

CASE STUDY

The Impact of Legal Frameworks on Bidding Mechanisms

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ABSTRACT

BACKGROUND AND OBJECTIVES: The long-term nature and capitalization of projects as well as the risks of the country's economic environment have made the provision of proper infrastructure as a permanent problem for national and local governments. Governments prefer to outsource the development and exploitation of capital assets to the private sector due to several reasons. In this matter, government institutions, due to their weaknesses in both technology and financing, are willing to create some optimal policy frameworks to utilize financial instruments to encourage private sector participation, as well as increase the share of revenues from the urban projects. The aim of this paper is to use the auction theory to improve the current mechanisms of public asset allocation.

METHODS: This paper investigated the legal framework to design an allocation mechanism for the public assets using a qualitative approach. This qualitative method is based on the case study. This paper works on a series of library studies in order to analyze and familiarize with the problems, shortcomings, and inadequacies in the allocation of public assets exploitation plans in the Municipality of Tehran.

FINDINGS: The obtained results indicate that the current rule can be improved in terms of choosing the process holding model, bidding criteria, and focusing on sharing future revenues in order to strengthen both the optimality and efficiency of outputs.

CONCLUSION: This paper proposed the bidding mechanisms that can be employed based on the current rules. After determining the qualifications of the contractors, a two-step model can be utilized to provide the set of assets. The mechanism of holding bidding was provided based on the results of previous researches as well as the features of the current rule in the form of two stages of price detection and the First Price Sealed Bid Auction mechanism.

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INTRODUCTION

Governments prefer to outsource the development and exploitation of capital assets to the private sector due to several reasons including insufficient financial resources, the lack of access to appropriate technologies, future uncertainties about infrastructure projects, and the exploitation of public resources. The utilization of administrative processes to allocate the resource exploitation rights is economically inefficient due to the restrictions of governments' financial and technical capacity to assess the work plans, leading to a loss of potential resource rents (Sunnevåg, 2000). In this way, recently, auctioning as a competitive allocation tool has become one of the most widely used models to allocate public assets to the private sector (Bulow et al., 2009). An auction is used to sell a resource that is then developed by the winning buyer to generate a profit (Abhishek et al., 2013). Utilizing the auctions to allocate the exploitation rights of public assets as a solution to the current situation, the use of negotiation is proposed in terms of domestic and international contractors. Auction and negotiation are known as both market mechanisms in the transaction of goods and services. The formal comparison between mechanisms in the economic literature is conducted based on the principles of rationality as well as the individual interests of the players, which is limited to real situations and takes an empirical form. Indeed, it is impossible to investigate and choose a preferred mechanism outside the framework without regard to three dimensions of the product, participants, and market (Bajari et al., 2008). Traditionally, from the auctioneer's point of view, the auction excludes the negotiator from the selection range because of the economic return, although the inability to optimally define the product or process can lead to the opposite result. As such, the content of the application of mechanisms is the main determinant in the investigation and comparison environment of the performance of mechanisms (Wu and Kersten, 2014). In this regard, the allocation of exploitation rights of the capital asset through competitive mechanisms, in addition to increasing revenue for the government, it decreases to some extent the inefficiencies of the auctioneer (government) due to information asymmetry because of information disclosure. Overall, utilizing the auction theory to allocate the exploitation of the public asset to

