barrier for modern neoinstitutional economic theory, all the tools of which are "sharpened" for the study of fairly simple institutional structures of pre-network capitalism. We often forget that neoinstitutional theories of transaction costs and institutions as the rules of the game were created at the turn of the 1980s and 90s. (Williamson, 1985; North, 1990), i.e. before the advent of the Internet, which radically transformed the entire institutional system. These theories are already failing when trying to use them to analyze modern institutions. But in the world with a widely used blockchain, they will become quite archaic. Moreover, the failures of these theories have only become aggravated as a result of the dramatic complication of the reality they describe. But these failures are generated by internal defects of neoinstitutional theory, first of all, by its one-sidedness.

Further, I will show that studying the blockchain only from the point of view of the theory of transaction costs, as S. Davidson, P. De Filippi and J. Potts do, gives an extremely distorted idea of it and requires addition from the point of view of the transaction value theory. In addition, blockchain-based institutions research suggests applying the institutional assemblages theory approach. This will make it possible to shift the emphasis on heterogeneity, hybridity, modularity, fragmentation and fluidity of fluidity as critical properties of the economic institutions of capitalism today - and especially after the massive introduction of blockchains. These new theoretical approaches relate to the arsenal of post-institutionalism - the avant-garde direction of institutional research, revising methodological conventions and dogmas of neoinstitutional theory from the standpoint of their adequacy for studying the institutional complexity of modern economic and social systems[2].

Blockchain and transaction value

Like any other technology, blockchain should be considered from the standpoint of two influential theoretical approaches - Schumpeterian and Coasian (Davidson, De Filippi, Potts, 2018. P. 640.).

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[1] Smart contracts are automatically executed (self-executable) contracts in the form of a blockchain-based computer algorithm. Decentralized Applications (DApps) - smart contracts outside financial relationships. Tokenization - transfer of ownership of tangible and intangible assets into digital format (tokens).

[2] The research program, as well as the conceptual framework of post-institutional analysis, is still in the formative stage (Cleaver, 2012; Cleaver, De Koning, 2015).

In terms of the Schumpeterian paradigm, blockchain is a radical disruptive innovation and (potentially) general purpose technology. The blockchain's radicalism is associated with the great depth of the transformations of technology, infrastructure, markets and society that it generates. In addition, the blockchain can dramatically reduce the average level of transaction costs. Blockchain as a disruptive innovation will lead to the emergence of new, more efficient models of business, regulation, consumption, etc. The result is a new "blue ocean" (unoccupied market space) (Kim, Mauborgne, 2005), as well as "blue" seas, bays, lagoons, lakes and smaller market niches with (as yet) extremely low competition. The blockchain has the characteristics of a general purpose technology (GPT) (Pilkington, 2016; Kane, 2017), namely, a variety of application areas and good compatibility with other technologies (technological complementarity). Since the blockchain is transforming GPT (Lipsey, Carlaw, Bekar, 2005), it is highly likely to create a huge "tree" of technology trends and applications. Based on the blockchain, a multi-level ecosystem with a long-term self-development potential will be formed. This guarantees the emergence of new generations of blockchain technologies and related breakthrough and improving innovations. In fact, the blockchain will increase the cumulative productivity of all factors of production and will create a cascade of constructive-destructive processes and effects (including indirect and deferred), and it will also cause serious transformations of industries, professions and institutions.

The Shumpeterian view of the blockchain can be constructively complemented with the viewpoint of the Coasean paradigm. From this point of view, the blockchain is regulatory (De Filippi, Hassan, 2016) or, more generally, institutional technology for implementing decentralized transactions without intermediaries and minimizing transaction costs (Davidson, De Filippi, Potts, 2018. P. 641). Blockchain eliminates the need for intermediaries - the state, banks, notaries, auditors, brokers, insurers, accountants, lawyers, etc. As a result, the blockchain can radically reduce the costs of transactions and increase the efficiency of all economic processes and systems, regardless of their scale and specificity. The blockchain will erase "paper footprint" and speed up the execution of transactions, facilitate the authentication of assets and the tracking of contract performance. Blockchain is a disruptive institutional technology because it destroys the order of transactions that exists in almost all markets and implies the existence of intermediaries. From the point of view of Coaseans, the blockchain in the long term eliminates the system of intermediation in the markets as an institutional fact. In the Coasean sense, the blockchain ranks with the main economic institutions of capitalism — the market, the firm, and the state — and acts as an alternative mode of economic coordination (Davidson, De Filippi, Potts, 2018. P. 641). Moreover, it can be stated with high confidence that the blockchain is an institutional GPT that can create qualitatively new types of transactions and contracts, business models and institutions. As a result, the blockchain will destroy many of the fundamental elements of the former (pre-digital) institutional order.

