

Ministry of Education and Science of Ukraine
Black Sea Universities Network

ODESA NATIONAL UNIVERSITY OF TECHNOLOGY

International Competition of
Student Scientific Works

BLACK SEA SCIENCE 2022 PROCEEDINGS



ODESA, ONUT 2022

Ministry of Education and Science of Ukraine

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BLACK SEA SCIENCE 2022

Proceedings

Odesa, ONUT 2022

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INTRODUCTION

International Competition of Student Scientific Works “Black Sea Science” has been held annually since 2018 at the initiative of Odesa National University of Technology (formerly Odesa National Academy of Food Technologies) with the support of the Ministry of Education and Science of Ukraine. It has been supported by Black Sea Universities Network (the Association of 110 higher education institutions from 12 countries of the Black Sea Region) since 2019, and by Iseki-FOOD Association (European Integrating Food Science and Engineering Knowledge into the Food Chain Association) since 2020.

The goal of the competition is to expand international relations and attract students to research activities. It is held in the following fields:

- Food science and technologies
- Economics and administration
- Information technologies, automation and robotics
- Power engineering and energy efficiency
- Ecology and environmental protection

The jury includes both Ukrainian and foreign scientists. In the 4 years that the competition has been held, the jury included scientists from universities of 24 countries: Angola, Azerbaijan, Benin, Bulgaria, China, Czech Republic, France, Georgia, Germany, Greece, Israel, Italy, Kazakhstan, Latvia, Lithuania, Moldova, Pakistan, Poland, Romania, Serbia, Slovakia, Switzerland, Turkey, USA.

At the same time, every year the geography has expanded and the number of foreign jury members has increased: from 46 jury members representing 25 universities from 12 countries in 2018, to 73 jury members of the 46 universities from 19 countries in 2022.

More than a thousand student research papers have been submitted to the competition from both Ukrainian and foreign institutions from 25 countries: China, Poland, Mexico, USA, France, Greece, Germany, Canada, Costa Rica, Brazil, India, Pakistan, Israel, Macedonia, Lithuania, Latvia, Slovakia, Romania, Kyrgyzstan, Kazakhstan, Bulgaria, Moldova, Georgia, Turkey, Serbia.

The interest of foreign students in the competition grew every year. In 2018, the students representing 15 institutions from 7 countries have submitted 33 works. In 2021 the number of submitted works increased to 73, authored by the students of 40 institutions from 18 countries.

The competition is held in two stages. In the first stage, student research papers are reviewed by members of the jury who are experts in the relevant fields. In the second stage of the competition, the winners of the first stage have the opportunity to present their work to a wide audience in person or online.

All participants of the competition and their scientific supervisors are awarded appropriate certificates, and the scientific works of the winners are included in the electronic proceedings of the competition. Every year the competition receives a large number of positive responses from Ukrainian and foreign colleagues with the desire to participate in the coming years.

2. ECONOMICS AND **ADMINISTRATION**

THE ECONOMIC AND ENVIRONMENTAL ASPECTS OF SHARING ECONOMY FUNCTIONING

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Abstract. *This research deals with economic and environmental issues of sharing economy. The essential principles of the sharing economy are clarified, including market self-regulation, openness, trust, and the use of surplus resources. Technological, economic, social, and environmental aspects are highlighted as the key drivers of the sharing economy's development. The COVID-19 pandemic is thought to have had an uncertain impact on the growth of sharing entrepreneurship. Obstacles to the sharing economy functioning have been identified.*

The impact of the sharing economy's functioning on the environment is explored. It is determined that the positive aspects of the sharing economy (reduction of CO₂ emissions, dematerialization of production) outweigh the negative ones. The development of new technologies is driving the sharing industry forward. The innovative aspect of the sharing economy involves not only a change in the paradigm of consumption, but also the formation of new trends in the labor market. The sharing market was discovered to be a complicated phenomenon with close interactions between its participants.