increase competition and encouraging private sector participation can strengthen the allocation outputs in both dimensions of both efficiency and optimality. To allocate the exploitation rights of the asset, entering the Contingent Payment (CP) of auctioned assets, the issue of the related Moral Hazard (MH), the characteristics of large contracts, the complexities of the economic environment, and how assets are assigned in the allocation of asset exploitation rights, creates an analytical gap compared to other economic goods and classical literature. Obviously, risk coverage and project uncertainty can restrict the optimal policies and affect the strategic behaviors of players. Organizations should try to produce and offer more of their customers' desired product or service with all the features they want, and to continuously provide new competitive advantages with a new combination of available resources (Hosseini et al., 2020). In this paper, the problem of designing an appropriate mechanism to allocate the asset exploitation, with the approach of game theory and strategic behaviors of players, is conducted using a qualitative research method. The complexity of applying auction theory in the country's market, in addition to legal challenges, may also encounter some challenges in two ways. There are few research studies conducted on the use of theory in Non-Concessionary Allocation Systems (NCAS). Moreover, the analysis gap is intensified due to the difficulties of inferring and predicting the outputs of the designed and alternative models. So far, the issue of using auction theory tools in the allocation of public assets has focused on the first Price Sealed Bid Auction. The present paper focuses on the study of legal capacities in the use of combined auction mechanisms and the extraction of a new model of price discovery with the approach of improving efficiency and optimization. Combined patterns in auction theory can cover the shortcomings of classical patterns and offer greater efficiency and optimization than conventional negotiation methods. This paper presents a composite model based on the existing challenges of allocating public assets with respect to the limitations of the current law in municipalities.

Research background

The generation and exploitation of public assets encompass a level of risk and uncertainty due to the inflationary environment of the country, long-

term characteristics of contracts and investment. Traditionally, the execution of government projects on a linear sequence with an emphasis on the bidding processes is usually focused to ensure transparency and responsiveness (Lam and Yang, 2020). As a result, designing a legal framework that can encourage players with appropriate technical and financial capabilities to manage and invest in participation, is known as the objective of policymakers. Nevertheless, holding auctions to choose the appropriate allocation model for assets as well as to predict their outputs is a complex and controversial mission (Brasil and Postali, 2014). The first step to designing an appropriate allocation process is to identify the nature of the markets. Creating a complete differentiation between markets may not be complete. Overall, four types of Dynamic Pricing (DP) are conceivable for each type of allocation: transaction, auction, bargaining and negotiation, and administrative allocation processes (Wyld, 2001). Recently, the auction theory to arrange the transactions and allocations in the real world has also been paid attention to. For instance, one can mention employing the theory in the allocation of Radio Spectrum Auctions (Rothkopf et al., 1998), transportation auctions (Ledyard et al., 2002), resource exploitation rights auctions (Cramton, 2010), and public asset allocation (Janssen, 2004). Conceptually, auction refers to any transaction or allocation, in which the final price in the allocation and equipment of goods, services, and asset utilization, is determined based on the competitive bidding by market players. Auction theory, in addition to being able to state current sales methods in the real market of the economy, can also describe the normative frameworks regarding the performance of the market institution (Samuelson, 2014). Theory as a tool for market price detection as well as an application of Arrow–Debreu value theory (Geanakoplos, 1989) in the general equilibrium theory is assumed to not explicitly address how prices are discovered, based on which it provides an alternative tool in the dynamic formation of prices by the market conditions. In this regard, several studies such as Klemperer (1999) and Milgrom (2004) surveyed the evolution and main features of the theory in previous research findings. In terms of functional design, it designs rules (i.e. mechanisms) in order to determine how to disclose information between players as well as to specify the conditions for information exchanging based on the

disclosed information (Talluri and Van Ryzin, 2006). Classification of holding models can take the form of an auction-based on some possible and different aspects of the auction. Based on the economic literature to call such holding models, a complete verbal sharing is not recognizable. Undoubtedly, recognizing the divisions on these auction models can be separated, can be more practical than terminology (Maasland, 2012). In terms of design, the auctioneer of the auction may encounter with dual choices to shape the auction process, which are summarized in Fig. 1.

In the simplest form possible, the auctioneer should decide on the following dualities:

- Choosing between conducting an auction process for one or more assets simultaneously,
- Choosing between the bidding single-criteria or multi-criteria model,
- Choosing between the bidding one-way or two-way (both the auctioneer or auctioneers announce the offers, and also the bidder such as simultaneous buying and selling)
- Choosing between an open bidding model, in which all players can see and then modify their bids, or a sealed package that reveals only the market signs of some information.
- Ascending or descending pricing method
- Choosing the winner agent payment based on the submitted bid or the bid of the n th player in the bid ranking.

