

Virtual Enterprises in A Spatial Economy

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Abstract: *The globalization of the economic space resulted in the establishment of enterprises that conduct transnational operations. Virtual enterprises make it possible to combine the best network resources in an optimal manner. Virtual enterprises make it possible to cut costs substantially and provide users with possibilities that were unavailable before. These advantages can be attained only based on a unified information space, a unified network communication system that is based on a wide application of new information technologies, mathematical models, software and hardware. In the article, the authors address possibilities and reality of establishing virtual enterprises in such sectors as logistics, banking systems, tourism and education. Regarding virtual enterprises in logistics, digital procurement portals that connect producers, consumers and logistics services providers prevail. Virtual enterprises in the banking sector are digital money suppliers, such as VISA, MasterCard, etc. In the tourism sector, virtual enterprises tackle issues related to booking and the provision of tours. The segment of international distance learning, which provides educational services to customers in various countries, has long stood out.*

Index Terms: *economic globalization, digital economy, unified information space, virtual enterprises, network structure, business processes, national payment system, clearing, electronic commerce, distance education.*

I. INTRODUCTION

Interaction and integration of people is under way worldwide. This process entails the integration of local and national economies into a global unregulated market economy. Globalization expanded on the back of progress in transportation and communication economies. Economic globalization leads to interdependency of national economies all around the world, the fast movement of goods, services, technologies and capital. Economic globalization comprises globalization of production, markets, technologies, corporations and industries [1, 2].

International standards made the trade of goods and services more efficient [3-5]. Container shipments considerably cut transportation costs and made trade more efficient [6, 7]. Transnational corporations, which control market segments in several countries and are stateless, began to dominate in the market. Economic globalization caused the emergence of a new area of the economy – spatial economics that is at the turn of the regional economy, economic geography, the theory of economics, mathematical economics and geographic information systems. Spatial economics [8, 9] studies global distribution of production resources, cities, industrial clusters, forms of agglomeration economy that help create a favorable economic environment. When manufacturers decide where to locate production facilities, they consider three factors: the presence of large sales markets, production resources and a convenient transportation network to transport goods.

The development of information technologies and means of communication, in turn, made it necessary to create new types of enterprises – virtual enterprises [10-12]. Virtual enterprises constitute a temporary association of various forms of businesses that united themselves by means of computer networks for the more efficient use of competences and resources to better respond to business opportunities [13-15].

II. MATERIALS AND METHODS

A virtual enterprise is an enterprise that unites geographically divided economic entities that interact in the course of joint production by means of largely electronic means of communication [16, 17].

The traditional form of corporate organization is focused on functions. In modern society, such a structure often becomes inefficient as there is no direct interest in results, the vision of business processes does not go beyond departments, the exchange of information among departments is complicated.

Virtual enterprises have several advantages: the impact of the geographical factor is eliminated, the information space of a virtual enterprise provides joint access to information resources (IR), and in-house coordination of participants' activities improves. The synonym of a virtual enterprise is a network enterprise. As a rule, the matter concerns a chain of partners that jointly develop and sell products.

Virtual enterprises include a virtual market of goods and services, virtual reality (the development and production of goods in cyberspace) and virtual organizational forms.

The purpose of establishing a virtual enterprise is to generate the highest possible profit by uniting various partners into a network structure.

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Virtual enterprises seek substantial knowledge and resources and are combined into a network structure. Partnership is established for a definite period, for a definite lifecycle of a product or an enterprise. A

key advantage of virtual enterprises is the possibility to choose the best resources offered by an economic space.

The space of enterprise virtualization includes three main categories:

- the virtual market;
- the market of goods and services that operates based on communication and information possibilities of global networks, the Internet in particular;
- virtual reality, i.e. the display and imitation of real developments and production in the cyber space that at the same time is both an instrument and an environment;
- virtual (network) organizational forms.

The development of multi-level friendly interfaces among agents of virtual enterprises plays a primary role. For this reason, it is necessary, first and foremost, to build models of interaction between manufacturers and customers, suppliers, contractors, etc., the testing of which makes it possible to achieve an enterprise's greater flexibility and responsiveness. Here an important role should be played by models of organizing partnership relations in a virtual enterprise on the basis of multivalued logic of interaction between enterprises and their divisions that are built depending on such parameters as compatibility of enterprises' goals, mutual trust and responsibility of partners in the course of execution of their obligations, the need of uniting resources and the lack of production experience of a separate enterprise.

IR play a decisive role for a virtual enterprise that operates within a unified information space [18].

In the document, IR [19, 20] are understood as technical means of automation (computers and means of telecommunication), electronic data storage devices of all types, information in the form of files, databases and knowledge bases on electronic data storage devices, and storage facilities for soft and hard data (archives and libraries), and personnel.

