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## Urban passenger water transport: operating within public-private partnership (international research and case study)

**Abstract**

*Introduction.* There are no examples of public-private partnership (PPP) projects realization in the field of transport infrastructure development in Ukraine, as compared to the successful experience of advanced economies. Further research is needed to solve the problems of forming an effective PPP implementation mechanism, justifying the relationship between public and private partners in the process of partnership projects realization, taking into account the specific areas of PPP application, including the system of urban passenger water transport.

*The purpose* of the research is to create a mechanism for cooperation of urban passenger water transport (UPWT) operators with local authorities on the basis of public-private partnership in order to improve the system of urban public passenger transport.

*Results.* The developed mechanism of functioning of public passenger water transport enterprises on the basis of PPP should include the following tools: competitive selection of a private partner who will engage in business activities in the field of local passenger water transport services by such forms of public-private partnership agreements as concession agreements for the development of coastal infrastructure and contracts for the provision of passenger transport services; a methodical approach to assessing the potential demand for services of UPWT operators by interviewing potential consumers of transportation services; a methodical approach to mutually agreed terms of PPP agreements on the basis of evaluating the effectiveness of partnership from the standpoint of private and public parties of the agreements; algorithm of fare system formation for the services of UPWT enterprises; immediate concession agreements and contracts for transportation services.

The developed mechanism has been piloted in the field of urban passenger water transportation in Kyiv capital city which is rich with river infrastructure in two directions of transportation: shuttle transportation (as an example is the route «Domania Bay - Pivnichnyi («Northern») Bridge - Rusanivska Embankment - Dnipro metro station - Postal Square», the length is 19.50 km) and chartered transportation. It was proposed to enter into a concession agreement of the shore base constituent with the local authorities, which consists in the purchase of a pontoon and the arrangement of the coastal zone (including waiting places for passengers) in order to equip the waterfront. The calculations showed that the use of the proposed mechanism would provide private operators with a margin of 16-21%, local budgets will receive additional revenues in the form of concession fees, and in general it would also achieve social effect due to the development of urban passenger water transport and transparency of relations between private operators of UPWT and local authorities.

*Conclusion.* Development projects for urban passenger water transport should be implemented on the basis of mutually beneficial cooperation between private operators and local authorities through concession agreements on the maintenance and expansion of coastal infrastructure and contracts on the passenger transport services.

**Keywords:** Concession Agreement; Service Contract; City Passenger Water Transport; Public-Private Partnership (PPP); River Infrastructure; City Logistics; Demand Forecasting Mechanism

**JEL Classification:** B41; L33; R42

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**Підприємства міського пасажирського водного транспорту:  
функціонування на засадах державно-приватного партнерства  
(міжнародне дослідження та кейс)**

**Анотація**

Мета дослідження полягає у формуванні механізму співпраці операторів міського пасажирського водного транспорту (МПВТ) з органами місцевої влади на засадах державно-приватного партнерства (ДПП) задля удосконалення системи громадського пасажирського транспорту. Розроблений механізм функціонування підприємств міського пасажирського водного транспорту на засадах ДПП передбачає використання такого інструментарію: конкурсний відбір приватного партнера, який здійснюватиме підприємницьку діяльність у сфері надання послуг МПВТ шляхом укладання таких форм державно-приватного партнерства, як концесійні угоди щодо розвитку об'єктів берегової інфраструктури та контракти на надання послуг з перевезення пасажирів; методичний підхід до оцінки потенційного попиту на послуги операторів МПВТ; методичний підхід до взаємоузгодження умов угод ДПП на основі оцінки ефективності партнерства з позиції приватного та державного учасників угод; алгоритм формування системи тарифів на послуги підприємств МПВТ; безпосереднє укладання угод концесій і контрактів на послуги з перевезень.

Апробація розробленого механізму здійснена в сфері міських пасажирських перевезень водним транспортом у Києві за двома напрямками: маршрутні перевезення й перевезення на замовлення. Розрахунки показали, що використання запропонованого механізму забезпечить приватним операторам прибутковість діяльності в розмірі 16-21%, місцеві бюджети отримуватимуть додаткові надходження у вигляді концесійних платежів, а в цілому це дозволить досягти позитивного соціального ефекту в результаті розвитку міського пасажирського водного транспорту й прозорості взаємовідносин між приватними операторами МПВТ та органами місцевої влади.

**Ключові слова:** концесійна угода; контракт на обслуговування; міський пасажирський водний транспорт; державно-приватне партнерство; річкова інфраструктура; міська логістика; механізм прогнозування попиту.

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**Предприятия городского пассажирского водного транспорта:  
функционирование на основе государственно-частного партнерства  
(международное исследование и кейс)**

**Аннотация**

Цель исследования заключается в формировании механизма сотрудничества операторов городского пассажирского водного транспорта (ГПВТ) с органами местной власти на основе государственно-частного партнерства (ГЧП) для усовершенствования системы общественного пассажирского транспорта. Разработанный механизм функционирования предприятий городского пассажирского водного транспорта на основе ГЧП предполагает использование следующего инструментария: конкурсный отбор частного партнера, осуществляющего деятельность по оказанию услуг ГПВТ на основе таких форм ГЧП, как концессионные соглашения по развитию объектов береговой инфраструктуры и контракты на услуги по перевозке пассажиров; методический подход к оценке потенциального спроса на услуги операторов ГПВТ; методический подход к согласованию условий сделок ГЧП на основе оценки эффективности партнерства с позиций частного и государственного партнеров; алгоритм формирования системы тарифов на услуги предприятий ГПВТ; непосредственно заключение договоров концессий и контрактов на услуги по перевозке.