But is the Coasean (neo-institutional) approach, focused on minimizing transaction costs, sufficient for understanding the real institutional nature of the

blockchain and determining the prospects for its evolution? My answer is definitely not.

Like other effective institutional innovations, blockchain significantly reduces transaction costs (Davidson, De Filippi, Potts, 2018. P. 648-653). Thus, blockchain has a positive effect on the effectiveness of various types of economic activity and the economy as a whole. This is a conventional view in Coasean paradigm (and, generally, in new institutional economics), which is shared as by scientific and by expert community. Blockchain has big potential to reduce transaction costs (Blockchain, a catalyst ..., 2017. P. 17), creates numerous opportunities for drastically reducing transaction costs (Blockchain Technology ..., 2017. P. 1), significantly reduces the time and costs of transactions (Morabito, 2017. P. 26), and so on. Here are the costs of regulation, verification, ensuring security, storing transactional data, monitoring opportunism, etc. By systematic influence on minimizing transaction costs, blockchain is even compared with Protestant ethics (Hazard, Sclavounis, Stieber, 2016), which, according to Max Weber, was the catalyst for the formation of capitalist institutions.

But recognition of the fact that blockchain comprehensively reduces transaction costs (and therefore it is not Schumpeterian, but Coasean or institutional technology) is still not enough to understand its real complexity. Institutional technologies should not only reduce transaction costs, but also increase transaction value. In the case of blockchain, this is more than obvious.

The theory of transactional value so far has exclusively a framework character and occupies peripheral positions in modern institutional economics. More precisely, this theory is almost indistinguishable on the map of institutional ideas[3]. Rare and too narrowly specialized works in this area have not developed into a critical mass that can lead to a serious revision of the dominant neoinstitutional approach. Neoinstitutionalists unilaterally consider institutions and institutional technologies exclusively in terms of minimizing transaction costs. At the same time, the transaction value generated by institutions and technologies is usually ignored. Transaction value is a combination of various positive effects for participants in transactions. The implementation of any transaction leads not only to its main result (for example, buying and selling goods and services, obtaining a loan, transferring money, etc.), but also to the mass of additional results or effects, which together characterize the quality of the transaction. The sum of the costs of a single or complex transaction (total transaction costs) includes the costs of obtaining both the main and additional results. In the institutional system based on intermediation, both the main and additional results of the vast majority of transactions can be acquired on the market as transactional services of intermediaries. Then “transaction services are the observable element of transaction costs” (Wallis, North, 1986. P. 99)[4]. Moreover, the proportions of

[3] A pioneering article on this issue (Zajac, Olsen, 1993) was devoted to the management of interorganizational interactions and strategies, which did not contribute to its serious perception by institutional theorists.

[4] In this regard, Wallis and North pointed to "a common but erroneous perception among corollary benefit" (Wallis, North, 1988. P. 654).

transaction costs associated with obtaining the main and additional results of transactions vary depending on their quality. Hence the difference in prices, for example, for standard and premium services of lawyers, realtors, insurers and other intermediaries. In an institutional system based on blockchain, the main results of most transactions are provided by algorithms, i.e. carried out automatically, without the intermediaries. However, additional transaction services that form the quality of transactions can not always be provided with blockchain technologies.

From the point of view of the theory of transaction costs, the blockchain crowding out intermediaries as a "necessary evil" of a market economy — and a source of excessive transaction costs, which are due to the established institutional order — has extremely positive consequences. Moreover, the disappearance of intermediation is inevitable, since the costly trust in the intermediary (trusted third party) is replaced by free trust in the blockchain protocol (Davidson, De Filippi, Potts, 2018. P. 644). However, from the standpoint of the theory of transaction value, the complete elimination of intermediaries is nothing more than an illusion, although the scope and forms of intermediation will certainly undergo significant changes. However, even if blockchain dominates, intermediaries will be able to add value to participants in transactions, so their services will be in demand.