Keywords: *sharing economy, sustainable development, digitalization, innovative technology, green economy.*

I. INTRODUCTION

In recent years, digitalization (creation of online platforms, development of digital marketing, etc.) has brought the sharing economy to a qualitatively new level. So, today the capitalization of "sharing giants" Uber and Airbnb exceeds \$ 25 billion. (Da Rosa et al., 2021). From an environmental point of view, the rapid development of the sharing economy, on the one hand, contributes to the dematerialization of production and, as a result, the reduction of the "carbon footprint", and on the other - excessive demand for shared goods or services can adversely affect the environment.

II. LITERATURE ANALYSIS

Many Ukrainian and foreign researchers (L. Richardson, J. Eckhart, K. Stack, R. Botsman, A. Gura, K. Kraus) have analyzed the economic aspect of sharing. Other scholars have focused on the ecological component of the shared economy, among them - P. Gatszola, F. Bonsu, A. Balgar, L. Melnyk, I. Khymych, N. Tymoshyk. The term "sharing economy" first appeared during the Great Recession (2008-2009), when it was used by Lawrence Lessig, a professor at Stanford University. The main populariser of sharing ideas is the British researcher Rachel Botsman, who in her work "What's Mine is Yours" noted that the transition to Industry 4.0 is not possible without

the development of the sharing economy. However, it is interesting to note that according to recent polls, 73% of Americans have failed to explain the concept of "sharing economy", which raises the issue of dissemination of knowledge about sharing among civil society (Gielen et al., 2019). In addition, comprehensive environmental and economic research on the sharing economy is not enough in modern scientific thought.

III. OBJECT, SUBJECT, AND METHODS OF RESEARCH

Object of the work - economic relations that arise in the management of the sharing enterprise.

The subject of the research is the process of managing a sharing enterprise.

Research methods. Significant methodological tools were used during the study, in particular: general theoretical methods (analysis and synthesis, induction and deduction, comparison), economic-statistical methods (for analysis of existing and forecasting future trends in sharing business).

The **results** of the research were used by PNP "Center for Economic Research" in developing the strategy for the development of Sumy region for 2023-2030 (Appendix 1).

IV. RESULTS

As Rachel Botsman stated, "the sharing economy has no shared definition". Indeed, there is no consensus among scholars on the interpretation of the definition of "sharing economy": the definitions may differ depending on whether they include the following factors:

- 1) "early" business models based on exchange, but working without the use of online resources;
- 2) B2C models: some researchers believe that they are the basis of sharing operations, while others are supporters of the "individualistic" (P2P) approach to sharing [1].
- 3) profitability: among scientists there is a debate about whether to consider activities aimed at making a profit, sharing.

Some of the definitions of the concept of "sharing economy" are given in Table 1.

Table 1. Approaches to the definition of "sharing economy"

Author	Definition
Nelson & Starcher, 2018	Economic system in which goods and services are exchanged between individual consumers
Mazzucato & Semieniuk, 2018	Socio-economic activities in which the exchange of goods and services is carried out through online services
Sen & Ganguly, 2017	Economic model, the essence of which is the exchange of unused assets
Ploetz et al., 2016	The type of economy that is mainly based on the use of digital platforms to provide temporary access to goods
Strachan et al., 2015	Economic culture aimed at exchanging unused assets
Sweeney et al., 2020	Satisfaction of supply and demand in certain goods or services through P2P sales or rent

In our opinion, the most optimal definition is M. Burke, "sharing economy" is an economic system based on the exchange of goods or services (for a fee or free of charge), usually using Internet technologies (Burke, 2018).

To better understand the essence of the sharing economy, it is important to consider its basic principles.

1. "You do not use - so you lose." Proponents of the sharing economy believe that every thing is a capital that should bring income. The time period when the thing is not used means lost profits and reduced value of capital. In this context, the sharing economy can be seen as a circular economy. If more people use one product, the need to buy another will disappear.

2. "Optional to own to use." The current generation of consumers prefers short-term rentals for a small fee rather than full-cost purchases. This approach is closely linked to mobility and a "flexible" approach to life. The sharing economy is a subspecies of the "access economy". An important element of modern consumer trends is the change of views on private property, which was previously perceived as a symbol of status, but now - no. Thus, in the United States, 43% of consumers generally perceive private property as a problem: due to the time spent on product selection, maintenance and storage [8]. In contrast, users of sharing companies are much less dependent on these factors.