The lifecycle [21-23] of a virtual enterprise is comprised of four main stages: identification of partners, establishment of a virtual enterprise, execution of a project, and dissolution of a virtual enterprise.

As regards the systematic approach, the following sub-systems designed for the management of a virtual enterprise can be highlighted [24-26]:

- a communicative sub-system, or a sub-system for the interaction with customers and potential participants;
- a configuration sub-system, or a sub-system for the formation of a pool of virtual enterprise's participants for the execution of an order;
- a sub-system for the distribution of knowledge, or a sub-system designed to keep record of and assess the status of participants;
- a coordination sub-system, or a sub-system for the distribution of business process, risks and gains among participants;
- a sub-system for the resolution of conflicts, or a sub-system

for the elimination of external and internal perturbations.

Any organization can be considered as a business system, i.e. a value chain comprising of separate links [27-30]. For this reason, the concept of competition at the present stage is regarded as *competition not of separate companies, but of value chains*, i.e. such a competition, when business partnership and professional cooperation exist in separate links of such a chain, becomes profitable for a firm.

If this is the case, all participants of a virtual enterprise should take part in the formation of a new added value that is generated from the execution of a project.

At least three types of virtual enterprises are differentiated:

- a virtual enterprise with the centralized type of management when one of the participants manages the process (understands a task, gives assignments to other agents, generalizes results and makes decisions);
- a virtual enterprise with the distributed type of management when knowledge and resources are distributed among participants, but a general body of command control, which makes decisions in conflict situations is preserved;
- a virtual enterprise with the decentralized type of management when all management processes are conducted only through local interactions among participants.

III. RESULTS

A. Virtual Enterprises in Logistics

Virtual enterprises provide a free movement of financial, material and information resources. Material resources are moved through logistics schemes [6, 7]. Virtual enterprises should have general information space and, consequently, the organization of such a space is a priority objective. Virtual enterprises operate based on common databases about participating enterprises, their functional possibilities and technological operations. Said databases can be accessed via the Internet, on a specially designed portal.

There can be three types of electronic portals, namely, those with a focus on the manufacturer – supplier of goods, focused on buyers and focused on the means of delivery.

Virtual buyer-focused enterprises are sometimes called electronic procurement portals. This scheme is used by such automotive giants as Daimler Chrysler, Ford and General Motors that developed a unified digital market space Covisint (<https://www.covisint.com/>) for the purchase of raw material and some components for automobile production in the future.

Covisint helps the world's biggest concerns exchange reliable information within business eco-systems. Small, mid-sized and major manufacturers deal with this scheme.

B. Virtual Enterprises in Banking

A commercial bank's external information interactions are based on computer networks that provide the performance of communication functions and access to segregated resources, i.e. the transfer of files, access to remote databases and remote launch of tasks [27, 31, 32].

A virtual enterprise interacts with an external environment (Figure 1): the central bank (the Bank of Russia), clients of a virtual enterprise (businesses and individuals), participants of digital non-cash settlements by means of plastic cards, branches of enterprises, commercial banks in Russian territory, international banks, other counterparties of a virtual enterprise (e.g. under operations with securities, precious metals, etc.) [33-35].

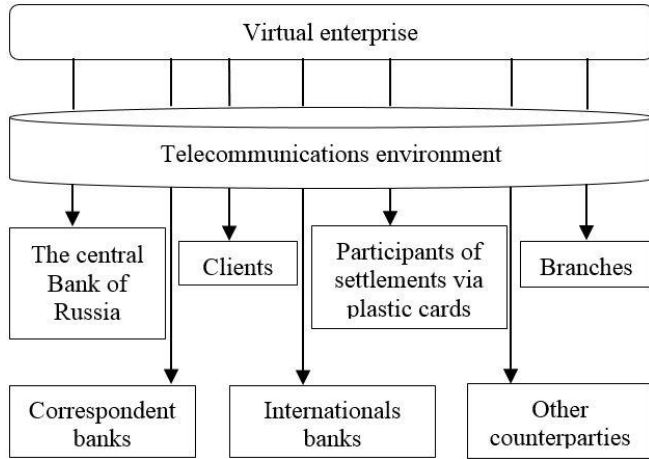


Fig. 1. Scheme a virtual enterprise’s interaction with an external environment

A virtual enterprise interacts via payment systems, which dispatch using electronic channels payment documents, account statements, compile registers of payments for any period, transaction certificates, etc. The dispatch of information on payment consists of two stages: a statement about a transaction and clearing, i.e. a set-off between enterprises. A commercial bank can interact with other resident banks according to one of three scenarios: through a system of mutual correspondent accounts, through a system of clearing centers or the Bank of Russia’s cash settlement center. International settlements are conducted through a system run by the Society for Worldwide Interbank Financial Telecommunication (SWIFT).