For example, blockchain competitors in the field of cashless payments - for example, Visa and Master Card - offer many additional services: direct discounts and cashbacks, accumulative bonuses, special privileges and offers from partners in various fields (from transport services, recruitment and software for business to travel, restaurants, museums, attractions, educational courses, etc.). All this is an additional transaction value for users of the cashless payment systems. Key players in the field of distributed (cloud) data storage - Google, Apple, Microsoft, Dropbox, Amazon, etc. - also offer additional features. These include unlimited storage, synchronization between devices, recovery of deleted files, setting access levels, using a corporate account for collaboration, file encryption, etc. These are also elements of transaction value.

In the case of banks and exchanges, which are expected to become the main victims of the blockchain, the approach of transaction cost theory is also shows its limitations. Of course, if the bank is understood only as an intermediary institution with the function of centralized ledger maintenance, then it is obvious that switching to the blockchains (that is, decentralized ledgers) automatically undermines the demand for banking services (McMillan, 2014; MacDonald, Allen, Potts, 2016). But we should not forget that banks provide a lot of additional services in the area of minimizing risks and improving the quality of transactions. Among them are co-branded cards, preferential credit programs, reversibility of transfers, insurance, biometric authentication, customer support system, tax refund, cost management, geolocation offers, interactive interface, etc. It is extremely difficult to give generalizing legal definition to modern banking (McMillan, 2014. P. 8) due to the variety of additional transaction services.

The exchanges also offer a set of transaction services besides intermediation and, accordingly, "production" prices. Thus, post-trade services (clearing, depository and settlement operations, etc.), market analytics, IT-support and other

services now make up 35% of the total income of stock exchanges (OECD ..., 2016. P. 123). Such services (and the associated transaction value) are not offered by decentralized exchanges - blockchain-based trading platforms. In addition, pre-trading and post-trading services are an extremely important product of capital market infrastructure providers, such as trading platforms, clearing organizations, inter-dealer brokers, depositories, specialized service companies (Capital Markets ..., 2017. P. 4).

The elimination of intermediaries will undoubtedly reduce the cost of transactions, but will clearly lead to a drop in their quality, in particular, will cause a systemic increase in risks. It is not by chance that in 2017, the U.S. Securities and Exchange Commission equated tokens issuers (attracting investors' capital through ICO)[5] to traditional issuers of equity securities, extending to them all the norms of current legislation (Report ..., 2017. P. 17-18). Such a decision is quite logical, since digitization in the case of ICO affects only institutional form of transactions, but not their content (investment attraction), while the requirements for the issuer in the case of ICO are minimal. The negative effects of ICO (including the growth of fraud, the increase in the number of obviously unreliable issuers and over-risky projects) clearly outweigh its positive consequences - and are not compensated for by eliminating the middlemen as such.

In general, the prerequisites for the active implementation of the blockchain are created by an overproduction of low-quality transactional services in the vast majority of markets. Therefore, the result of the large-scale “blockchaining” of the economy will be the optimization (in the sense of reducing) the scale of the transaction sector. This will be achieved at the expense of crowding out archaic and traditional forms of intermediation based on the exploitation of imperfections and defects of market institutions and being sources of excessive, economically unjustified transaction costs for participants in transactions. But at the same time, contrary to the forecasts of neoinstitutionalists (Davidson, De Filippi, Potts, 2018. P. 640, 643-644), there will not be a complete disappearance of intermediary activities - most of them will be reformatted. We should expect a massive reorientation of intermediaries to improve the quality of transactions and related transactional services. In other words, there will be a tougher competition of intermediaries in the area of production of transaction value, and not in the area of reducing transaction costs. In the new reality, the cost of intermediaries will be extra costs for additional high-quality transaction services – knowledge intensive, highly specialized, customized, etc.