According to these choices, the classic four-mode bidding of English, Dutch, sealed package based on the best bid, and sealed package based on the n th bid of player are identified, based on which under some certain assumptions, they can generate the Revenue Equivalence for the auctioneer. Although this assumption has little application in the real world, one of the main applications of the revenue equivalence theorem as a criterion model is to analyze those cases that the assumptions of the theorem are not assumed to be fixed (Milgrom, 2004).

Here, it should be noted that the characteristics to allocate the exploitation rights of assets can restrict the use of classical models. Some of the characteristics affecting the allocation of these rights are as follows:

1. Uncertainty arising from business and non-business risks, in addition to strategic behaviors, affects the allocation models due to bidding time

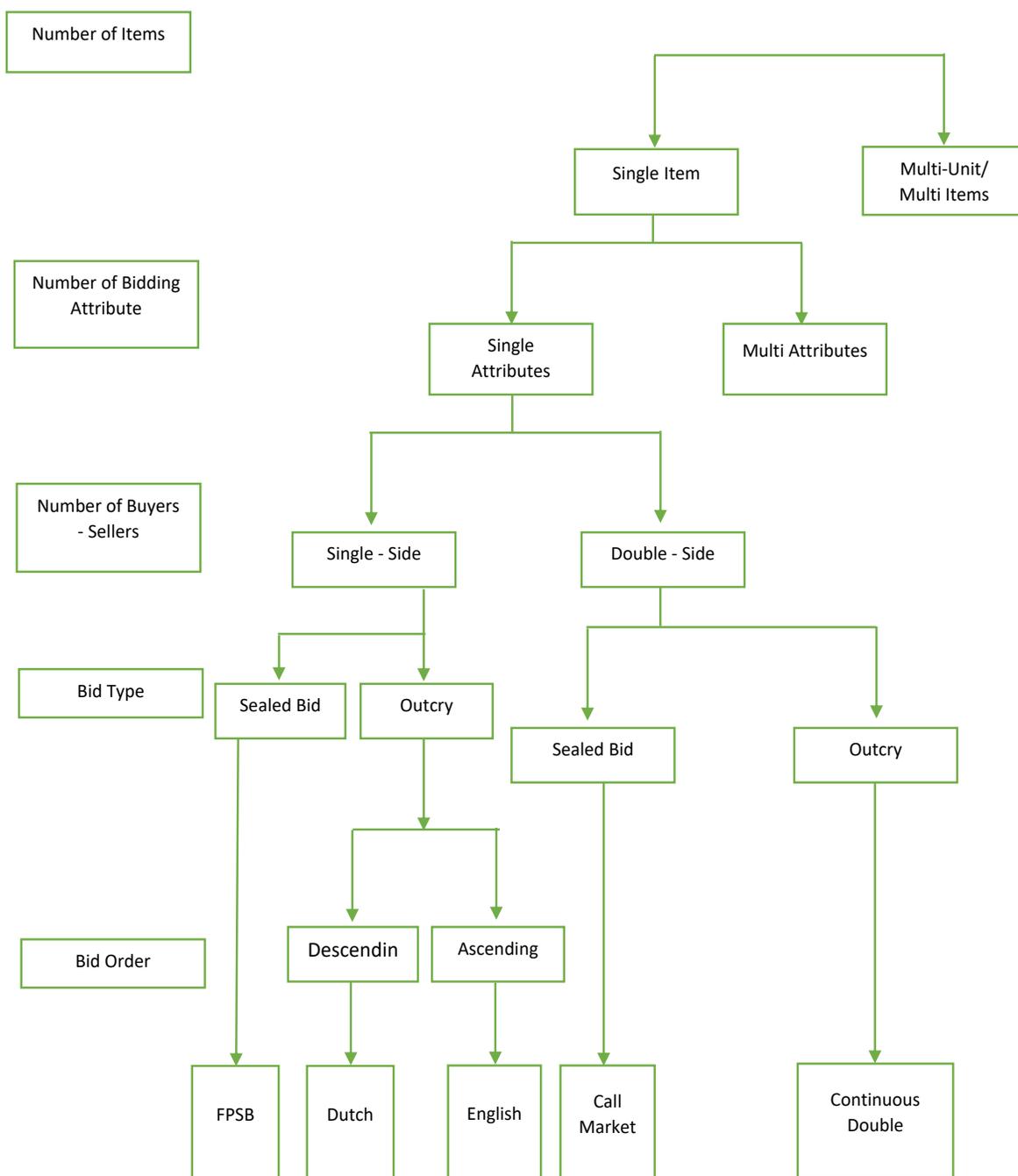


Fig. 1: Auction environment classification (Emiris and Marentakis, 2010)