3. "Having a certain level of trust in communicating with people." Globalization of the economy and the development of information technologies bring people together. Even today, a person's reputation in the online environment is often enough for successful sharing operations.

4. "The sharing market is self-regulating." The principle of self-regulation is realized through the acceptance by all participants of the sharing of one measure of responsibility both for their actions and for all their possible consequences. If a seller has fulfilled its obligations poorly or incompletely, it will be reduced by the number of buyers (Davidson, 2019).

5. "Openness is the key to success." This principle establishes barrier-free activity, as well as the possibility of forming supply and demand for any, even the most unusual goods and services.

Thus, the most optimal definition of the definition of "sharing economy" given by the scientist S. Curtis is singled out. The basic principles of the sharing economy are clarified, namely: the principle of market self-regulation, the principle of openness, the principle of trust, the principle of using unused resources.

The development of the sharing economy is due to a number of factors. Thus, the main drivers in the development of the sharing economy are economic, environmental, social and technological factors (Table 2).

Thus, the development of information and communication technologies allows anyone to be both a producer and consumer of goods and services. Digital technologies significantly reduce transaction costs, leading to cheaper and easier ways to exchange goods and services. For example, fully automated order processing and online payment systems greatly simplify the search process. The use of such modern technologies as blockchain, the Internet of Things, and artificial intelligence is promising.

Table 2. Prerequisites for the development of the sharing economy

Technological prerequisites	Social prerequisites
<ul style="list-style-type: none"> - Industry 4.0 and digitalization of the economy - Development of online services and digital platforms - Development of payment systems - The emergence of new devices that have the ability to connect to the Internet - The boom of social networks 	<ul style="list-style-type: none"> - Gradual change in the culture of consumption, in particular the attitude to property - Population growth and density - Increase in life expectancy - The trend towards sestanization of social processes
Environmental prerequisites	Economic prerequisites
<ul style="list-style-type: none"> - Increasing environmental problems, in particular related to climate change - Growth of anthropogenic load 	<ul style="list-style-type: none"> - Crisis phenomena in the economy - Emergence of new business ideas and models - Downward trend in transaction costs - Development of a network of venture funds - Improving financial literacy

No less important factors in the development of the sharing economy are socio-economic. It is no coincidence that a significant number of shared companies were established in 2008-2010, during and immediately after the global financial crisis. It is the decline of financial markets and labor market uncertainty that explains the transition from the ownership paradigm to temporary access to goods and services. In addition, the global financial crisis has raised the issue of sustainable consumption, dematerialization of the economy and its service function. Scientists also claim that sharing is cost-effective for both consumers and producers or owners. For example, owners of an unused asset may earn by renting it out. Tenants, on the other hand, can pay less than when buying. It is interesting to substantiate the essence of the sharing economy Rachel Botsman, who noted that the average time of use of an electric drill is 12-15 minutes for its entire life. This statement is a clear example of the possibility of obtaining economic benefits by providing assets.

The COVID-19 pandemic had a mixed impact on the development of sharing business. The sharing economy has, of course, suffered from quarantine restrictions: some consumers have begun to abandon the sharing of goods and have returned to the usual purchase of traditional goods and services. On the other hand, the crisis in the economy has contributed to digitalization, which, in turn, may have a positive impact on the functioning of sharing.

Environmental drivers of sharing are especially relevant. In recent years, public ecological self-awareness has become especially widespread. The world's leading countries have declared a course to "green" the economy, reorienting society to the consumption of environmentally friendly goods and services.

However, there are certain problems in the development of the sharing economy: the "grayness" of sharing companies, unfair competition, danger and legal irregularities.

Sharing companies often work in the "gray", avoiding paying taxes and hiding employment. From a macroeconomic point of view, it is important to ensure budget

revenues through the transition of sharing companies to work in "white". In this context, it is necessary to understand the difference between sharing companies that provide exclusively online platform and resource owners (Gamez et al., 2017). Although accurate data are lacking, experience shows that a significant proportion of individual entrepreneurs and small companies do not declare any or partial income from sharing. The main problem with such transactions is the difficulty in monitoring them, as resource providers are usually not members of the company that owns the platform. Difficulties are also caused by the ambiguity of the actual structure of taxation.

