

# Trust Technologies as a Basis for the Formation of Intersubjective Interaction in a Virtual Economic Environment

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**Abstract.** The article deals with the formation of intersubjective relations in a virtual environment. Attention is paid to the peculiarities of the implementation of intersubjective relations in a virtual environment, the factors of intersubjective relations are highlighted, the role of trust as an institutional factor in ensuring relations is examined. The models of intersubjective relations based on trust are studied, the change in the historical conditions of intersubjective relations in the context of the development of digital technologies is considered. It indicates the special role of the Internet as a global communication technology that implements the principles of peer-to-peer decentralized relations. The role of the blockchain technology and its ability to provide a model of decentralized trust at the technological level is considered. The decentralized nature of trust in virtual economic environments based on blockchain technology is justified.

It is concluded that the analysis of virtual environments, including economic ones, should use a post-classical scientific approach, that involves the inclusion of the subject in the study as an integral part of the system. In this case, the person becomes a key factor determining the state of the system.

## 1. Introduction

Trust is the basic institutional factor determining intersubjective relations in general in all their manifestations. Moreover, trust is fractal in nature, defining relationships both at the level of individuals and at the level of the enterprise and even at the interstate level. It is obvious that trust is a basic factor of intersubjective relations in the social and economic spheres. It can be argued that trust is the core for systems of institutions are being formed, i.e. rules and principles in accordance with them actors interact.

The current stage of development of society is characterized by total digitalization of all areas of activity and is determined by digital transformation, including intersubjective relations. The development of a virtual economic environment based on the global Internet and associated communication technologies, on the other hand, creates the prerequisites not only for the transformation of existing relations, but also for the formation of new types of them. Virtual economic environment allows you to create and develop new business-models that could not arise without digital technology. It is about technology blockchain, the Internet of things, predictive analytics based on the analysis of big data.

Digital technologies change the basis of intersubjective relations, i.e. trust, formalize it, create pre-requisites for the formation of a trusting environment. This new trusted digital space based on objective mathematically precise algorithms, allow ensure the accuracy of the historical data occurred.

At present, the question of the impact of new technological approaches to determining trust and the potential of using digital trusted spaces in the implementation of virtual economic activity of subjects and the formation of new forms of intersubjective interaction remains open.

## **2. Problem statement**

Trust is the basic factor in any relationship between subjects [1]. Confidence is also defined as a multi-faceted concept with cognitive, emotional, and behavioral dimensions [2]. Analysis that was done by Loebbecke et al [3], allows to highlight the main characteristics of trust:

1. Action. Trust leads to the action of a partner in a trustee relationship. Such an action is risky behavior when the relying party risks losing something. "Willingness to take risks can be one of the few characteristics common to all situations of trust" [4].

2. In any relationship, the trustee-trustee must have one party that trusts (the trustee), and one party that is trusted (the trustee) in any trust relationship. The parties involved may be people, devices, technologies or organizations.

3. Confidence is accompanied by the vulnerability of one person or organization to the results of the actions of another. That is, trust is necessary only in risky and unpredictable conditions, when a trust relationship is deemed vulnerable to a potential negative outcome associated with the use of a trust manager trust management.

4. The subjectivity of trust and the perception of trust is embedded in the trust experienced differently depending on the characteristics and situation of the principal. Blomqvist [5] distinguishes between the measurement of competence and the measurement of trust. Confidence in competence means that the trustee believes in the technical and managerial skills of the trustee and the know-how to carry out the agreed transaction. On the contrary, the trust in goodwill describes the expectation of the principal, that the trustee has no negative intentions and acts in accordance with morality.

The development of information and communication technologies over the past 50 years has created the conditions for the formation of a new technological basis for the development of society as a whole as a civilization. A key role in this process of information transformation is played by the global computer network Internet. Despite the fact that the importance of the Internet as a factor in changing society as a whole and the life of each person individually is devoted to many works, however, current trends in technological development, defined in terms of decentralization, make it possible to take a fresh look at and reassess the impact and significance of the Internet for development civilization.