Апробация разработанного механизма осуществлена в сфере городских пассажирских перевозок водным транспортом в Киеве по двум направлениям: маршрутные перевозки и перевозки на заказ. Расчеты показали, что использование предложенного механизма обеспечит частным операторам прибыльность деятельности в размере 16-21%, городские бюджеты получают дополнительные поступления в виде концессионных платежей, а в целом это позволит достичь также положительного социального эффекта вследствие развития городского пассажирского водного транспорта и прозрачности отношений между частными операторами ГПВТ и органами местной власти.

**Ключевые слова:** концессионное соглашение; контракт на обслуживание; городской пассажирский водный транспорт; государственно-частное партнерство; речная инфраструктура; городская логистика; механизм прогнозирования спроса.

## 1. Problem statement

The global experience in the development of infrastructure shows that the implementation of public-private partnership (PPP) is the most effective tool for attracting investment resources to renovate and modernize material and technical basis of transport infrastructure facilities, improve the quality and competitiveness of transport services, innovative transformations of public administration in the field of transport infrastructure.

Today the practical implementation of PPP has not been sufficiently developed in Ukraine, although the legal means for the development of government and business partnership have been designed; the institutional environment for the implementation of PPP projects is being formed; government and local authorities are working on the economic and organizational aspects of the partnership and etc. At the same time there are no examples of large-scale partnerships in the field of transport infrastructure development now, as opposed to the successful experience of advanced economies. Further research is needed to solve the problems of forming an effective PPP implementation mechanism, justification of economic, organizational, legal and social relations between the government and business in the implementation of partnership projects, taking into account the specific areas of PPP application.

## 2. Brief Literature Review

Modern domestic scientific thought pays considerable attention to the issues of PPP implementation, in particular in the projects of development and functioning of transport infrastructure facilities. Domestic academic economists whose works are devoted to such problems, consider the prospects and benefits for PPP and analyze the foreign experience of its application (I. Brailovskiy, Z. Varnalii, A. Halchynskiy, V. Heiets, T. Yefimenko, I. Zapatrina, K. Pavliuk, P. Shelepnytskyi), develop mechanisms of PPP in development projects for urban agglomerations (N. Bondar, Y. Hradoboieva, M. Melnykova), study the problematic issues of the transport industry, including river transport (S. Boniar, V. Zhykharieva, V. Koba, O. Kotlubai, L. Nikolaieva, P. Pidlisnyi).

The issue of urban development through the involvement of water transport in urban transport infrastructure is also reflected in numerous works of foreign scientists. Thus, L. Márquez, V. Cantillo, J. Arellana (2014) study the qualitative influencing factors (safety and comfort of water transportation) which have an effect on the choice of passengers to go by water transport, develop tools for promotion of inland waterway passenger transportation and improving the security of such transportations by the Government of Colombia and private operators [12]. M. Tanko, M. Burke (2017) made international comparisons of urban linear ferry systems and studied the causes and process of their implementation. The authors established a set of predefined criteria and chose seven systems for the analysis: Brisbane, New York, London, Gothenburg, Copenhagen, Hamburg and Bangkok. The research shows that these systems are a source of innovation in each city and they have been implemented for a number of reasons, the main ones being movement of people, economic development, tourism and city branding. Particular attention is paid to the role of both private and government entities in the emergence and development of these transport innovations - urban linear ferry systems worldwide [16]. And in [15] A. Soltani, M. Tanko, M. Burke, R. Farid (2015) analyzed the operations of smart cards sales for travelling by urban linear ferry systems, which are the forms of public transport in cities around the world. The result of this work is that the ferry systems are in demand, especially where integration with terrestrial urban transport is possible and where there is a cross-ferry connection. In addition to these works, T. Smythe and J. McCann (2019) [14], M. Moret, L. Antonio and H. Pereira (2012) [13], A. Zlatoudis (2017) [1], M. Tanko, H. Cheemarkurthy, S. Hall and K. Garne (2019) [17], M. Burger, B. De Schutter and J. Hellendoorn (2012) [4], Z. Xiao and J. S. Lee Lam (2017) [22] and others paid attention to urban passenger water transportation.

The methodology of PPP application has been proposed by many foreign scientists who, in particular, study the distribution of risks among the participants of the partnership, the problems of PPP project management, suggest mechanisms for involving the PPP, namely: S. Leland and D. Read (2012) [11], P. Wiater (2015) [20], Ch. H. Bovis (2015) [2], H. Xu and K. Morgan (2012) [23], K. van Gestel, J. Voets and K. Verhoest (2012) [18], I. Kunst (2011) [10], R. Hrelja, T. Rye and C. Mullen (2018) [8], M. Cabrera, A. Suárez-Alemán and L. Trujillo (2015) [5], Ch. Willoughby (2013) [21].