Another problem is the payment of taxes that operate internationally. Such online platforms usually pay a small fee in the country of registration, sometimes in the country where the services are provided. In many cases sharing business models have the ability to circumvent the requirements of entering the market. Because sharing companies tend to have lower costs (including administrative costs), they have an advantage over traditional players. For example, an online food delivery service avoids so many restrictions on its operation compared to traditional restaurants. Some countries (France, Belgium) consider this to be unfair competition and create additional barriers to the entry of shareholders.

Potential dangers in concluding an agreement are an important obstacle to the development of sharing. Of course, large companies provide an opportunity for consumers to transparently assess the quality of service and provide feedback. With large volumes of transactions, the effect of self-regulation is activated (people avoid dealing with low-rated service providers, and the system may even block them). However, small companies cannot provide such reliability that it can endanger the health of consumers or their property.

A significant obstacle to activity is the fact, that sharing companies are legally unregulated. In many cases, companies use legal loopholes for their own benefit, but not always. It is difficult for small sharing companies to adapt to frequent changes in regulations, which leads to negative financial results.

Thus, the main drivers of the development of the sharing economy are identified, which include: technological, economic, social and environmental factors. It is considered that the COVID-19 pandemic had an ambiguous impact on the development of sharing entrepreneurship. Obstacles to the functioning of the shared economy have been highlighted: the "grayness" of sharing companies and legislative irregularities.

The sharing economy has a positive impact on the environment by reducing the total resources required, reducing emissions of pollutants, reducing the carbon footprint. Thus, in 2018 in Shanghai, the joint use of bicycles reduced emissions of carbon dioxide by 25 thousand tons and nitrous oxide by 64 tons. It is important that sharing activities contribute to long-term changes in consumer behavior: for example, instead of buying your own car, a person can use car sharing on a regular basis. In addition, sharing goods and services can help improve health. For example, N. Davidson claimed that more than 10,000 premature deaths could be avoided each year if European cities reached the target of a quarter of bicycle trips.

However, despite these benefits, some studies question the environmental performance of the sharing economy. Thus, researcher K. Stendig found that users of

P2P platforms (HomeExchange and Couchsurfing) stay in tourist places longer (thus polluting the environment) than it would be in the traditional use of hotels. J. Shchor, analyzing the activities of a number of car-sharing companies, proved that their relative cheapness contributes to more frequent use, as a result - increased carbon dioxide emissions.

According to recent studies, in contrast to users of traditional hotels, consumers of home sharing services consume 63-78% less electricity, 44-48% less water, and generally generate 61-89% less greenhouse gas emissions (Gozgor et al., 2020). In July 2019, the BlaBlaCar car-sharing platform (with more than 20 million users in Europe) reported a significant environmental impact from their activities: the prevention of emissions of 1 million tons of CO₂, equivalent to 250,000 cars. The main driver of this positive effect is the higher occupancy of cars (2.8 passengers in one car) than in traditional taxi services (1.7 passengers in one car) [15]. However, companies do not have a clear methodology for such calculations, so the validity of these results should be taken with caution.

There are various independent studies of the impact of car sharing on the environment. Most of the data relate to the B2C segment (traditional car sharing) and note that the main essence of sharing is a change in the private psychology of people. Thus, recent research reviews indicate that some people refuse to buy their own car, thereby significantly reducing greenhouse gas emissions.

One of the general issues regarding the environmental friendliness of the sharing economy is the "rebound effect". As a result of cheaper sharing services, real incomes of consumers are increasing. Additional income with a high degree of probability will be spent on other consumer goods. Another open issue is the environmental benefits of sharing small items (such as toys), as the negative environmental impact of transporting and cleaning may outweigh the positive. The sharing economy can be sustainable only through mutual cooperation between government agencies, businesses and consumers.

It is important to analyze the impact of the sharing economy on the transition to sustainable development. It was found that sharing creates a favorable environment for the realization of most of these goals.