Initially, the Internet was created on an innovative ideological basis - the ideas of decentralization of development and functioning. As Hoffmann points out, the Internet was created by a "weakly self-organized group of people who contribute to the design and development of Internet technologies" [6]. In this case, the novelty of the Boarding as a medium of subjects interaction consisted in the fact that the new model of interaction of subjects has been realized in him, instead of a model "from the manufacturer to the consumer through a broadcast system (broadcast)" model was implemented In broadcast model subject serves as a consumer and as a producer, entering into direct one-gang relations among themselves - peer-to-peer (P2P) scalable exchange model [7].

Further development of the new model was obtained with the advent of blockchain technology. On the one hand, the blockchain is by its nature a peer-to-peer system, which allowed it to easily adapt to the new model, on the other hand, the development of the Internet-based intersubjective relationship organization made it possible to form a system with a synergistic effect. It is a system that has a strong and reliable trust in intersubjective relations expressed in transactions that all participants in the system have access to thanks to decentralized means of reaching consensus [7].

For the presence of two basic trust models intersubject reviews also indicates Loebbecke et al. They define them as trust architectures that define trust behavior: (1) delegation of authority and (2) intersubjective trust relationships [3].

1. Trust is achieved by transferring authority to a third party or intermediary who forces the parties to act in an expected and consistent manner [8]. Such power third parties can be governments, organizations or companies [9]. Confidence in the actions of the other party is the result of the ability of a third party to enforce the agreed terms of the transaction and its ability to control the behavior of another player [5]. Delegation to a third party is often combined with higher costs and is not always practical [10]. However, it is a good choice if you can attract a third party who is able to ensure the validity of transactions at reasonable costs.

2. intersubjective trust relationships are based on direct trust between the parties involved. This can happen when a trusted player knows other players personally and believes in their goodwill and competence. Such confidence may also arise when the parties to the transaction adhere to common rules and believe that they all behave in an acceptable manner within the framework of common rules [11]. Interpersonal trust on an equal basis is limited to small applications where players have personal connections. In online transactions without any interpersonal contact, this is difficult to achieve [12].

The importance for the development of the blockchain civilization is also indicated by Tampuskot [13]: the creation of blockchain technology is compared in importance with the development of the Internet. This value of the blockchain allowed to get its special properties in relation to transactions, as facts of intersubject interaction that include: efficiency (in the sense of processing speed), constancy (in the sense of immutability in time) and verifiability (in the sense of being able to verify any previously made record and confirm its validity) [3].

### **3. Intersubject interaction in Virtual economic environment**

Intersubjective relations are formed from separate acts of interaction, that are called transactions. At the same time, the subjects of relations should be understood as individual, as well as enterprises, organizations, communities, authorities, and society. To further analyze the impact of digital technology on intersubjective relations, the role of trust in interaction should be considered.

So, for example, Loebbecke et al., analyzes the role of trust in transactions [3]. They indicate that trust is institutional in nature, or rather, it is the institutional basis of intersubjective relations. According to the New Institutional Economics (NIE), that deals with “an analysis of the transaction costs of property rights, contracts and organizations” [14], the economic importance of trust lies in any market transaction. It is based on limited rationality in economic transactions; perfect forecasting and full contracts are impossible. Asset specificity implies that certain investments create a more positive result in this particular transaction than in another [15].

Attention should be paid to research on changes in intersubjective relations in modern society. For instance, in [16] the importance of the role of the bureaucracy in the formation and transformation of the modern system of intersubjective relations is pointed out. In particular, it is determined that Weber’s “ideal bureaucracy” was the basis for organizing the activities of the overwhelming majority of social systems, such as firms, enterprises, organizations, states, in a historical aspect in the first half of the twentieth century. This form of organization of social systems was justified by the existing level of communication or information load within the systems themselves, while the “ideal bureaucracy” was effective. As indicated by Shepard “Bureaucratic systems are designed to perform actions that can be programmed in a stable, predictable environment” [16]. Already in the middle of the twentieth century, it became obvious that environmental conditions became less and less stable and rapidly changing, that determined the need “for organizations of this type that would allow them to quickly adapt to changing conditions” [16]. In the classical scientific paradigm, on the basis of which the concept of Weber’s “ideal bureaucracy” was formed, a person was deprived of subjectivity or subjectivity within the bureaucratic system and was only a bureaucratic function [17]. The changing conditions for the development of society, if necessary, require the formation of a new scientific paradigm, which Vitykh calls postclassical [17], within that the subject is not separated from the object (as classical science does), but, on the contrary, takes into account the correlation of the knowledge gained about the object with individual features of the subject and the means of his activities [18].

