Big Data in the Context of the Essential Facilities Doctrine

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Abstract

Digital transformation of economy leads to changes in industrial markets and firms behavior on them. They begin to compete basing not on expansion of their market share but on creating a benefit for a consumer. So far increase of firm competitiveness requires knowledge about preferences and behavior of consumers within a broad range of indicators. In such a situation firms operating big data obtain competitive advantage. As gaining a benefit from big data is connected to high fixed cost they gain monopoly power. Big data do not cover a market entirely but impose limitation on competitiveness of those who do not possess them. As a result it leads to creation of entrance barriers on the market. In this case question arises about possibility of big data consideration basing on the essential facilities doctrine. The purpose of this article is to analyze big data from the perspective of the essential facilities doctrine and to reveal specific features of big data market functioning distinguishing it from traditional markets of essential facilities. The research is based on the essential facilities doctrine and its application to building of optimization model of big data market firms behavior. The matter of big data attribution to essential facilities is solved basing on study of approaches to interpretation of big data category, analysis of interrelation and size of big data processing costs, building a model of big data operator behavior when supplying firms on neighboring markets with processed information. It is shown that big data in processed form can be attributed to essential facilities as their collection and processing are connected to high initial costs which block possibility of their duplication by competitors. But a specific thing here is that they do not entirely block market entering availability and define firms competitiveness on it. As a result growth of normal profit on markets connected to big data creates entrance barriers. Such results set a question about further and more accurate study of the big data phenomena as their incorrect regulation or absence of any regulation can result in decrease of markets functioning effectiveness and results of industrial and antimonopoly regulation.

Keywords

Big Data, Essential Facilities, Digitalization, Competition, Costs of Big Data, Processed Information
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Introduction

Digital transformation of economy is one of main directions of modern society development. The influence of digital technologies changes not only composition of goods to better correspondence to consumer preferences but also the mechanisms of industrial markets functioning. Implementation of digital technologies leads to emergence of new and changes in existing forms of markets functioning, economic systems and social structures. The ongoing transformation opens new ways of marketing, goods promotion, building relations between suppliers, producers, sellers and consumers, as well as consumption maintenance by the aid of digital platforms, smart things, big data and so on (Markova, 2019). Thanks to these new mechanisms of market competition which reflect transition from struggle for market share to leadership in creating benefit for consumers and sustainable business environment are formed. Along with that these processes are accompanied with opposite effects. On one hand digital

technologies allow to cut transactional costs through decrease of costs of information searching and contracts making. The consequence is market borders smoothing and supply chains decentralization. On another hand such technologies like the Internet of things and platforms concentrating both production and sales sphere within digital giants allow to improve control of production processes, increase of ability of specific subjects to control supply chains. Consequently at the current day economies of many countries came to concentration of digital markets in hands of small number of firms (Tsarikovskiy, 2018).

One of specific features of the digital epoch is that digital technologies became an important element of a firm competitiveness on markets. The reasons for that are changes in market borders, the mechanism of benefit gaining, ways of added value formation, net effects etc. For example, functioning of markets with multisided net effects is connected to positive externalities which could be internalized through mediation of platforms (Marciano et al., 2020). On such markets utility gained by buyers and benefits gained by sellers are connected both to transactions with a good itself and to a platform service. Functioning of multisided net effect results in concentration of platform consumers who are both sellers and buyers of goods, which is the reason of platform owners market power increase (the operating system by Microsoft, the Internet platform Aliexpress could be an example) (Evans, 2011).

Together with digital platforms positive externalities are created due to big data. However the process of their gathering, processing and commercialization is connected to high costs because of big data specific features which could be demonstrated in the three V model (Fig. 1).