However, the issue of the interaction of private partners providing urban transport services in the passenger water transport field, such as transport development, the mechanism of cooperation between private partners and local authorities in the implementation process of development projects for urban passenger water transport (UPWT) have not been studied. The feasibility study tools

of PPP projects in the field of passenger water transport at the city level and the defining partnership agreement parameters are not developed. The relevance of these issues has led to the necessity of developing a mechanism for functioning of UPWT enterprises on the basis of PPP, the application which is of scientific and practical importance for private business, city government, transport infrastructure of the city, society as a whole.

**3. The purpose** of the study is to develop a mechanism for cooperation of urban passenger water transport operators on the basis of public-private partnership with local authorities in order to improve the system of urban public passenger transport.

#### 4. Results

Foreign experience in the implementation of PPP projects shows that transport infrastructure is the leader in partnership projects value implemented in EU countries. Thus, according to The European PPP Expertise Centre (EPEC) [7], 7 PPP with a total value of EUR 7 billion were implemented in the EU transport field in 2018, and 10 projects with a total value of EUR 7.6 billion in 2017.

Among the most ambitious European projects of partnership in the field of transport infrastructure implemented over the past five years are the following:

- implementation of the Intercity Rolling Stock Replacement Program in the United Kingdom (East Coast Main Line, Great Western Highway, EUR 2.6 billion);
- highways construction in Turkey (North Marmara, EUR 2 billion), Belgium (Bruges - Zeebrugge, EUR 1.1 billion) and Slovakia (highway D4 / R7, EUR 998 million);
- subway line construction in Italy (Milan, EUR 820 million);
- construction of an airport in Turkey (Istanbul, EUR 6 billion);
- construction of a tunnel in the Netherlands (Blankenburg, EUR 1 billion) etc.

In Ukraine, due to the legislative issues related to the implementation of infrastructure projects on the basis of PPP, namely the lack of a well-understood methodology and effective mechanism for interaction between private business and government, PPP agreements are rarely concluded, and the process of negotiating them lasts too long and as a rule it stops if the implementation of such projects results in little financial benefits for the public partner, despite the considerable social impact.

At the same time, the tools of partnership of private water transport operators and city authorities are not used in the field of urban transport infrastructure in Ukraine. In cities with waterways and, consequently, with significant potential for improving public transport services, passenger transport services are provided by public utilities (e. g. «water bus» and «water taxi» projects of Kyiv city government, 2009-2010 [6], 2015 [19], 2017 [9]), or by private operators without regulating organizational and financial issues regarding the control of service quality by local authorities, economic and legal issues regarding the use of shore facilities, making payments to local budgets, etc. That is why there is a need to develop an appropriate mechanism that will ensure the implementation of UPWT projects due to the coherence of parties in PPP agreements and the structuring of the UPWT system.

Such a mechanism should reflect the interaction of the UPWT system elements, the separate action of which is directed at the general vector movement of the UPWT system participants to obtain the effective result of the activities of the UPWT utilities on the basis of PPP by means of methods, tools and factors that affect the entire UPWT system or its individual elements. Institutional, legal, organizational conditions and appropriate methodological support must be built into the mechanism for the effective implementation of the UPWT program on the PPP basis.

The use of PPPs during the implementation of UPWT will help to attract extrabudgetary investment resources, reduce budget expenditure for the maintenance and operation of the fleet and coastal service base (traditionally funded by the State budget), increase budget revenues, create opportunities for private business operations in the transportation field at the city level; enable risk sharing among the participants during the implementation of the UPWT project.

The mentioned information allows developing the mechanism of UPWT enterprises functioning on the basis of PPP. The structure of the mechanism (Figure 1) takes into account the implementation of UPWT services on shuttle transportation (ST) and chartered transportation (CT) by concluding concession agreements, as well as the maintenance of the shore service base and the provision of UPWT services through concession agreements.

The entities of the mechanism which are the UPWT operators, local authorities and users of the services aimed to ensure its implementation.

Interaction between UPWT enterprises and local authorities during the conclusion of PPP agreements (concession or service contract) includes demand estimation on a representative sample from consumer market analysis, negotiating PPP agreements based on the evaluation of partnership effectiveness from the standpoint of agreements participants that includes fare system development for UPWT services. Enterprises and local authorities make decisions on the formation of such a system and conclude appropriate agreements guided by the principles of the UPWT system on the PPP basis. Experience has shown that organizing the operation of the UPWT is unpromising without involving private business, only through public utility enterprises, and will have negative financial performance, which leads to unprofitability and closing up of infrastructure projects.

UPWT enterprises form urban water transport infrastructure by creating or reconstructing an existing one in accordance with the terms of the PPP agreement. They begin to provide their services and local authorities control their quality, safety and accessibility to users. Other UPWT entities