In matters of organizing intersubjective relationships in virtual spaces, it is important to understand the fact that the very nature of virtual space (including economic) is artificial. This is a key point in the choice of the scientific paradigm of research. For artificial environments or artificial systems it is native that "decisions taken and implemented by people who are" inside "(and not "out") of the situation, determine the development of this situation. [17]. As Simon noted, "if in natural phenomena everything looks "inevitable", which is caused by the indisputability of natural laws, then artificial phenomena always bear the stamp of "freedom of choice" [19]. It can be concluded that in virtual spaces, subjects have a key role in determining the state of the system. Systems of organization of intersubjective relations should be based on a special system of norms and rules that would take into account the specific nature of the conditions of the relations themselves, i.e. information formalization determined by the technological basis of digital technologies.

The methodology for analyzing the institutional characteristics of the interaction environment of the subjects is discussed in the works of sociologists (for instance, [20, 21]). These studies highlight such components of the institutional environment as conventions, norms and rules. At the same time, conventions are understood as descriptive statements, social instructions providing for the designation and specification of situations, actions and subjects. Normally, an element of responsibility appears, expressed in the "if" clause. The norm is conditionally binding in nature, which is determined by the deontological operators of the ban, requirements and permits. And the third institutional element is the rule, which allows for the authorization of violations and, in addition to the norm, has another part "differently" (for more detail in [22]).

Based on this concept of the structure of the institutional environment of intersubjective relations, we can conclude that the virtual economic environment based on digital technologies is fundamentally different. In the natural or traditional economic environment, the implementation of institutional conventions, norm and rules is required by a third party acting as an arbitrator or a guarantor of compliance with institutional elements. In the virtual economic environment, which is artificial by its nature, and exists on the technological basis of information and communication technologies, that, importantly, are characterized by algorithmic (rules) and formality of standardized protocols (conventions and norms), the environment itself ensures unconditional institutional integrity. In other words, the virtual economic environment is by its nature an environment with unambiguously determined institutional characteristics that exclude the possibility of opportunism. And this, in turn, significantly increases the economic efficiency of the virtual economic environment by reducing transaction costs due to reduced costs of countering and insurance against the opportunistic behavior of the subjects.

As noted Eggerston conventions reduces transaction costs, "abuse and waste of a valuable resource occurs when the measurement and enforcement costs exceed the potential benefits of limiting access to it" [23].

The question of intersubjective relations from the point of view of the influence of the institutional environment is considered by Erznkayn, who uses the concept of institutional strengthening and its types to determine the evolution of institutions. So Erznkayn identifies the following types of institutional strengthening relationships [24]:

1. The institution to itself, but in a different time dimension (for comparing the degree of constancy and variability of the institution, the identity of which can change changes in dynamics - to increase [25]).

2. The institution to the wearer - for transmitting the behavioral characteristics of individuals who are prone to experience varying degree of institutional impact [26, 27, 28].

3. Between the coexisting in synchrony institutions (for expression ability of institutions to operate in association with each other - adding, replacing, reinforcing or weakening a particular combination institutions).

Within the framework of the issue under consideration, the second type of impact is the most interesting - the impact of the institute on its carrier, that is defined as the exogenous impact of the institute [24]. It should be noted that when analyzing the influence of institutions on its carriers, two types of carriers are distinguished: homo institutius ( HI ) and homo economicus ( HE ) [24]. The principal

difference between these two types is the motivation of the institutional choice: HI – the type is inclined to achieve the institutional position, and HE - type is motivated by the achievement of individual economic goals. It should also be noted that in [26] it is noted that all interactions of individuals and their groups can be reduced to market and non-market, or transactions and interactions. This concept provides some insight into the features of the implementation of intersubjective relations in a virtual economic environment. Taking into account that, as was shown above, the virtual economic environment is characterized by a trust model based on the internal self-regulation of the community, expressed in the concept of reputation, it can be concluded that the main participants of virtual economic systems will be mainly HI. From the point of view of the formation of the strategy of behavior of participants in intersubjective relations, behavior will prevail, aimed at maintaining and improving its rating in the virtual environment, or in other words, the institutional position in the system. Thus, we can conclude that the rating acts not only as a measure of confidence in a participant in the virtual economic environment, but also as a measure of social status.