At the same time, traditional intermediaries will actively use blockchain technologies - for example, private blockchains and incorporative blockchain applications (O'Dair, 2019. P. 26), - which increase the efficiency of transactions without requiring radical reformatting of existing institutions. As a result, intermediaries will benefit from the reduction transaction costs, but at the same

[5] ICO (initial coin offering) is an alternative IPO (initial public offering) and a much cheaper way of attracting investments through crowdfunding, which initially did not require compliance with strict regulatory requirements for public companies.

time block the scenario of dismantling the intermediation system (Carson et al., 2018. P. 4-5). The transaction sector will become more compact and efficient, and the volume of excess transaction costs (payment imposed on intermediaries transaction services) will decline sharply. Intermediaries will be ousted from the lower price segments and (gradually) will no longer be perceived as "system-imposed" sources of transaction costs. They are transforming their value proposition to ensure high-quality transactions. It is in this direction that banking innovations are now intensified, in particular.

Already, a new generation of intermediaries in the financial markets - Fintech companies - are not just reducing transaction costs for their clients; they offer them additional transaction value: "Their superior value proposition is based on the argument that they are able operate with an innovation agility that traditional banks are unable to provide, have a better understanding of today's technologies and are able to laser focus on narrow solutions to the exact needs of the customers" (Molnár, 2018. P. 45). In my opinion, the basis of value propositions of intermediaries in the era of blockchains will be hyper-relevant transaction services associated with continuous, interactive, highly personalized offers based on anticipating the needs of each customer. This will be achieved with the help of digital technologies – predictive analytics, artificial intelligence, and digital assistants (Accenture Strategy, 2017; Wollah et al., 2017). The intermediaries of the new generation will focus on creating additional transaction value for consumers in new areas of customer experience, as well as on building trust capital as a critical factor in hyper-personalization.

The blockchain in combination with other digital technologies creates the most comfortable conditions for the development of interactive organizations of a market-like type - platforms. Platforms are not so much multilateral markets as in their traditional interpretation (Rochet, Tirole, 2003; Evans, 2003), but rather multi-actor "spontaneous organizations" (MacDonald, Allen, Potts, 2016. P. 286), which are institutional alternative to traditional organizations. However, platform analysis only from the standpoint of minimizing transaction costs (Martens, 2016, P. 17) is too narrow. Blockchains does not eliminate transaction costs in general, but changes their causes and specific forms. In particular, market failures are replaced by no less destructive platform failures. There are examples of parallel reduction in transaction costs for some actors of platforms and increase for others. Thus, blockchain recruitment platforms simultaneously reduce transaction costs for employers and increase them for freelance workers, who are also delegated the main risks (Drahokoupil, Piasna, 2017). In addition, rating assessment systems based on user feedback often exacerbate failures of the platforms (Querbes, 2018. P. 641).

It is important that platforms are not so much intermediaries (in the traditional sense), as moderators. They do not just facilitate transactions (reducing their costs), but provide participants with a wide range of transaction services, linking networks of developers and networks of consumers into a single ecosystem of value co-creation. Therefore, in the near future, integrated platforms will become dominant. They will combine the possibilities of transactional, innovation

and investment types of platforms (Evans, Gawer, 2016. P. 21). Such integrated platforms will allow you to quickly form networks and communities around new projects, attracting investment, connecting many developers and forming collaborations, creating and promoting new products to the market and quickly receiving feedback from consumers. But the rise of the platforms happening before our eyes is the result not only and not so much of their minimization of transaction costs, as of offering a unique transaction value.

So, considering the blockchain in the Coasean sense - as an institutional general purpose technology - it is necessary to take into account not just the reduction of excessive transaction costs, but, above all, the maximization of transaction value provided by the blockchain technologies. The blockchain's value proposition varies depending on the types of transactions (and, more broadly, types of economic activities)[6], so its implementation will not lead to the widespread destruction of intermediation, but will inevitably cause its institutional transformations of different depths. In general, intermediaries under pressure from blockchain technologies will have to emphasize the transaction value delivered to customers - additional services that improve the quality of transactions. This trend will affect all intermediaries without exception - from banks, stock exchanges, auditing and insurance companies to streaming music services.

Blockchain as an institutional assemblage

Analysis of the blockchain from the standpoint of its institutional complexity requires the abandonment of the fundamental method of the new institutional economic theory - a comparative analysis of discrete institutional alternatives. Further, we will show that, in principle, a blockchain cannot be systematically described by any discrete institutional alternative separately and does not constitute a homogeneous institutional system. The blockchain generates not a homogeneous, but a multifaceted, heterogeneous, hybrid institutional system. Therefore, it is promising to use another post-institutional approach - the theory of institutional assemblages.