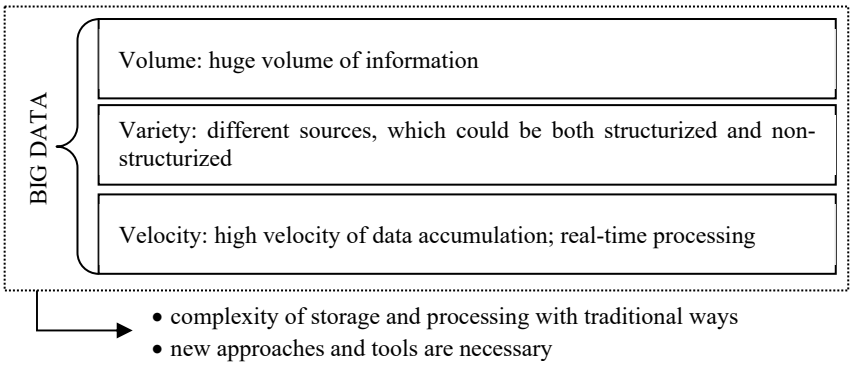

Figure no. 1. Three V of big data model

Source: composed by the author basing on (Laney, 2012; Tsarikovskiy, et al.,2018)

Most frequently big data are interpreted as a huge volume of structured and non-structured data including different factors and indicators, for instance, data about buyers and their orders. Hence complexities appear due to growth of such data volume storage costs. Along with it high diversity of big data appears as they include text data, different structure, code and so on. This also leads to arising of market functioning complexities as different systems of their collection are necessary together with, even more important, complex mechanisms of their processing, for instance, mathematical algorithms, methods of non-structured data processing. The last aspect of big data is velocity, namely acceleration of data accumulation thanks for digital technologies development. In particular this acceleration occurred due to spread of the mechanism of free data transfer from consumers, for instance, in social networks or internet shops (Navickasetal., 2015).

Thanks to information which could be obtained from big data firms can improve their competitiveness. For example, G. Lee and T. S. Raghu showed how a firm's rating in a mobile application has an impact on sales performance (Lee and Raghu, 2014), M. Seo, O. Yang and Y. Yang identified the main determinants of consumers rating of various applications (Seo, et al., 2020). Thus such an aspect of digital economy as data economy was outlined. It is based on the potential contained in big data analysis, which is expressed in better consideration of consumers tastes and preferences so today firms are aimed at supply of unique needs satisfaction, but not unique goods. At the same time the complexities arising as a consequence of functioning of connected to big data markets resulted in

limited opportunities of firms for their gain, accumulation and processing, which led to concentration of the big data market. The purpose of this article is to analyze big data from the perspective of the essential facilities doctrine and to reveal specific features of big data market functioning which distinguish it from traditional markets of essential facilities. In the first section existing approaches to the essential facilities concept interpretation and possibility of attribution of big data to them are considered. In the second chapter the costs connected to big data collection and processing are discussed as well as influence of these costs on availability of big data duplication and their link to the statements of the essential facilities doctrine. In the third chapter incentives of a big data operator separated from neighboring markets to grant access to such data to firms on neighboring markets are modeled.

The essential facilities concept and big data

The essential facilities doctrine originates from the practice of antitrust regulation in the USA. It is mentioned for the first time in the case United States vs. Terminal Railroad Association of St. Louis (Reiffen and Kleit, 1990). There were outlined such conditions of the doctrine application as control of essential facilities by a monopolist, physical or economic impossibility of their duplication, denial of access to them by the monopolist while he would be capable to provide it. As S. Golovanova notes, the problem of essential facilities is in that their owner can directly influence on neighboring along technological chain markets by changing access to them. Along with it its interest in limitation of competition on such markets is not always evident as he could not be present on them (Golovanova, 2013).

I. Graef notes that the essential facilities doctrine played an important role in competitive law of the EU, where it was applied both to physical infrastructure (for examples, ports and railways) and to intangible assets protected by author's rights. The Author underlines that such assets as online platforms data or ranking, for instance, in search systems, are the base of majority of digital markets and can form the object of the essential facilities doctrine (Graef, 2019).