decisions in terms of asset value and related investment costs. Based on the effects of the winner agent's subsequent decisions on asset outputs, the issue of moral hazard is added to the problem of

adverse selection in the classical auction models. The moral hazard can give policymakers the tools to focus on extracting unpredictable product rents, contingent cash flow sharing; so it excludes some of the classical

models to design in this field (Cong, 2018).

2. Entering the contingent revenues of the asset to the related moral hazard as well as the characteristics of large contracts, the complexities of allocating infrastructure projects, and how assets are allocated over other economic goods. The proposed models should provide the dimensions of efficiency, optimality, Reducing Transaction Costs (RTC), and transparency (Griffin, 2013)

3. Long-term definition of contracts is created due to the risk and operating costs of the activity that challenges transparency, profit sharing, rent extraction for the auctioneer (The economic literature distinguishes between an auctioneer and an asset owner. As municipalities manage the process, in this paper, the auctioneer is used instead of the asset owner), and the loss of the opportunity to exploit the information obtained to change the conditions of the allocation (Brown *et al.*, 2016).

4. Concerning the mentioned differences, more diverse variables are available as the bidding parameters separately and in combination with other auctions.

To design a holding model by the status of the various assets, the following process should be determined by the auctioneer and then clarified and announced before the start of the bidding time.

- A clear and precise definition of the objectives of the auction, and assuming the optimality (maximization of revenue from the asset) as the classical purpose of the auction. Having a clear and understandable process methodology to translate winners' bids and auction rules (Cramton, 2010) is a key point in this section. Here, some policymakers assume that the bidders' decisions are taken based on the contractual terms bid by the auctioneer, such as the shared revenue such as taxes, design process (Milgrom and Weber, 1982), decision theory, and game theory (Rothkopf, 2007).

- Regarding the susceptibility of players from other market players, the auctioneer must consider the strategic behavior of all players (Dixit and Skeath, 2015). In the real case, in a designed competitive model, the payments of the winner are auctioned under the influence of individual preferences, the preferences of other players, and the intrinsic characteristics of the asset (Milgrom and Weber, 1982).

- The exact definition of the dimensions of the

auctioned asset, although the auctioned product or asset are predefined in the standard theories, in many cases in the design of actual processes, the design, and definition of the asset form part of the design of the auction.

- The transparency, definition of prediction, and announcement of the bidding process are required before the start of the auction. The issues related to how to choose the winner and payment rules are described in this section.

- Determining the qualified players to participate in the process in the very key design for the use in this section, refers to the process being open to all participants and non-discrimination in participation or restriction of participation according to open conditions (Sunnevåg, 2000). Two approaches can be identified to determining the qualifications of players in the auction as follows: determining the qualifications of bidders by imposing the required minimums on bidders - generating a shortlist of the qualified bidders to participate; and the second case, the prediction of qualitative dimensions to define the product (specific asset) that is considered as a prediction before the bidding process, or as part of the participation and bidding process that can also be visualized as the translation form into the financial bids (Asker and Cantillon, 2008). Overall, to design a holding model by the status of the various assets, the following process, Fig 2, should be determined, so that the auctioneer should announce the bidding time before beginning.