A universal card payment system can consist of the following types of participants:

An issuing bank (lending institution) that issues bank cards.

A holder of a bank card, i.e. an individual who uses a bank card based on an agreement signed with the issuer, or an individual – an authorized representative of the issuer’s client.

An acquiring bank (lending institution) that conducts acquiring operations. Acquiring operations mean activities that include settlements with trade firms (service providers) against operations made with the use of bank cards, and the conduct of operations to issue cash to bank cardholders who are not clients of this lending institution.

A trade firm (service provider) that in accordance with the agreement signed with an acquiring bank, accepts documents, which are compiled with the use of bank cards as payment for goods (services) to be provided. An individual – an individual entrepreneur – can act as a trade firm (service provider).

A processing center is a legal entity or its division that provides information and technological interaction among participants of settlements. Activities carried out by a processing center are called processing and include the collection, processing and distribution of information about

card transactions by participants of settlement (settlement agents, issuers and acquiring banks).

A settlement agent is a lending institution that conducts mutual settlements among participants of settlements against card transactions.

Payment system leaders are VISA and MasterCard. These global payment systems provide cardholders, trade firms and service providers, financial and government institutions with access to a fast, safe and reliable network of electronic payments [36].

C. Model of A Virtual Travel Company

Services offered by travel companies have quite a wide coverage in the global information network [37-39]. There are many portals and websites related to historical, agricultural and industrial tourism on the Internet [40-42]. Nearly every hotel has a website. Data on available hotel rooms are united into virtual tourist companies that engage in booking and sales. There are virtual enterprises, which provide information support, book rooms and sells tickets for airplanes, trains and tourist destinations [43-45]. Car rental services are booked through the global computer network.

Travel companies are divided into tour operators and travel agencies. Tour operators engage in the development of tourist tours which are designed for massive consumer demand, advertising and sales of tourist tours through a network of retail travel agencies.

Of the tours offered on servers of travel agencies consumers choose a tour they want and place orders on the Internet. An order is sent to the corporate booking system which by means of a distribution network books air tickets, hotel rooms, sightseeing packages, etc.

A virtual travel company should have its own internal information system and telecommunication facilities to execute key business processes (channels for clearing settlements, access to booking systems, systems designed to process and receive payments). Travel agencies can both use their own booking systems and make use of a global distribution system.

It costs approximately two times cheaper to sell tours on the Internet than through a travel agency. It also costs less for air carriers to sell air tickets on the Internet than via travel agencies or booking centers.

The selection of a hotel and an air carrier is a service that requires fast analysis of several databases. E-commerce development made it possible to connect ordinary users with this system. The introduction of mobile systems has expanded, allowing consumers to sign up for tourist services using their mobile devices.

Modern information technologies allow users to analyze places of interest, reviewing maps, description and virtual multimedia tours [46-48].

D. Virtual Enterprises in Distance Education

During the period of the society’s digital transformation, there are changes in both the structure of the labor market [49] and ways of knowledge acquisition [50-52].

In scientific papers, researchers broadly discuss innovation regarding the conduct of classes, methods used to assess the quality of a higher education institution [53], and problems related to the employment of young professionals [54, 55].

The development of education is currently perceived as the most important prerequisite of economic and social welfare. During the era of the post-industrial society, higher education is required to ensure that all social institutions of the society operate [56]. Meanwhile, a key objective of higher education institutions is to provide students with relevant high-quality educational content [57].

The quality of distance education is an integral indicator that includes the following factors: educational content, teaching, information technologies, organization of teaching.

Educational content should meet the following requirements: be simple for description, topical, illustrative, and should also contain various elements aimed to encourage acquiring of knowledge and reflection.

The quality of educational content is assessed based on expert reports compiled by specialists in the relevant field, and a rating system designed to identify how much materials comply with the requirements imposed.

Teaching includes pedagogical methods and technologies that are used in the course of education (business games, case studies, tests, practical works, group projects and other forms of interactive and active work of students), and the level and qualification of academic teachers, including regarding distance work with students. The assessment of the quality of teaching is closely linked with the assessment of the quality of content and is carried out by means of the current control of progress in studies, to what extent students acquire required competences, and with the analysis of time spent by a student on the study of a course and the execution of an assignment.

Information technologies should ensure a diverse presentation of educational content and the possibility of its examination via mobile devices. For instance, a long-distance course can include video lectures, audio lectures, digital textbooks, various means of computer animation and modeling that ensure the virtual execution of practical assignments.

Conditions for the active use of the Internet and the possibility of having access to IR at any time and from any place (using smartphones and portable PCs) stipulate new possibilities and requirements for long-distance learning and the assurance of its quality.