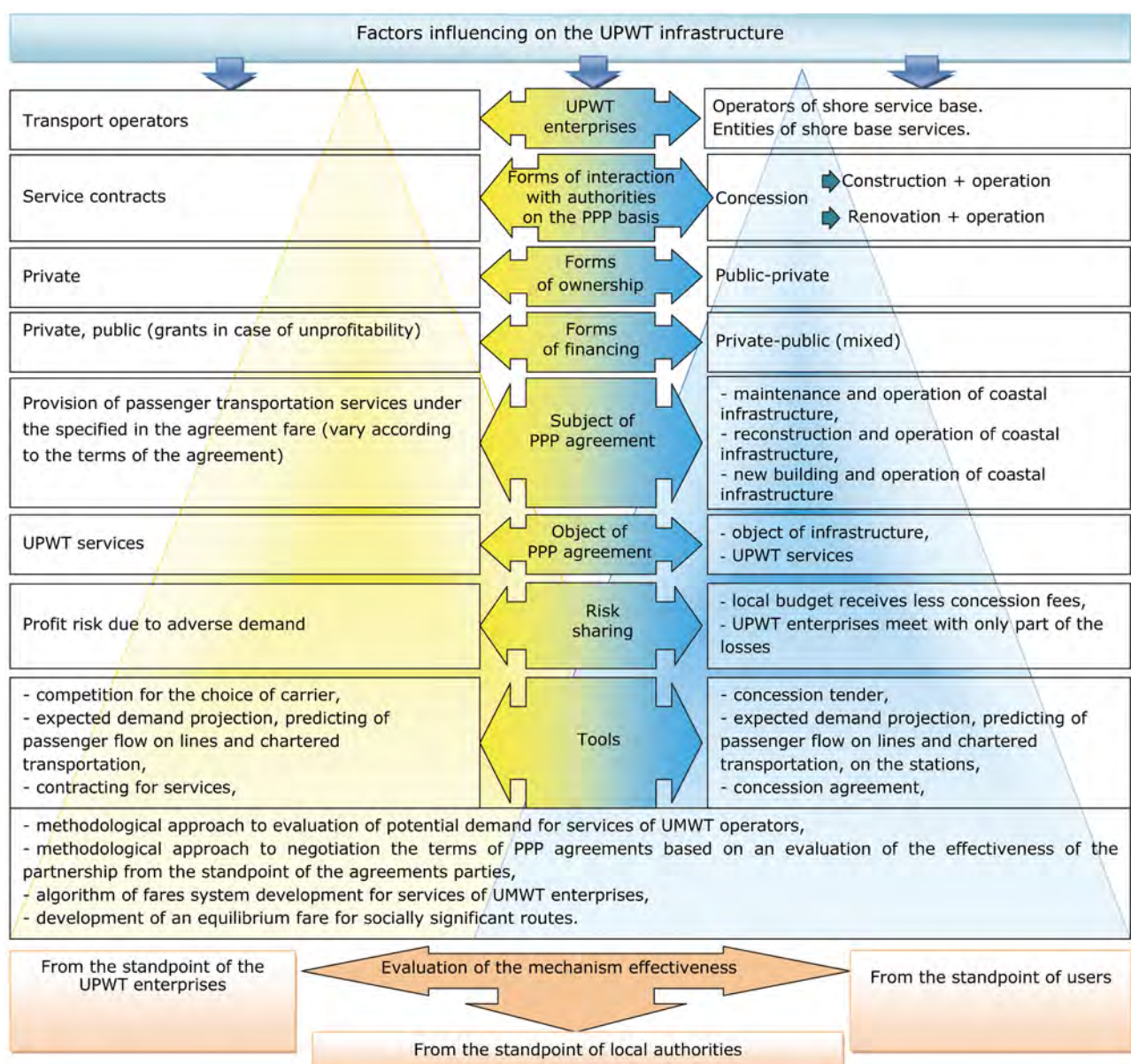


Figure 1:  
**Structure of functioning of urban passenger water transport enterprises on the basis of public-private partnership**

Source: Compiled by the authors

such as regulatory entities and users regulate the activities and consumption of UPWT services respectively. The relations between the UPWT entities should be based on simple and clear principles: honesty, integrity, legitimacy, control, professionalism, responsibility, efficiency, interaction, effectiveness, consistency. Such interaction will contribute to the effective activity of UPWT enterprises and development of the infrastructure of this transport type. In the case of its negative functioning, the interaction of the entities is reviewed and the points of weakness are identified that should be corrected.

The object of the mechanism is the services offered by UPWT (transportation and shore-based services).

The formation of the UPWT infrastructure is established by administrative, economic, methodological, organizational and social methods.

Legal and administrative methods involve the development of a legislative framework to support the UPWT activities. Local authorities regulate the UPWT functioning by laws and regulations in general and exert administrative and legal influence over the entities of this transport type. Development requirements of the UPWT development are taken into account by local authorities also when developing city strategies.

Economic methods are coercive and incentive. Local authorities establish fares for STs (which are of social importance) coordinating them with operators of UPWT and provide grants from the local budget. Fares for CT and services provided within the shore service base vary depending on the amount of privileges (tax exemptions, deferrals, accelerated depreciation, etc.) received by UPWT enterprises when concluding PPP agreements. In addition to pricing, economic methods include providing guarantees from local authorities in the implementation of concluded PPP agreements, in lending; strategic planning; insurance and more.

Procedural methods are based on the application of methodical support for implementation and development of UPWT by working out an approach to negotiating the terms of PPP agreements on the basis of evaluating the partnership effectiveness from the standpoint of UPWT enterprises and local authorities.

Organizational methods provide for the organizational and functional support of the UPWT infrastructure by developing appropriate schemes for the UPWT entities relations and applying PPP in the field of passenger water transportation at the local level.