Among four design steps, the main focus of this paper is on the rules of bidding as well as the problem solving of how to choose the winning broker. In the empirical models of choosing the appropriate model in target markets will often involve a complex process, particularly in the areas of efficiency, optimality, application, proportion to different levels, the asymmetry with the target market, approaches to player risk, and collusion (Cramton, 2010). On the other hand, Janssen (2004) classified the decision-making indices into five indicators:

1. Optimality, maximizing the expected revenue is the first decision criterion in this area. Optimal auctions to maximize the expected revenues of the seller with a set of tools such as the minimum price, setting the entering cost, etc., lead the surplus welfare expected from other players to the auctioneer. The classic paper for this issue goes back to the study of

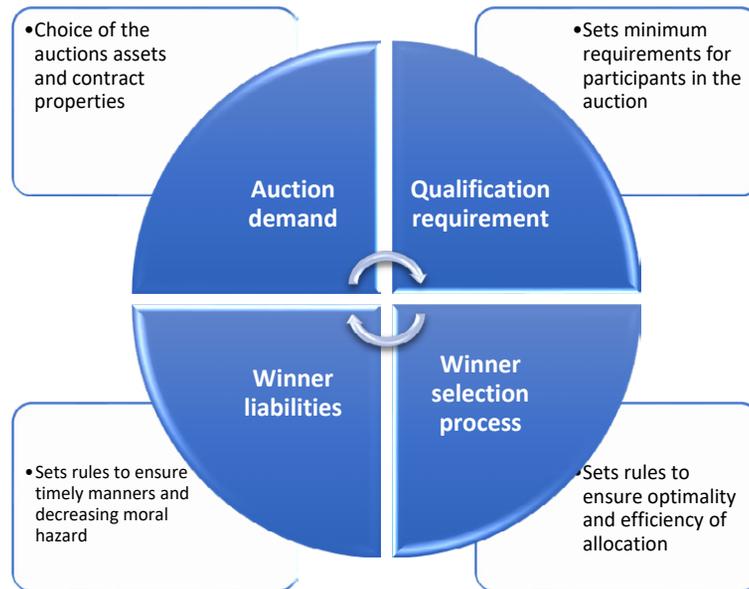


Fig. 2: The influential components on auction design (Grenadier and Wang, 2005; IRENA, 2017)

Myerson (1981).

2. The efficiency of the process: in the auction literature is called as efficient, provided that the allocation to the highest bidder for the subject of the auction is made as prior. This concept, in turn, is equivalent to the best use of the allocated license. This feature is especially important when it comes to the transfer of a public asset by governments and when it provides services or revenue flow in the future. Some limitations are significant to achieve efficiency; for example, if players have different limitations relative to each other, ensuring the efficiency may encounter some problems. For instance, if a player allocates the highest value to the asset that faces financial limitations, the efficiency may not necessarily be accomplished (Krishna, 2009). The issue of efficiency should be employed with caution if the government acts as the auctioneer. The concept of allocating assets to the highest value is not always equivalent to the concept of “economic efficiency”. The reason for this should be founded on the foreign license allocation. The benevolent government sells the license for the welfare of the consumer, but the consumer does not participate directly in the auction; as a result, the output of the licensing process is the most valuable company, not necessarily coordinated with the consumer preferences (Borgers and Van Damme,

2004). Overall, in the condition that the desired result is not achieved by conventional models, it may be necessary to change the rules to allow the desired result to be achieved. When there are net common values, the investigation of efficiency is not debatable, as all bidders allocate relatively equal values to their assets (Kagel and Levin, 2009). In the case that the desired result is not obtained from the conventional models, changing the rules may be achieved to make it possible to achieve the desired result. This can easily be accomplished due to the inherent flexibility in the process design.

3. Time and other holding costs, the designed processes by the characteristics of the subject of the auction, volume, and the number of assets to be auctioned. Structural optimization in terms of time, the effort required, etc. can be an effective criterion to choose a mechanism.

4. Simplicity, if it is assumed that attracting more participants in the process is one of the main objectives of auctions, simplicity of auction rules can help increase participation.

5. Collusion, the issue of how the use of collusion in any of the conventional models will affect the outputs and revenue of the auction, is the issue of many discussions in the economic literature. For instance, McAfee and McMillan (1987) investigated

the SPSB and then concluded that the results of creating a loop in this model could not necessarily be better than the random allocation. Previous studies have considered various aspects.

In order to achieve a comprehensive theoretical framework based on the mentioned issues, the models listed in Table 1 can be utilized to allocate the infrastructure projects as well as the asset exploitation, which allows the measurement of different methods.