The assemblage is a “roomy” interdisciplinary term introduced by the philosophers Gilles Deleuze and Felix Guattari in the 1970s and 80s (Deleuze, Guattari, 2005) [7]. The assemblage in the most general sense is understood as the set of elements of a fundamentally different nature, united by their co-functioning (Deleuze, Parnet, 1977. P. 52). At the same time, integration into the system does not follow from the internal logic of its elements: being interconnected, they remain fairly autonomous (DeLanda, 2016. P. 2). Parts of the assemblage do not form a seamless monolithic or “organic” whole (Delanda, 2018. P. 10-11), and the

[6] For example, in the field of commercial real estate, blockchain is best suited for automating short-term rental relations with a large number of tenants (Blockchain in ..., 2017. P. 14.).

[7] More precisely, it originated in the English translation of the term “agencement”, the key one for the book of Deleuze and Guattari.

assemblage itself does not become a totally integrated unity: after all, assemblages are hybrid and fuzzy systems constructed from heterogeneous parts.

Like any other systems, assemblages are characterized by synergy (mutual reinforcement of elements, which creates an effect that exceeds the total) and emergence, i.e. the presence of system properties that are not reducible to the properties of elements. But, unlike standard systems[8] with their unitarity, solidity and homogenization, assemblages are characterized by other key properties - heterogeneity, redundancy, modularity, interchangeability, multifunctionality, hybridity, fragmentation, entanglement, plasticity.

In this sense, the theory of assemblages, like "assemblage thinking is about relations, heterogeneity, and differences rather than parts, homogeneity, and similarities" (Kamalipour, 2015. P. 404). In assemblages, instead of identical elements, there are functionally diverse modules. Modules are fairly free to add, are interchanged and replaced by others; while the modules interact, but also compete with each other.

The basis of assemblages is a symbiosis of heterogeneous and largely independent elements. A classic example of assemblage is a knight on horseback (Deleuze, Parnet, 1977. P. 52), which, if we continue this metaphorical line, is fundamentally different from the centaur, i.e. totally integrated system[9]. It is not by chance that it is organismic metaphors that are most consistently and severely criticized by the theory of assemblages. Another example of assemblage given by Deleuze and Guattari is the plant and its insects pollinating it (Deleuze, Guattari, 2005. P. 10). Wasp and orchid as heterogeneous elements, as completely different self-sufficient entities belonging to different biological kingdoms, form a symbiosis in the process of co-evolution. This symbiotic system is not inseparable: both wasps and orchids can exist completely independently of each other. However, they are interdependent during the pollination period, when wasps receive nectar, and orchids transfer pollen. If in standard systems all elements are connected by logically necessary relations resulting from their nature (and the internal logic of development), then in assemblages these relations can only be relatively obligatory, that is, they become obligatory during co-evolution (Delanda, 2018. P. 20).

Assemblages are characterized by high adaptability and plasticity, even fluidity. Since assemblages are not organic unities and combine intertwining heterogeneous elements, they are constantly experiencing internal tensions and therefore are in a fluid reassembly process. Such a reassembly is a co-evolutionary process of self-organization and self-ordering, "in which the elements put together are not fixed in shape" (Law, 2004. P. 42). If we use mechanistic metaphors, then a

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[8] Standard systems are understood to mean systems whose elements form an inseparable, monolithic whole.

[9] A knight on the horse combines ontologically diverse elements - a rider, a horse, weapons and equipment (stirrups, harness, horse armor, etc.) - and it is a typical "assemblage of war" (Deleuze, Parnet, 1977. P. 52). But this assemblage can be easily disassembled into modules and transformed: for example, the rider is transferred to the infantry, the horse - to the quartermaster service, and the weapons and ammunition are redistributed between warriors.

standard system (even a complex adaptive system) is always a transformer, whose variations are structurally limited and rigidly defined by its internal logic. On the contrary, assemblage is a Lego constructor in which practically any object can be assembled from a mass of modules of various shapes.

The total lack of attention of institutional economists to assemblage themes is a serious omission that needs to be corrected. In my definition, institutional assemblages are hypercomplex systems of institutions based on parallel existing institutional logics and orders[10]. Institutional assemblages are hybrid and flexible systems of multifunctional, intertwining, and intersecting institutions governed by alternative principles. For them, hybridity, modularity, polycentricity, interactivity, redundancy, fragmentation, plasticity and fluidity are not only organic properties, but, above all, evolutionary competitive advantages.