Z. Abrahamson justifies that to regard any data to essential facilities they have to meet the same requirements that are affirmed in the essential facilities doctrine (Abrahamson, 2014):

1. The Owner of data have to control and to be able to block access to the data.

2. Competition have to decrease without access to the data.

3. Competitors have to be not able to duplicate the data.

4. The owner have to possess the tools of data change.

5. The owner have to possess monopoly power on a data market.

Along with that Z. Abrahamson introduces the term of essential data and underlines that data monopolists in emerging industries do not fall under the theory of pure monopoly as, the first, the same data set can provide both zero and infinite number of finished goods, and the second, the monopolist could have no ability to define the amount of supplied goods with the use of essential data. As a result, uncertainty can smoothen the curve of final demand, which the data monopolist faces to. It excludes application of tool of neighboring markets participants enforcement to selling a monopoly amount of goods.

It is necessary to noted that, despite the growth in the number of works on the topic of big data (Ogrean, 2018), the matter of whether big data are regarded to essential facilities is a debatable one. For instance, C. Tucker mentions that data are often not valuable for users. Also digital data have an attribute of non-competitiveness and there are many sources of them (Tucker, 2019). It appears that the arguments brought by the author are sooner related to unprocessed data, as information, which is a public good, really has the attribute of non-competitiveness and it often has no value in its unprocessed form. However in our opinion the matter is not in access to data when analyzing the essential facilities doctrine, but in mechanisms of data processing and their transformation into the state of readiness for use, which requires high costs. It is necessary to consider the information obtained from these data which is valuable for users. Along with it C. Tucker points out that competitors have access to data but this us

because of possibility to purchase them from a databroker. Valuableness of brokers service depends not only on scale of data but also on what brokers can gain from them.

Costs on the big data market

Analysis and use of big data have their own structure of costs. And their accumulation, storage and processing require large data centers, highly productive servers, specialized software, advanced system of digital protection and specialized labor force, which results in high fixed costs of data centers maintenance (Horak and Boksova, 2017). The process of information gaining itself after tuning all the systems is not connected to significant costs, i.e. variable costs are very small. The latter is stipulated by that just as on traditional markets, households form demand on goods and supply production factors. Thus because of their activity in the digital environment individuals supply the information as a production factor to firms for free. That is the reason of low variable costs while fixed costs are high. Along with it the question about effectiveness of resources distribution occurs as the problems of information overproduction and high market entrance barriers creation for firms not having tools to process this information appear. They are analogous to those described in the Kaldor's model of advertisement overproduction (Kaldor, 1950).

In the economy of knowledge and hence on markers in the epoch of digital transformation limitation of access to big data storage and processing due to high fixed costs while variable costs are minimal leads to the problem of essential facilities. They are a necessary condition of successful activity on a given industrial market while high costs for their creation result in complexity of their duplication. Hence the owner of essential facilities can influence on competition level on neighboring markets of supply chain by varying access to them and supporting some participants groups so far, even when he is not present on these markets.

Usually the essential facilities doctrine is considered in the context of natural monopolies, however ongoing processes of digital transformation result in widening of its application. On big data markets it means that such an entrance barrier as customers loyalty formation can become one of the most significant as limitation of access to information leads to absence of supply of goods satisfying individual needs of customers, which would decrease competitiveness of individual firms and hence the competition level. An important feature is that in contrast to goods on standard markets of essential facilities big data do not lead to the total loss of ability to function on a market. Firms can possess necessary resources to save their presence on the market, but big data allow to obtain competitive advantages. J. Begenau, M. Farboodi and L. Veldkamp showed that larger firms get higher benefits (Begenau, et al., 2018). The absence of government tariffs imposed on activity of big data owners and very low marginal costs of obtaining such data together with non-price methods allow to use price methods of demand influencing as well (Avdasheva and Shastitko, 2018).