Social methods provide consideration of the users' requirements of the UPWT enterprises services on the transportation value, ensuring the possibility of using the services of the UPWT of different social classes, development of transport products for tourism, distribution of passenger traffic at the local level, achieving social effect, improving the image of the city by optimizing the transport infrastructure.

Influencing factors for UPWT infrastructure based on PPP are:

1. Legislative and regulatory measures. They include laws and other legal acts which regulate the functioning of the UPWT and the application of PPP in Ukraine.
2. Institutional support. It reflects the influence of institutions (standards, regulators, restrictions) on the efficiency of the UPWT performance and is revealed in the organizational and functional scheme of ensuring the UPWT activities.
3. External factors which determine the development and conditions of UPWT functioning.
4. Sectoral influencing factors for UPWT. The users are influenced by the price and quality factors of the choice of services provided by the UPWT enterprises.
5. The needs of society in the UPWT's services. They emerge from the existing transportation and public demand for new means of transportation, namely the UPWT. Value and qualitative factors influence users in their choice of services provided by UPWT enterprises.

The formation of the UPWT infrastructure involves the following tasks:

- 1) selecting of the private PPP partner for passenger water transport activities at the local level;
- 2) estimating of demand for the services of UPWT enterprises, study of the available supply;
- 3) negotiating terms of PPP agreements;
- 4) establishing fares for the services of UPWT enterprises;
- 5) deciding on cooperation between private businesses and local authorities.

The implementation of these tasks requires the presence of some methodical tools which include:

1. Holding of a competitive tender for the selection of a private partner to engage in business activities in the field of UPWT services: concession tender, tender for the conclusion of a service

contract. The winners of the tenders are selected on a competitive basis the maximum net present value (NPV) criterion for local authorities which ensures the efficiency of the UPWT project and best value for investment in such project. However, as an exception, a winner may be selected without ensuring the maximum NPV from the standpoint of local authorities in a case when the high social impact from the implementation of the UPWT project is ensured.

Each case should be thoroughly and carefully considered during the competition and local authorities should be guided first and foremost by the well-being of the city and its inhabitants.

2. Methodical approach to estimation of potential demand for services of UPWT operators. The level of projected demand for UPWT services is determined by means of an appropriate questionnaire. The advantage of the questionnaire method among others is the ability to estimate demand in the absence of statistics. The questionnaire helps to obtain a wide range of information required for the formation of UPWT infrastructure and start-up of enterprises in this field, namely:

- short description of the respondent (age, gender, income level per family member, amount of transport expenses per month as a percentage of income in overland transport and UPWT, place of residence and place of employment, availability of own vehicle);
- respondent's satisfaction with urban overland transport (what types of overland urban transport he/she uses, how much time he/she spends on the road, satisfaction with comfort, service and comprehensiveness in the services, on which basis he/she chooses a mode of transport, how the transportation value affects the choice of a transport mode, what characteristics should be improved in the respondent's opinion);
- respondent's interest in the UPWT (interest in the appearance of the UPWT, activities that may prompt the respondent to use the UPWT services, the list of required routes, tariffication of the UPWT services, method of purchasing a ticket, Internet site availability, way of informing and performing orders, selecting the most essential characteristics of UPWT, how often the respondent plans to use the UPWT, the feasibility of UPWT implementing, wishes and comments).

An important prerequisite is the selection of a number of respondents that allows a qualitative interview and reflects the general trends among potential passengers. For this purpose, a representative sample of the general population is calculated and the consistency of respondents' opinions is analyzed. A seasonal cycle is being developed to account seasonal fluctuations in the demand for services provided by the UPWT enterprises. A detailed analysis of the users' market allows them to be segmented according to different characteristics and to plan the activities of the UPWT enterprises strategically.

3. A methodical approach to the negotiating the terms of PPP agreements based on an evaluation of the partnership effectiveness from the standpoint of the parties to the agreements. This approach involves the consistent revision of all the parameters of the PPP agreement with the simultaneous calculation of investment performance indicators for the parties of the agreement in order to achieve profitable and effective performance [3]. In order to ensure the efficiency and effectiveness of the functioning mechanism and development of the UPWT enterprises, it is necessary to review the constituent parameters of PPP at all stages of the formation of the UPWT system, which involves this approach.

4. The fare system algorithm for services of the UPWT enterprises. The fare system for the services of the UPWT enterprises is developed using this method, taking into account the stages of development of this transport infrastructure and the break even of their activity is achieved.

5. Development of equilibrium price for ST. The equilibrium price is developed only for socially significant routes and only under conditions where it is possible to receive subsidies from the city budget.

6. Conclusion of PPP agreements.

The mechanism of functioning and development of the UPWT enterprises based on PPP is presented in Figure 2.

The economic effect from the emergence of a new transport mode and its efficient functioning must be considered from the standpoint of three parties:

1. UPWT companies meet the demands for profitable activities.
2. Local authorities receive an increase in the city's budget revenues while achieving the social impact of the UPWT's operation and improving the urban passenger transport system.
3. Users receive quality transportation services and alternative routes.

The social effect is achieved for all UPWT entities in new jobs, expansion of transport infrastructure, improvement of the quality of passenger services, redirection of passenger traffic to the UPWT from overland transport, improving the image of the city, increasing the attractiveness of tourism, etc.