The confusion of parallel institutional logics, including those that are poorly compatible, fundamentally different, and even alternative, is a source of constitutive features and internal contradictions of institutional assemblages, since connections between their elements are created across different natures (Deleuze, Parnet, 1977. P. 69). But the hybridity of institutional logics does not exhaust the nature of institutional assemblages[11]. This is not just a random or temporary combination of weakly compatible logics. No, in the case of institutional assemblages, the symbiosis of logics is an organic and natural consequence of their nature. This is due to the functional redundancy and modular structure of assemblages: in the seeming conflict of internal logics, in fact, there is a guarantee of the stability of these hypercomplex systems. When the complexity and turbulence of the environment grow rapidly, it is assemblages that have the most adaptive efficiency.

The digital economy (including blockchains) has a pronounced assemblage nature. This is manifested in the mixing and hybridization of elements of the real and virtual, living and inanimate, natural and humanitarian, commercial and non-commercial, industrial and service, material and digitized worlds. But no matter how many of these dissimilar elements are mixed and "whipped", they never form a homogeneous mixture. They remain hybrids, which accounts for the internal inconsistency of digitalization. At the same time, the continuous and ubiquitous fragmentation of value chains and value co-creation ecosystems actually leads to a total modularization of the digital economy. The smallest modules become the units of business - extremely atomized elements of business processes, i.e. any activities and even operations that can be functionally distinguished from others. Digital technologies allow you to effectively manage these modules and they (modules) become the basis of the new generation of competitive strategies. For example, Fintech startups successfully attack traditional financial institutions by focusing on "microscopic" elements - discrete modules –of their business models

[10] Institutional logics are the sets of fundamental values, principles and beliefs that underlie institutions.

[11] Absolutization of this property is a weak point of the theory of hybrid organizations, closely adjacent to the theory of institutional assemblages.

(Bhatt, 2017. P. 106-111). The combination of hybridity and modularity in digital technologies and business processes will inevitably affect the specifics of related institutions, making them attractive objects for the theory of institutional assemblages. After all, the study of those areas where any boundaries are absent in principle, requires new, analytically more capacious categories. Just such a category are assemblages.

Blockchain inevitably leads to the creation of new economic activities and new ways to enhance the effectiveness of existing activities. As a result, new modes of coordinating activities based on blockchains — blockchain-based institutions — are emerging. Institutions related with any technology always reflect its substantial specificity, acquiring similar features. For example, the institutions of the network economy embody the principles of building the Internet and Web 2.0, including social networks and new media — just recalling definition of institutions as cognitive media (Aoki, 2011). Institutions of an industrial society are most relevantly described in terms of mechanisms, tools, friction, etc. In the case of blockchain-based institutions, it can be safely assumed that these institutions will be much more complex than modern ones, and (apparently) these will be institutions of a qualitatively new type (Davidson, De Filippi, Potts, 2018. P. 641, 654). In this sense, the role of the blockchain is not so much to increase the effectiveness of the existing system of capitalist institutions, but rather to increase its quality progressively - due to the massive introduction of a new type of institutions having blockchain nature and expanding the diversity of their specific forms of application.

Institutions based on the blockchain will have pronounced assemblage features and properties. The redundancy associated with functional duplication of modules (nodes) is technologically built into the architecture of decentralized ledgers. Unlike traditional databases, which presuppose centralized storage and management, the distributed ledger is copied synchronously to all computers of the blockchain participants. Such redundancy (or modularity) is a typical and, moreover, constitutive characteristic of assemblages, as well as hybridity. But even more important for the systemic understanding of the future of blockchain is another property of institutional assemblages - their fluidity, i.e. continuous variability, non-fixability of boundaries and states, therefore assemblage systems often look like poorly structured, “loose”, fuzzy, blurred. It is impossible to determine them once and for all, therefore, below I will consider only a few of the most obvious manifestations of the assemblage nature of blockchain-based institutions.