Thus, the ecological effect of the sharing economy is considered. It is determined that the positive aspects of the sharing economy (reduction of CO₂ emissions, dematerialization of production) outweigh the negative ones.

The advent of new technologies is driving the sharing industry forward. The importance and significance of the sharing economy is reinforced by the fact that over the past 10 years, more than 200 startups (based on sharing) have received funding totaling more than \$ 11.5 billion.

Important is the study by PricewaterhouseCoopers, which shows that by 2025 the revenue of sharing companies will reach 335 billion dollars and is almost equal to the total income of traditional rental companies (Fig. 2.1) (Sheikh et al., 2016).

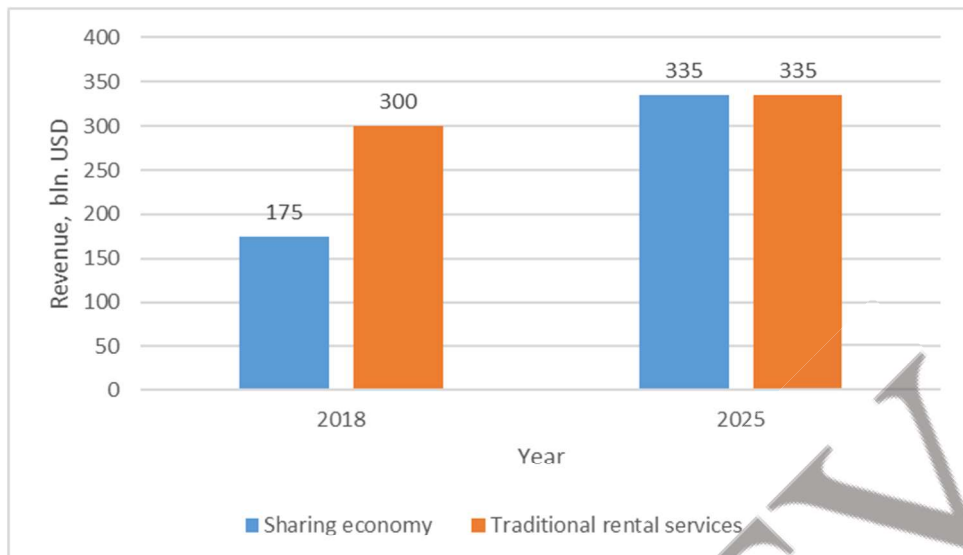


Fig. 1. Income of the sharing economy and traditional models in 2018 and 2025 (forecast value)

Studies show that more than 400 million people in 2030 will use car sharing on a regular basis. IBM estimates that 39% of car owners can abandon them if they have an extensive and balanced car-sharing network (Jebli et al., 2016).

The use of electric cars for sharing is promising. Thus, in 2018, the Polish company TAURON launched the first share of electric cars. A larger project launched in 2019 by Innology is the use of 500 BMW electric vehicles.

Over the last 10 years, car sharing has indeed started to grow exponentially. This can be largely explained by advances in digital technology, which have simplified the process of booking, paying for and accommodating cars, and digital unlocking and verification services have eliminated confusion with car keys. According to S. Miller, as of October 2019, car sharing was operating in 33 countries, five continents and 1,531 cities, covering approximately 4.8 million people, exchanging more than 104,000 vehicles. The number of people using car-sharing services in Europe, the largest car-sharing region, is 46% of all car-sharing people in the world, and the number of cars involved in car-sharing is 56% of the world's total. As of October 2019, 17.6% of car-sharing people use one-way car sharing, 82.4% use roundtrip car sharing. Europe had the highest percentage of one-way car sharing at the regional level, at 31.1%. It is important to note that some European car-sharing companies include electric cars in their fleet. The project to replace conventional cars with electric vehicles received funding from the European Union's Horizon 2020 Research and Innovation Program under grant agreement № 640401.

Currently, the growth of car-sharing services is most pronounced in Belgium, Germany and the Netherlands. For example, in Brussels, in 2018 the number of people using car sharing was 15,000 (for comparison - in 2013 9,000 people). Growth across Europe (and around the world) is concentrated in urban areas. The growth from approximately 400,000 car sharing in 2006 to over 3,500,000 in 2018 shows a significant expansion of the car sharing network. In fig. 2.2 shows the rating of European platforms of the sharing economy in terms of income in 2015 and provides forecast values for 2025.