Testing of the developed mechanism is carried out on the example of predicted urban passenger water transport in the city of Kyiv in two directions of transportation: shuttle transportation and chartered transportation. Given the need to equip the waterfront to provide ST and CT, it is also proposed to make calculations for the concession agreement with local authorities as a service entity for the coastal base that includes the purchase of a pontoon and equipping the shore zone (including the equipment of waiting places).

*Shuttle transportation.* According to the results of a survey of Kyiv and the suburbs inhabitants, it was found that the route «Domania Bay - Pivnichnyi («Northern») Bridge - Rusanivska Embankment -

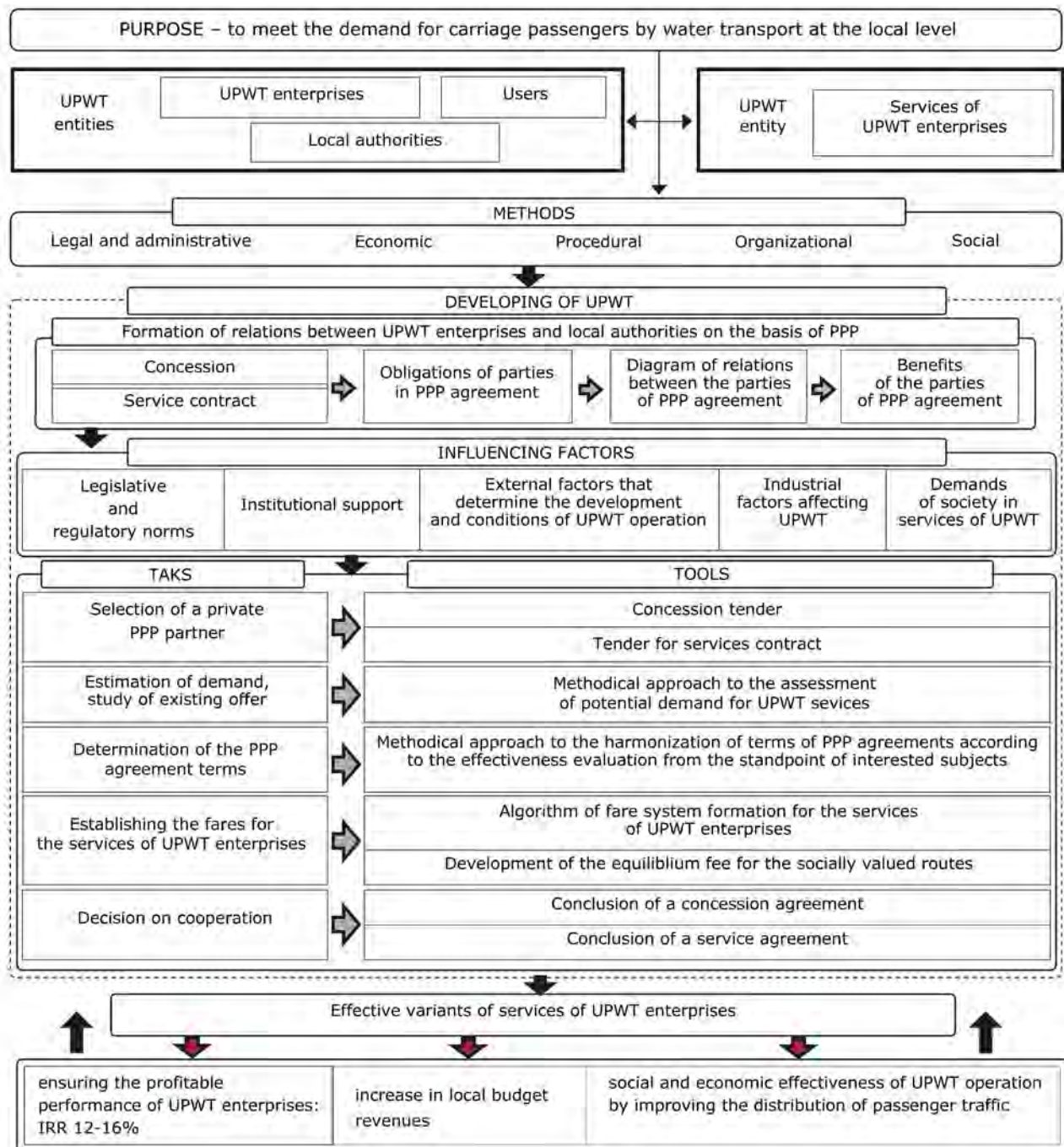


Figure 2:  
**Diagram of the functioning mechanism and development of the UPWT enterprises based on PPP**  
Source: Compiled by the authors



Dnipro metro station - Postal Square» with a length of 19.50 km (Figure 3) is of highest demand. During the testing of the mechanism through the selection of the indicators of the concession agreement the fare value was determined, by which ST operator has profitable performance outcomes (NPV = EUR 102 104, IRR = 26%) according to the initial data given in Table 1 (from there on, the currency exchange rate established by NBU was EUR 1 = 29.117373 UAH - at the moment of the calculations in July 2019). The base fare was:  $T_{bas} = \text{EUR } 1.37 / \text{passenger} / \text{voyage}$ : part of