Blockchain is a symbiosis of regulatory and algorithmic law. Any technology necessarily generates related institutions that determine the modes of coordination of economic activities based on this technology. But each technology also includes institutions integrated into it — technical rules and prescribed practices of technologically conditioned actions — that literally “tells us what to do and how to do it, often in a more compelling manner than the law does” (Lanzara, 2009. P. 13). Such technology-integrated institutions will be of increasing importance. It is highly likely that the blockchain will cause an

institutional shift from legal (traditional) rules to code-based rules. Such rules, combined into blockchain protocols, are not controlled by actors, but are created, modified and maintained by decentralized ledgers (De Filippi, Wright, 2018. P. 7). They may comply or not to comply with legal norms, but code-based rules will form the basis of the institutional order in the digital economy. In fact, this is "code-ification" of law, i.e. hybridization of traditional (legal, regulatory) and technological (algorithmic) law, when smart contracts will be used more often than traditional ones. In essence, blockchain technologies (i.e., the algorithms underlying smart contracts) will perform the functions of standard contracts, with the result that the law will be increasingly transformed into code (De Filippi, Hassan, 2016). But the complete mixing of legal and code rules still will not happen.

Blockchain is a "bundle" of Ricardian and smart contracts. Contract relations in the digital economy will not be fully implemented by smart contracts (i.e., contracts that are self-fulfilling using blockchain algorithms), despite their enormous effectiveness in reducing excessive transaction costs. Each smart contract will be accompanied by a Ricardian contract - a tool for mediating digital and text contracts, which allows, on the one hand, "translate" an standard legal contract into the "language" of the blockchain, which can be read by an electronic system, and, on the other, give a smart contract legal force and allow lawyers and counterparties to read it in the usual document format. A mandatory combination of Ricardian and smart contracts will become increasingly common.

Blockchain is a hybrid of decentralization and arbitrage. According to many experts, the blockchain is in its essence a decentralization technology (Davidson, De Filippi, Potts, 2018. P. 649). This is largely a consequence of the hype around Bitcoin, which belongs to decentralized models of blockchain. However, in reality, there is a wide range of technologies of distributed ledgers, involving different levels of centralization and various forms of control and governance (Walport, 2016. P. 7). Now the most common are open access blockchains with free entry. But in closed access systems, administrators can be delegated not only the functions of checking and admitting (or not admitting) new members to the system, but also the exclusive right to add entries to the ledger, the right to cancel previously confirmed transactions, etc.

The illusion of the disappearance of intermediaries replaced by blockchains must be overcome. An example of a governed blockchain is the EOS blockchain platform, which is one of the five leaders in the world ranking of cryptocurrencies CoinMarketCap and set a world record for attracting investment through ICO. The main document of the platform - the EOS Constitution - introduces an EOS Core Arbitration Forum as a dispute resolution body, and also assigns a significant level of authority to the arbitrators. Certification and verification of participants and transactions are especially important for the Internet of Things, international and wholesale trade, etc., where the prospects for hybrid models of blockchain are obvious now.

According to neoinstitutionalists, blockchain technologies will lead to the creation of a new type of economic institution - a decentralized collaborative

organization (DCO)[12] (Davidson, De Filippi, Potts, 2018. P. 654). In DCO there is no hierarchy (as opposed to traditional firms); they carry out both exchange and production (as opposed to markets). The power in DCO belongs to the many owners of tokens, while all employees are engaged in project work through smart contracts. In addition, employees have a rating determined by other owners of tokens, and reaching its minimum threshold results in automatic dismissal. However, neoinstitutionalists are actually forced to resort to tricks: for example, they refer to the work of M. Atzori only in part of the positive assessment of the DCO, keeping silent about the fears and risks expressed in it. In particular, we are talking about hidden and veiled forms of centralization of power in the DCO, which are gradually becoming more common. It is not only about speculation, information asymmetry and opacity in blockchain systems[13], but also about the formation of a new elite of code developers and the oligarchy of blockchain platforms' owners (Atzori, 2015. P. 29-30). These trends fundamentally undermine the idea of the blockchain's egalitarian nature. Therefore, neo-institutional ideas about the blockchain should be recognized as very naive and generally related to high-tech versions of libertarian utopias. As institutional assemblages, DCOs will never be completely horizontal and will inevitably include significant features of the hierarchy. They will not create a new type of economic order associated with anonymous peer-to-peer interactions based on automatic enforcement of rules through smart contracts (Davidson, De Filippi, Potts, 2018. P. 654). Anonymity will be partial, equality will be undermined by the formation of new elites, and the blockchain's "invisible hand" will face numerous failures.