#### 4. Blockchain as a trust technology

At the present stage of development, society faces new fundamental challenges, that will change civilization. One of these challenges is the transformation of a basic category of organization of society as trust. Digital transformations change the approaches to understanding and the essence of trust, allow to identify key factors that were previously unavailable or could not be isolated as objects of analysis. Some researchers even talk about a fundamental crisis of trust in the modern world [29]. For example, Caseau et al says that “a single trust exists today only in two areas: family and community” [29]. And Cévipof indicates that “Who do we trust in 2016? Neither Google nor Facebook, that we trust less and less of our secrets, nor Apple. We no longer trust brands and do not trust states [29].

As you know, there are four main characteristics of trust: actions, trustee and guarantor relations, vulnerability and subjective assessment (action, trustor and trustee relationship, vulnerability, and the subjective matter ) [30].

Caseau et al distinguish two basic trust models: community trust and external trust [29]. It is also argued that the model of external trust, trust through a third party or a third party, becomes inadequate in the modern world, in conditions where the frequency of interaction between the subjects of relations increases significantly. This leads to the fact that the source of external trust begins to fight and resist the relationship itself and demand an increasing number of resources. This behavior of the regulator is in conflict with the law of diminishing returns, which necessarily makes the entire system of relationships ineffective (in terms of resources consumed and the result). The relationship model based on community trust is scalable and able to cope with the increasing frequency of individual transactional interactions between the subjects of the relationship.

Currently, there is an increased interest in blockchain technology and the possibilities of its use in various areas of human activity and society. Initially, the scope of the application, that made the blockchain popular and attracted the attention of a wide range of users, was cryptocurrency and bitcoin itself. As you know, the bitcoin blockchain was launched in 1998 and is still developing [31].

Summarizing the areas of applicability of the blockchain technology, it can be concluded that the blockchain can be applied in all those areas that are based on transactions, or as indicated by Caseau and Soudoplatoff, have a transactional nature [7]. This is an important point in the context of intersubjective relations, that are essentially transactional and can be represented as a set of consecutive interaction operations. When using a blockchain in any area, one should be guided by the following principle: “to guarantee trust and higher efficiency, offering, on the one hand, improved turnover and a higher transaction rate, and on the other - significantly reducing costs, simply eliminating the bottleneck in known as the “trusted third party””[7].

Intense, explosive development and implementation of blockchain leads many researchers to analyze the development of technology in accordance with the model Gartner “hype cycle“ [32]. However, despite the fact that, according to all signs, the blockchain technology has passed the peak of its

popularity according to the hype cycle, it is recognized that the blockchain is a “contractual basis of trust in the digital age” [33].

The practical significance of the blockchain for business, its economic importance for achieving business goals can be confirmed by the fact that more than 57% of companies with more than 20,000 thousand employees (top industries) either use or actively implement blockchain technologies [34].

As stated in the Deloitte study, the blockchain has a devastating effect on existing institutional trust-building systems in intersubjective relations: “new reliability indicators violate existing trust protocols, such as banking systems, credit rating agencies and legal tools that make transactions between parties possible [35]. Moreover, it is pointed out that the old mechanisms for ensuring confidence stop working and new mechanisms come to replace them. Peer-to-peer technologies play a special role in this process (peer-2-peer, P2P). Unlike the past, a trust-based economy evolving around transactions between people does not include credit ratings, guaranteed cash checks, or other traditional trust mechanisms. Rather, it relies on the reputation and digital identification of each transactional party, elements of which can soon be stored and managed in the blockchain [35]. In this case, two significant factors stand out: reputation and digital identification of the parties to intersubjective relations. Digital identity begins to play a fundamental role in the organization not only of relations between the subjects of the system, but also determines the structure of the newest economic system, that is called the economy of trust (trust economy). As stated in the Deloitte study “in an economy of trust, the “ digital identity” of a person or organization confirms belonging to a country (citizenship) or community, ownership of assets, the right to receive benefits or services and, more importantly, the existence of an individual or organization” [35].