Big data as essential facility

Let us use the essential facilities doctrine to reflect the opportunity of big data attribution to this category in theoretical aspect and firms behavior analysis within the doctrine concept. Regarding to the standard essential facilities doctrine it is necessary to outline a specific feature of the big data market functioning as the market of essential facilities. Let us consider a variant when a big data operator is absent on neighbor market. Let $q_{BD} = kn_{BD}$ is volume of demand on information obtained as a result of big data processing, where n_{BD} is a number of firms on a neighboring market which are big data buyers; k is a proportionality ratio defining the size of firms and setting therefore the volume of demand from a separate firm. $P_{BD}(q_{BD}) = 1 - q_{BD}$ is an inverse function of demand on services of the big data operator (essential facility owner) and $TC_{BD} = A + c_{BD}q_{BD} + f(n_{BD})$ is a function of the operator costs, where A is fixed costs of big data infrastructure maintenance; c_{BD} is variable costs of big data operator service supply, and A is significantly bigger than c_{BD}; $f(n_{BD}) = tkn_{BD}$ is transactional costs of granting access to essential facilities, where t is transactional costs of one big data buyer servicing, which depend on the size of the buyer, i.e. on. k. Then the big data operator profit would be:

$$\pi_{BD} = P_{BD}q_{BD} - A - c_{BD}q_{BD} - f(n_{BD}) = (1 - kn_{BD})kn_{BD} - A - c_{BD}kn_{BD} - tkn_{BD} \quad (1)$$

Profit maximization on the number of big data buyers allows to calculate the optimum number of such firms on neighbouring markets, which would be $n^*_{BD} = \frac{1-c-t}{2k}$. It can be seen that the lower are marginal and transactional costs of one firm servicing the higher number of firms would be serviced by the big data operator. An important difference from the standard essential facilities doctrine is that the costs of service supply on digital markets are low, hence in contrast, for instance, to natural monopoly markets, probability of competition limitation on neighboring markers by the big data operator, i.e. the owner of essential facility of a digital market, is lower. Higher impact is created by size of firms on neighboring markets which are buyers of the big data operator services, among other things it is caused by potential ability of large firms to create their own center of big data processing. Therefore for correct making of conclusions regarding to consequences of big data control by firms it is necessary to make a deeper analysis of their activity, as the given case does not confirm the thesis that limitation of competition on markets neighboring to essential facilities markets meets the interests of these facilities owners[*]

The problem of initially high costs sets the main rule of firms functioning on digital markets, which suggests necessity to gain monopoly power in order to repay these costs and obtain positive benefits. The history of development of information and communication technologies markets first, and of digital markets now reflects passage of the same stages, which were pointed out by Tim Wu, who called these regularities as cycles (CapitolReader, 2011). The strive to market monopolization could weakly reveal in the horizontal aspect, but vertical limitations could make a stronger impact both on the market where the firm is present and on neighboring markets. All of this results in limitation of markets competition. However these conclusions could not be definitive as revealing specific features of digital markets which positively influence on social wealth requires consideration and analysis of all described above factors of industrial markets functioning in the epoch of digital transformation of economy.

Conclusions

As a result we can note that in our opinion big data can be considered as essential facilities as they create capability for their owners to influence on neighboring markets and cannot be duplicated by competitors due to high initial costs. Along with it their specific feature differing them from traditional essential facilities markets is that they do not entirely close entrance to a market but influence on the competitiveness level of such data consumers, thus creating an entrance barrier. There is no definitive answer to the question of influence on social wealth. On one hand high initial costs of creation centers of big data processing gives their operators the monopoly power. On another hand the thesis that limitation of competition on markets neighboring to essential facilities markets meets the interests of these facilities owners is not confirmed. But in the given article the variant of absence of a big data operator on neighboring markets was considered. Therefore to specify the incentives of an essential facility owner on such markets it is necessary to widen the model to the variant of their presence on neighboring markets, which, in particular, is confirmed by the practice when digital platforms sooner or later limited access to the resource. For instance, it happened in interaction between Twitter and PeopleBrowsr in 2012 (Tombal, 2020).