Furthermore, the main development trends of information technologies are a shift to corporate social networks, the organization of employees' remote and safe work with corporate content. The visualization of means of development and applied programs imposes new requirements on employees regarding their PC skills. Speaking about the quality of education, one should bear in mind not only higher and secondary education programs, but also retraining and further training courses, as well as corporate training programs.

There are two types of educational service exports: active and passive. Passive exports are linked with the training of foreign students in a country. Active exports emerged recently and are attributable to the foreign expansion of higher education institutions, the opening of branches and

representative offices in other countries under the model of transnational corporations, international cooperation among higher education institutions [56, 57].

International distance education is experiencing rampant growth. It is evident that leadership in education issues is the most important component when determining the status of a country. Leadership in terms of distance education is resolutely held by the United Kingdom, followed by the United States. The UK and the US stand out in terms of courses offered by leading educational institutions.

Main subjects that are taught using remote system are history, political science, cultural studies, mathematics, physics, management, economics, informatics and information technologies.

There are both paid and free courses. As a rule, free courses are either temporary or promotional. Even though much attention is paid to distance education in the UK and the US, Russia tries to keep up with the leading countries. In addition to the courses mentioned in the article, nearly every university has a system of correspondence and distance education, with some courses conducted long-distance and some in classrooms of universities.

One of the international trends in education is the active expansion of massive open online courses. The global community of higher education institutions is on the road to unification and development of free educational resources.

The management of network educational resources includes strategy, tactics and efficient actions. It makes use of a resource management model. The resource management model comprises the formation of a resource base designed to ensure educational processes, to use educational products, to assess the efficiency of training results, and to ensure the continuity of educational processes.

The strategy of managing network educational resources aims to improve the quality of education and efficiency of the measures to organize teaching. Tactics include the optimal organization of resources as a system. Efficient actions include the optimal use of resources.

The resource strategy of managing network educational resources is part of the general strategy of education and education management.

Some resources are publicly available, some others are available via closed access. The latter requires measures for the organization of a system of information security.

E. Virtual enterprises in research

A virtual enterprise in research constitutes an electronic environment, which makes it possible to create and study models of real phenomena. Enterprises of this kind can provide interaction between a user and a real laboratory unit via network technologies, providing information about conditions and means of managing a laboratory unit with the use of a graphic user interface, multimedia and augmented reality [58-60].

An important peculiarity of virtual research firms is the fact that their use makes it possible to conduct experiments using a virtual unit from any place of the world. This helps to use them in distance education for the formation and examination of general scientific and instrumental competences, which are difficult or impossible to form in another way. Such a specific feature helps not only in the conditions of distance education but also in some aspects of traditional education. For example, it is possible to improve efficiency of the use of real laboratory units if access is provided in advance to their virtual simulators for the purpose of studies and training or to organize checking of results of virtual laboratory work in a more comfortable long-distance format or to fully automate attestation if a virtual laboratory has functions for automatic verification of results, which is a mandatory requirement for virtual research firms that are introduced in the system of distance education.

A virtual research firm comprises of two main modules, a virtual laboratory stand, which is a virtual model of a laboratory unit, and a server of a virtual research firm that verifies laboratory reports makes intermediary calculations and provides a bank of assignments.

IV. DISCUSSION

Virtual enterprises are a modern economically expedient form of labor organization. They have taken deep roots in the life of people. In the article, we review examples of their use in various segments of the global economy. These examples convincingly show that the use of these entities is advisable.

The global business environment becomes more complicated and erratic. In these conditions, enterprises will encounter a situation that their form, structure and prevailing environment will transform and adapt to a constantly changing environment. Boundaries of organizations will no longer be exact as nowadays. In the conditions of market participants' unpredictable behavior, controls, which are based on cause-effect relations, will not be quite efficient any more.

In addition, there is another area for research, namely innovation activities in virtual enterprises that relate to the parallel development of new types of products and services. The study of virtual enterprises can concern a variety of issues, e.g. socio-economic relations in the course of economic globalization.

V. CONCLUSION

An advantage of virtual corporate forms is the fact that participants of a virtual enterprise have the possibility of choosing and applying the best resources, knowledge and abilities with the least time spent. This advantage and the network organization itself form such key competitive advantages as

- the speed of execution of a market order;
- the possibility of cutting overall costs;
- the possibility of a better satisfaction of a client's needs;
- the possibility of flexible adaptation to changes in an environment;
- the possibility of lowering barriers for the entry into new

markets.

A virtual enterprise is a model of the new consumer-oriented market which uses other schemes for companies to interact both with one another and end consumers.

A virtual enterprise is a special form of organizing a company's activities by means of information technologies with a focus on the description of business processes.

A virtual enterprise has a unified information infrastructure based on the latest information technologies and general databases, to which all enterprises have access.

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