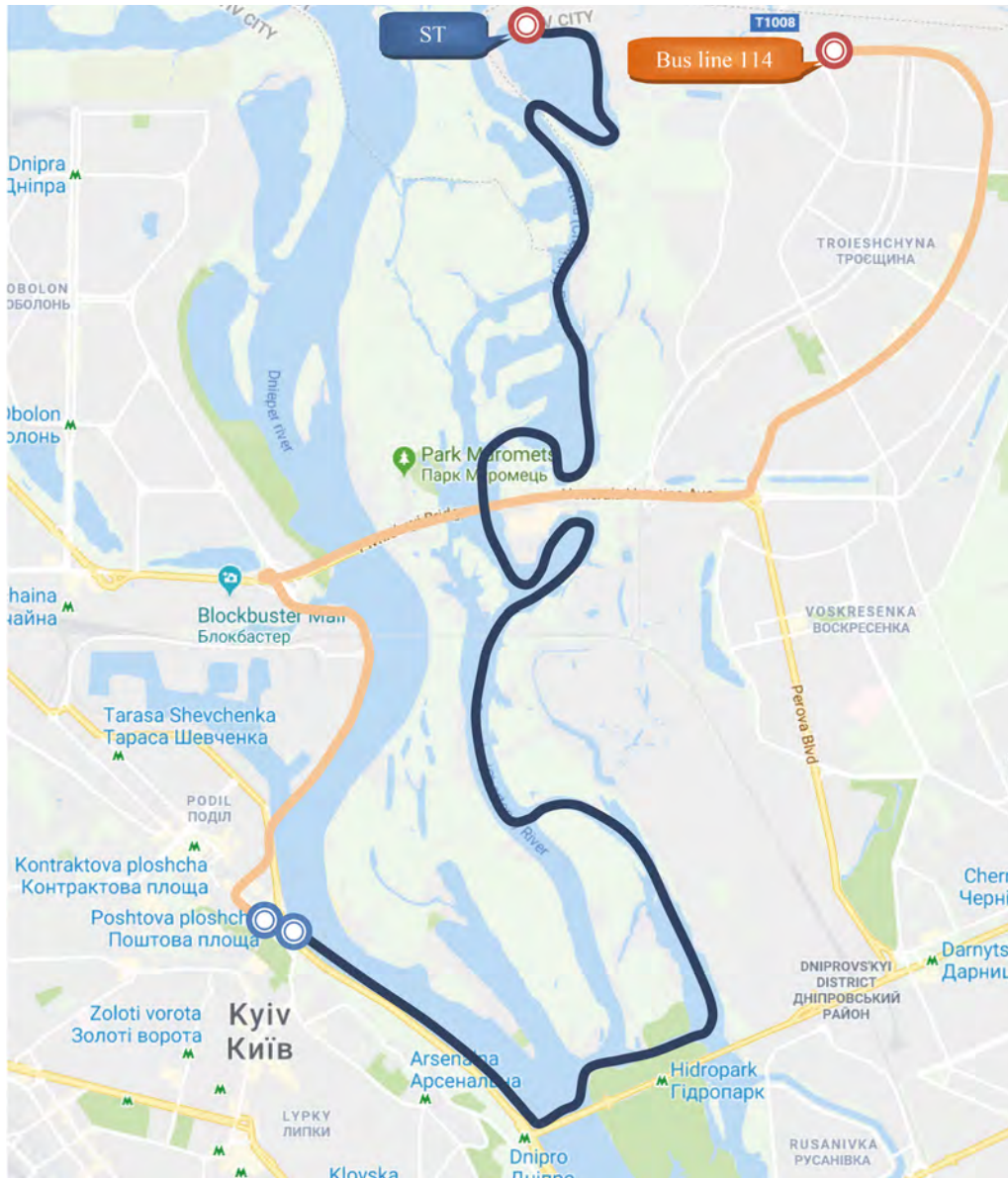


Figure 3:  
ST route «Domania Bay - Postal Square» (Kyiv city)  
Source: Compiled by the authors

Table 1:  
**Approval of a methodological approach to the harmonization of PPP agreement terms for the terms of concluding a contract for the shuttle transportation**

TERMS	By framework terms			Changes in terms		
	$T_{bas}$	NPV, EUR	IRR, %	$T_{bas}$	NPV, EUR	IRR, %
Service contract for shuttle transportation (catamaran)	Value of the ship: EUR 103 031, profit: EUR 26 362, duration of agreement: 20 years			Value of the ship: EUR 51 516, profit: EUR 12 029, duration of agreement: 20 years		
	EUR 1.37 / passenger / voyage (compensation from the local budget - EUR 0.78 / passenger / voyage)	102 104	26	EUR 1.07 / passenger / voyage (compensation from the local budget - EUR 0.48 / passenger / voyage)	13 066	16

Source: Compiled by the authors

the fare is paid by the passenger (EUR 0.59 / passenger / voyage) and the other part is compensated from the local budget to the transport operator (EUR 0.78 / passenger / voyage).

We get a base fare equal to  $T_{bas} = \text{EUR } 1.07 / \text{passenger} / \text{voyage}$ , while maintaining profitability of the ST operator (NPV = EUR 13 066, IRR = 16%), changing the basic conditions by reducing the value of the ship. Subsidies from the local budget are reduced under these conditions to EUR 0.48 / passenger / voyage (the part of the fare paid by the passenger remains unchanged).