Digital identification of the subject is an abstract concept that acquires real mechanisms of implementation through the use of blockchain technology. The formation of a digital identification of the subject involves the placement and use of various information about the subject, that are controlled by the subject, and not by a third party. In this case, the subject is able to independently determine by whom and how the relevant information will be used. According to Deloitte, one can single out such elements of a subject’s digital identification:

- Digital copies of traditional identification documents: driver's license, medical insurance, etc.
- Documents confirming ownership of the assets, and the corresponding transfer of ownership: houses, cars, stocks and other assets of any type.
- Financial documents such as insurance, loans, bank accounts, tax reports, etc.
- Information access control codes that limit the use of identity information. Areas of applicability can range from using information on a website to accessing external systems, the Internet of things, smart mobiles, and government agencies.
- A complete overview of the medical history, which includes medical and pharmaceutical records, doctor's notes, fitness charts, and medical device usage data.

One of the important aspects of digital trust provided by blockchain solutions, is the ability for significant scalability. As noted in the IDC study, by 2020, the use of blockchain technologies in business will reach: at the enterprises of the Global 2000 list - 25%, industrial enterprises and in sales - 30%, in health care - 20% [36]. Such high rates of implementation of the blockchain technology in solving business problems are determined, inter alia, by the fact that distributed ledger technology ( DLT ) potentially have scalable digital trust, that is achieved through a single version of authenticity (information security), transfer of values (security of ownership rights records), fast settlement operations, smart contracts (automatic execution of transactions).

According to the Juniper Research data, the main areas of use for the blockchain are (table 1)

**Table 1.** The main uses of the blockchain.

Region	Percentage of blockchain usage,%
calculations and payments	30%
smart contracts	10%
supply chain / movement tracking	10%
Internet of things	8%
identity management	7%
Data management	6%
health care	6%

Source: [37].

## 5. Conclusion

Logic of this study allows us to follow the formation of intersubjective relationship factors in the virtual environment. The current stage of development of the technological basis for the implementation of intersubjective relations allows us to speak about the formation and development of trust technologies.

On the one hand, the very nature of intersubjective relations is based on trust. As the study showed, two directions or two types of models can be distinguished that describe the role of trust in the organization of intersubjective relations. First, these are models based on an external center of trust, or a center of power, or a third party interaction, the main task of what is to ensure, guarantee compliance with institutional conventions, rules and regulations. These are models that implement the ideas of Weber's "ideal bureaucracy", and are historically effective provided that the interaction between subjects was based on the principles of algorithmicity, stability and uniqueness.

However, as a result of the technological development of society, especially information and telecommunication technologies, firstly, the number of transactions themselves significantly and sharply increased, i.e. acts of interaction of subjects, and secondly, due to the strengthening of horizontal links and the formation of predominantly new network structures as opposed to the hierarchical structures of the past, the instability and ambiguity of interaction between subjects increased. This led to the fact that models of intersubjective relations based on an external center ceased to be effective. By virtue of the law of diminishing marginal utility, the cost of maintaining trust in such a system, i.e. on the maintenance of a bureaucratic confidence building mechanism, they began to exceed the results.

As a result, systems began to take shape in which the second approach to building trust, based on community-generated trust, is being implemented. Such a model is characterized by the absence of a single center for ensuring trust; trust is formed in the process of reciprocal transactions between peers of the community, i.e. system. The global technological base that was able to provide this type of intersubjective relations, that is, equal and peer-to-peer (peering), has become the Internet.

The further development of the peer-to-peer network concept was acquired in blockchain technology, that essentially became a new institutional environment for ensuring trust of intersubjective relations. The blockchain technology allows to obtain such important characteristics as: reliability, availability and scalability. At the same time, the blockchain technology makes it possible to realize support for such two fundamental concepts as reputation and digital identification that defines the economy of trust.

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