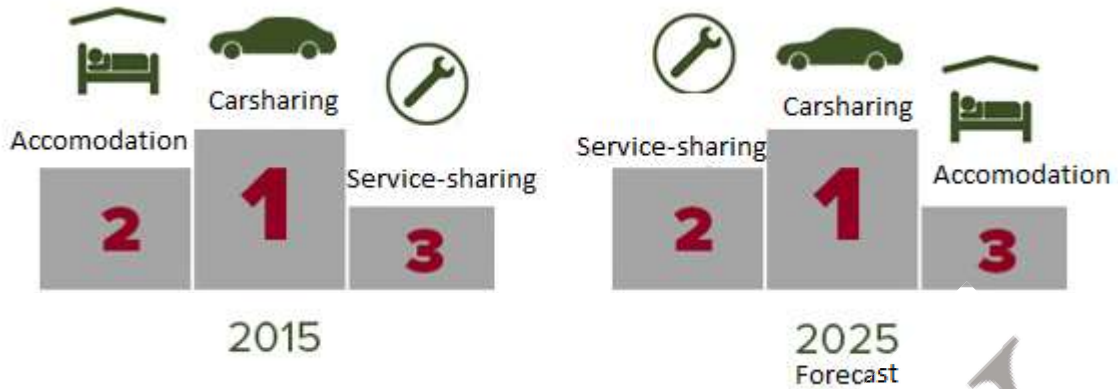


Fig. 2. Rating of European platforms of the sharing economy by revenue in 2015 and 2025 (forecast)

Digital aspects of its work are important in the innovative activity of the enterprise. The digital features of the sharing business include the company's information base, modularity, openness, capacity utilization. If a company creates added value mainly through information resources, it is easier for the company's ecosystem members to gain added value from interacting with each other on the basis of a digital platform, as information is scaled and disseminated at zero extra cost. The community that exchanges information within the digital platform is also valuable in itself, as it forms the basis of the network from which network effects arise. In this case, the information flows of the digital platform may have explicit forms (for example, user-generated content), and be covert (for example, digital platform algorithms). Thus, we can conclude that the greatest effect from the introduction of digital platforms will benefit companies in those sectors of the economy whose business model is based on information resources (services in general, banking, telecommunications, software development) (Mazzucato & Semieniuk, 2018). And companies in such sectors of the traditional economy as mining, metallurgy, construction, fuel and energy, where the share of capital assets is quite large, have difficulty in transforming their own business models in the development of digital platforms. whose business model is based on information resources (services in general, banking, telecommunications, software development). And companies in such sectors of the traditional economy as mining, metallurgy, construction, fuel and energy, where the share of capital assets is quite large, have difficulty in transforming their own business models in the development of digital platforms. whose business model is based on information resources (services in general, banking, telecommunications, software development). And companies in such sectors of the traditional economy as mining, metallurgy, construction, fuel and energy, where the share of capital assets is quite large, have difficulty in transforming their own business models in the development of digital platforms.

The impact of sharing on the future labor market is interesting. Although traditional jobs are unlikely to disappear completely soon, for some professions, sharing talent markets can be a much more attractive form of employment. They are more flexible than traditional hiring mechanisms, and employment platforms allow you to make money without leaving home or car.

Sharing reduces consumption, requires less valuable things, minimizes care for them, allows you to turn directly to people to solve household or one-time professional problems. In a broad sense, sharing is embedded in the general trend of abandoning hyperconsumption and returning to traditional communication between buyer and seller - without intermediaries in the form of resellers, agencies and consultants.

Thus, the development of new technologies moves the sharing industry forward. The digital features of the sharing business include the company's information base, modularity, openness, etc. The innovative aspect of the sharing economy involves not only a change in the paradigm of consumption, but also creates new trends in the labor market (Schmidt et al., 2016).

The sharing market is a complex phenomenon with close relationships between its subjects. Thus, in Fig. 3.1 shows the relationship between the main participants in the sharing market: asset owners, asset users and the online platform (which most often act as intermediaries).