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[*] The given model of essential facilities on a big data market is build basing on the model of essential facilities of full vertical separation, presented in (Avdasheva and Shastitko, 2018).

References

Abrahamson, Z., 2014. Essential Data. *Yale Law Journal*, 124(3), pp.867-881.

Avdasheva, S.B. and Shastitko, A.E. (ed.), 2018. *Antimonopoly Policy on Linked Markets: Theory and Practice*. Moscow: "Delo" publishing house, RANEPA. (In Russian).

Begenau, J., Farboodi, M. and Veldkamp, L., 2018. Big Data in Finance and the Growth of Large Firms. *Journal of Monetary Economics*, 97, pp. 71-87.

Capitol Reader, 2011. *The Master Switch: The Rise and Fall of Information Empires by Tim Wu*. [pfd] Available at: <http://www.capitolreader.com/sum/10211-masterswitch.pdf> [Accessed 2 December 2019].

Evans, D.S., 2011. *Platform Economics: Essays on Multi-Sided Business*. S.l.: Competition Police International (CPI).

Golovanova, S.B., 2013. The Essential Facilities Doctrine in the Russian Antimonopoly Policy: Reasons and Risks of Implementation. *Economic policy*, 3, pp.126–143. (In Russian).

Graef, I., 2019. *Rethinking the Essential Facilities Doctrine for the EU Digital Economy*. TILEC Discussion Paper.

Horak, J. and Boksova, J., 2017. Will the Big data Lead to the Savings in Overhead Costs? *The 11th International Days of Statistics and Economics*, pp.489-496.

Kaldor, N., 1950. The Economic Aspects of Advertising. *The Review of Economic Studies*, 18(1), pp.1–27.

Laney, D., 2012. *3D Data Management: Controlling Data Volume, Velocity, and Variety*. [pdf] Available at: <https://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf> [Accessed 15 January 2020].

Lee, G. and Raghu, T.S., 2014. Determinants of Mobile Apps Success: Evidence from App Store Market. *Journal of Management Information Systems*, 31(2), pp.133-170.

Marciano, A., Nicita, A. and Ramello, G. B., 2020. Big Data and Big Techs: Understanding the Value of Information in Platform Capitalism. *European Journal of Law and Economics*, 50, pp.345-358.

Markova, V. D., 2019. *Digital Economy*. Moscow: INFRA-M. (In Russian).

Navickas, V., Gruzauskas, V. and Svazas, M., 2015. Non-economic Factors Impact to the Business Competitiveness. *NIGRE*, X(17), pp. 66–71.

Ogrean, C., 2018. Relevance of Big Data for Business and Management. Exploratory Insights (Part I). *Studies in Business and Economics*, 13(2), pp. 153-163.

Reiffen, D. and Kleit, A. N., 1990. Terminal Railroad Revisited: Foreclosure of an Essential Facility or Simple Horizontal Monopoly. *The Journal of Law and Economics*, 33(2), pp.419-438.

Seo, M., Yang, O. and Yang, Y., 2020. Global Big Data Analysis Exploring the Determinants of Application Ratings: Evidence from the Google Play Store. *Journal of Korea Trade*, 24(7), pp.1-28.

Tombal, T., 2020. Economic Dependence and Data Access. *IIC-International Review of Intellectual Property and Competition Law*, 51(1), pp.70-98.

Tsarikovskiy, A.J., Ivanova, A.J. and Voynikakis, E.A. (ed.), 2018. *Antimonopoly Regulation in the Digital Epoch: How to Protect Competition in the Conditions of Globalization and the Fourth Industrial Revolution*. Moscow: Publ. house of the Higher school of economics. (In Russian).

Tucker, C., 2019. Digital Data, Platforms and the Usual [Antitrust] Suspects: Network Effects, Switching Costs, Essential Facility. *Review of Industrial Organization*, 54, pp.683-694.