*Concession (pontoon).* The expected revenues of the concessionaire consist of the revenues from payment for the parking of two ST catamarans and four CT. Under the basic terms of concession (Table 2) it is determined that a shore base entity will have profitable performance results (NPV = EUR 21 215, IRR = 37%), paying concession fees of 10 % of revenue. By going through the parameters of the concession agreement, it was determined that the amount of concession fees could be reduced up to 5%, berthing fee of UPWT vessels is also reduced (Table 2), while maintaining the performance profitability of this enterprise (NPV = EUR 3 114, IRR = 16 %).

*Chartered transportation.* It is difficult to calculate the base fare of CT because demand is formed on the basis of factors such as mood, personal priorities, payment behaviour and saving of passenger's time. The influence of the subjective assessment of the passenger on the decision regarding possibility of using this type of transportation complicates the mathematical justification of the fare. Therefore, the transport operator establishes a base fare according to competitors' prices and economic performance (Table 3). There are no grants for this transportation by the city.

According to the basic terms of the service contract (Table 3) by going through the parameters of the agreement, the amount of the fare value was determined at which the CT operator has profitable performance results (NPV = EUR 63 411, IRR = 98%):  $T_{bas} = \text{EUR } 0.28 / \text{vessel} / \text{km}$ . Such strong economic performance of the project makes it possible to assume that, provided that by maintaining this fare value, the operator is able to buy a more upgraded vessel of higher value to provide better quality services. By going through the parameters of the agreement we get: the base fare remains  $T_{bas} = \text{EUR } 0.28 / \text{vessel} / \text{km}$ , and the amount of money that can be spent on the purchase of the vessel, while maintaining the profitability of the WT operator is (NPV = EUR 15 145, IRR = 21%), is equal to EUR 68 688. The results of the calculations prove that the CT operator, while maintaining profitable results of operations, can purchase new modern vessels to ensure safe and high-quality chartered transportation of passengers by water transport within the city.

The calculations confirm the economic effectiveness of projects implementation of the UPWT under the terms of concession and service contract.

Table 2:  
**Approval of a methodical approach to the coordination of PPP agreement terms for the concession agreement terms (pontoon)**

TERMS	By framework terms				Changes in terms			
	$T_{bas}$		NPV, EUR	IRR, %	$T_{bas}$		NPV, EUR	IRR, %
Concession (pontoon)	Investment volumes of a concessionaire: EUR 12 020, profit: EUR 4 376, concession fees (10%): EUR 866, duration of agreement: 20 years				Investment volumes of a concessionaire: EUR 12 020, profit: EUR 1 953, concession fees (5%): EUR 247, duration of agreement: 20 years			
	for berthing of catamaran	for berthing of motorboat	21 215	37	for berthing of catamaran	for berthing of motorboat	3 114	16
	EUR 206 / vessel / month	EUR 137 / vessel / month			EUR 137 / vessel / month	EUR 69 / vessel / month		

Source: Compiled by the authors

Table 3:  
**Approval of a methodological approach to the harmonization of PPP agreement terms for the terms of concluding a contract for the chartered transportation**

TERMS	By framework terms			Changes in terms		
	$T_{bas}$	NPV, EUR	IRR, %	$T_{bas}$	NPV, EUR	IRR, %
Service contract for chartered services of WT (motorboat)	Value of the ship: EUR 10 145, profit: EUR 9 799, duration of agreement: 20 years			Value of the ship: EUR 68 688, profit: EUR 9 214, duration of agreement: 20 years		
	EUR 0.28 / vessel / km	63 411	98	EUR 0.28 / vessel / km	15 145	21

Source: Compiled by the authors

Thus, the approval of the proposed mechanism confirmed that the use of the described formation of an UPWT system allows to achieve a profitability of the performance of UPWT enterprises in the amount of 16-21%, receive additional revenues to local budgets and achieve social effect.

## 5. Conclusions

We believe that development projects for urban passenger water transport should be implemented on the basis of public-private partnership, i.e. mutually beneficial cooperation of private operators, who will carry passengers by waterways within the city public transport system.

Implementation of the developed mechanism of urban passenger water transport enterprises' operation on the basis of partnership with local authorities will allow to form an effective infrastructure of passenger water transport at the local level by using the following tools: competitive selection of a private partner who will engage in business activities in the field of local passenger water transport services by such forms of public-private partnership agreements as concession agreements and contracts for the provision of passenger transport services; a methodical approach to estimating the potential demand for services of UPWT operators by interviewing potential consumers of transportation services; a methodical approach to assessing the potential demand for services of UPWT operators by interviewing potential consumers of transportation services; algorithm of fares system formation for the services of UPWT enterprises and calculation of the equilibrium fare shuttle transportation, for which it is supposed to receive subsidies from the city budget; immediate concession agreements and contracts for transportation services.

The calculations showed that the application of the proposed mechanism will provide private carriers with a profitability of 16-21%, local budgets will receive additional revenues in the form of concession fees, and in general it will also allow to achieve a social effect due to the development of urban passenger water transport and transparency between the private transport operators and local authorities.

Further research should be conducted in the area of forming effective tools for activity of passenger water transport operators that will reduce corruption risks in the process of concluding concession agreements for the maintenance of coastal infrastructure objects and contracts for the transportation services with local authorities.

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