It is important to analyse sharing market on a certain example. Carsharing is one of the leading sharing markets. Carsharing companies can be classified into four main types depending on their operational characteristics and features of business models: one-way with operational area, one-way with stationary parking, roundtrip (with return to the place) and P2P (Fig. 3).

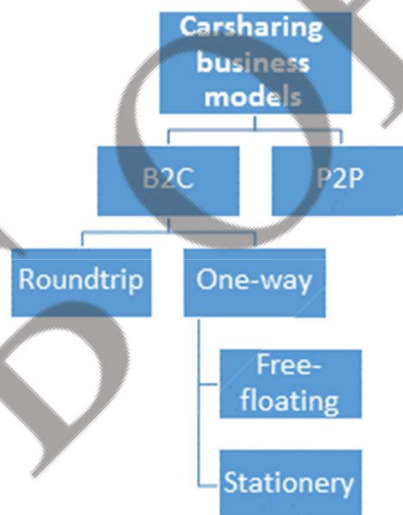


Fig. 3. Classification of car-sharing business models

In the one-way free-floating model, users rent a car and leave it in a convenient place for them. The presented model is the most flexible, as it allows freedom of movement and parking. However, the disadvantage is the limited operational area of service (in practice, limited to the city center).

The business model of a free-floating company with stationary parking spaces is much less common. Car-sharing users rent a car at the appropriate stationary sharing point and return it to the same or another parking space (Nelson et al, 2018). This business model is commonly used when sharing electric vehicles, so maintenance time is limited by charging the battery and the location of the point with the charger. In addition, potential users often have to wait until the electric car is sufficiently charged. Due to significant fixed costs and sometimes underdeveloped electric network, such a

business model is in most cases unprofitable, and only the rent from the tenant is not enough to make a profit (such companies often provide at least a minimum income from advertising).

The roundtrip business model requires the return of the car to the rental location (however, not necessarily to a stationary sharing point). Accordingly, this model is not convenient for one-way travel, but is used for short trips back and forth. Most existing business models of this type provide traditional cars instead of electric cars, which makes this model more flexible to use.

Recently, the P2P business model has become increasingly popular, with the company acting as an intermediary (renting cars from private owners and then renting them out to customers, winning the price difference).

Some classifications include business models not only for profit-making economic activities, but also for non-profit car-sharing, the essence of which is car-sharing on a charitable basis.

Thus, it was found that the sharing market is a complex phenomenon with close relationships between its subjects. It is determined that car sharing companies can be classified into four main types depending on their operational characteristics and features of business models.

V. CONCLUSIONS

In accordance with the purpose and objectives of the research work, the following conclusions can be drawn:

The most optimal definition of the definition of "sharing economy" given by the scientist S. Curtis is singled out. The basic principles of the sharing economy are clarified, namely: the principle of market self-regulation, the principle of openness, the principle of trust, the principle of using unused resources. The main drivers of the sharing economy development are identified, which include: technological, economic, social and environmental factors. It is considered that the COVID-19 pandemic had an ambiguous impact on the development of sharing entrepreneurship. Obstacles to the functioning of the common economy have been highlighted: the "grayness" of sharing companies and legislative irregularities.

The ecological effect of the functioning of the sharing economy is considered. It is determined that the positive aspects of the sharing economy (reduction of CO2 emissions, dematerialization of production) outweigh the negative ones. The development of new technologies is driving the sharing industry forward. The digital features of the sharing business include the company's information base, modularity, openness, etc. The innovative aspect of the sharing economy involves not only a change in the paradigm of consumption, but also the formation of new trends in the labor market.

It was found that the sharing market is a complex phenomenon with close relationships between its subjects. It is determined that car sharing companies can be classified into four main types depending on their operational characteristics and features of business models.

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Deputy director of the enterprise
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Act
on the implementation of the results of the study on the work
**«The Economic and Environmental Aspects of Sharing Economy
Functioning »**

The results of the study, namely the economic substantiation of sharing economy functioning was used by PNP "Center for Economic Research" in developing a strategy for the development of Sumy region for 2023-2030.

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