Conclusion

Blockchain is a complex digital technology that is the basis of fundamentally new ways of coordinating transactions. The blockchain can rightfully be considered an institutional technology that can bring about radical innovations in the current system of economic institutions of capitalism. However, modern neoinstitutional theory offers a rather simplified toolkit for understanding the real institutional complexity of the blockchain. As a result, institutional economists who study blockchain come to one-sided and often idealistic conclusions, predicting the elimination of intermediation, elimination of control, total decentralization, etc. These conclusions are a sad consequence of the moral obsolescence of the methodology of neoinstitutionalism. But it is also the impetus

[12] In essence, this is an analogue of the term "decentralized autonomous organization", which is widely used in modern blockchain practice.

[13] Although the blockchain (like the Internet) was originally created as a non-mediated technology, a number of third parties have emerged in the modern blockchain ecosystem. They are engaged in a profitable business on intermediary services, including those based on hidden information asymmetry between developers and users. In blockchain systems, the emergence of dominant players is quite possible - and this risk is now being realized with increasing clarity. These players can abuse their status, because "whoever controls mining also controls the protocol" (Kritikos, 2018. P. 2), i.e. certification of the validity of transactions.

for the development of a new generation of institutional theories overcoming the built-in limitations of neoinstitutional methodology. I combine such alternatives to neoinstitutionalism under the term “post-institutionalism”.

Using the blockchain example, this paper presented two particular post-institutional theories - the theory of transaction value (which complements the neoinstitutional theory of transaction costs) and the theory of institutional assemblages, which is opposed to the analysis of standard institutional systems.

The neoinstitutional point of view is that the blockchain is a substitute for traditional intermediaries (banks, exchanges, notaries, lawyers, insurers, etc.), replacing these third parties in transactions with technological (software) solutions that minimize transaction costs. However, this conclusion is extremely one-sided (since it focuses only on transaction-cost minimizing), and the underlying Coasean paradigm needs to be expanded by taking into account the transaction value. Blokchain offers cheaper institutional solutions, but the quality of transactions is relegated to the background. Transaction value includes not only the direct result of the transaction, but also a lot of additional transaction services. Intermediaries will actively (and successfully) compete with the blockchain precisely by expanding the range of such services and improving the quality of transactions. This conclusion could not have been made while remaining within the framework of the traditional approach to the theory of transaction costs.

Neoinstitutionalists predict the formation of a homogeneous system of blockchain-based institutions, ensuring total elimination of control, decentralization of transactions and the public nature of databases (registries). From the point of view of the theory of institutional assemblages, this scenario is unrealistic. The hypercomplex institutional systems (assemblages) arising on the blockchain contain - and will always contain - a conflict of multiple institutional logics. This, for example, is a conflict between technological logic (striving for the optimal functionality of software solutions) and bureaucratic logic (aimed at creating restrictions and retaining control). This is a conflict between libertarian logic (anonymity, decentralization, elimination of intermediaries) and ethical logic (reduced potential for carrying out illegal activities of varying degrees). Therefore, it is important to proceed from the fundamental impossibility of convergence of alternative institutional logics and orders. Blockchain-based institutions will inevitably be heterogeneous: for example, they will combine social orders and models of regulation of private (“allowed”) and public, open and closed blockchains. The understanding of organic hybridity, internal conflict, high fragmentation and fluidity of blockchain-based institutions is a consequence of the application of the theory of institutional assemblages leading to the abandonment of idealistic forecasts and scenarios of the future blockchain.

We emphasize once again: the methodology and theoretical guidelines of the new institutional economy are becoming less and less adequate for the study of the institutions of modern digital capitalism. The intensive growth of the institutional complexity of the economy and society requires a transition to a new generation of methodologies and theories of institutional analysis that can be considered post-institutional in relation to neo-institutionalism. Instead of the neoinstitutionalist

mantra on the significance of institutions, post-institutionalism proposes a new motto: “Institutional complexity matters!”. A post-institutional research program is still being developed, but it is already clear that the development of methodologies and theories for analyzing institutional complexity is a top priority task and a critical challenge for the community of institutional economists.

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