In this paper, the results of previous conducted studies are surveyed to investigate the impact of various auction features on process performance as well as possible policy recommendations. This

qualitative study is based on individuals at the Municipality of Tehran, in 2020. The root of the analysis is in the framework of the principal-agent analysis environment, in which the knowledge and private information of the players can affect the strategic behaviors in bidding and output of the process in terms of revenue by increasing public welfare. In order to achieve the answer, along with studying the dimensions and frameworks of the theory and the differences between the target market and the classical theory, the investigation of allocation models in other areas of public asset transfer is the basis of research inferences in the next section. The second section deals with the research

Table 1: Characteristics of chosen models to allocate the exploitation rights of assets

Design criteria/patterns	FPSB based on the best or k rating offered - in one round	Iterative	Hybrid	More than one asset at a time
Simplicity	Maximum	Relative - Require gathering all bidder	Minimum - More difficult to implement and communicate	Relative minimum - More difficult to package bidding and Set the rules and ex-ante choices
Transparency and fairness (Cramton, 2010; Gretschno and Wambach, 2016)	Relative - Possibly opaque mechanism once offer is opened	Maximum – open real-time information	Relative Maximum - Ensured by the iterative phase	Relative - According to the information available on various assets
Efficiency (Cramton, 2010; Klemperer, 2002; (Klemperer, 2000; Milgrom and Weber, 1982)	Relative – bidding subject to winner curse	Relative – bidding subject to collusion Vulnerability	Relative – bidding subject to collusion Vulnerability	Relative maximum – decrease collusion Vulnerability and complement and substitute assets
Bidder ability to react	Minimum – information must be disclosed beforehand	Maximum – gradual disclosure of information, allowing agents to respond	Relative – only during the iterative phase	Relative - Not including all information in the combinatorial auction
Prevent of collusion (Salant, 2014)	Relative maximum – undisclosed in formation bid collusion	Relative minimum – bidder may force the auction to terminate early	Relative – second phase makes collusion more difficult	Relative – because of different preferences of bidders
Matching	Maximum – market curves fully known	Relative minimum – requires some assumption for optimal results	Relative maximum – market curves fully know in the second phase	Relative minimum - requires some assumption for optimal results

method. The general study of the rules and the conditions of the case study based on the outputs of the second section is the focus of the third section of the research. The final section provides conclusions and summaries. The current study has been carried out in Tehran in 2020.

MATERIALS AND METHODS

According to the content of the issue, this paper is conducted as a qualitative method based on the case study. The selection of the case study is carried out according to the questions of what and how it is performed. Qualitative research is research that aims to explore and examine the problems of research so that it reflects the views of participants in those problems based on the collection of textual and visual data (Clark and Creswell, 2014). Regarding the focus of the paper on the presentation of lessons learned, "Case study research" is chosen because it is a study of a system of individuals at the Municipality of Tehran in order to understand, interpret, and improve what is being performed. Collecting and analyzing different forms of data in order to describe the issues and lessons learned is a key procedure of this method. The case study is chosen based on theoretical reasons rather than statistics, where the aim is to select items that are likely to replicate or develop the theory (Eisenhardt, 1989). This paper aims to investigate the results of utilizing the auction in the process as well as its impact on legal frameworks. Accordingly, the type of case study is "instrumental case study", in which the researcher focuses on a controversial issue or problem, and then selects a limit and individual case to illustrate that issue (Clark and Creswell, 2014). This paper is the result of a series of library studies in order to analyze and familiarize with the problems, shortcomings, and inadequacies in the allocation of public assets exploitation plans in the Municipality of Tehran, Iran.

RESULTS AND DISCUSSION

Utilizing the theory in allocating asset exploitation rights in municipalities

The criteria for the processes of tenders and auctions in the Municipality of Tehran are the Rule on Tenders approved in 2004 (Majlis Research Center, 2004), and the Transactions Regulations of the Municipality of Tehran approved in 1976 (Majlis Research Center, 1976), in which the main focus is on buying and selling of assets and procurement rules. Moreover, there are

several rules for holding this at the national level. The law on Holding Tenders Approved in 2004 (Majlis Research Center, 2004), Approval of the Cabinet of Ministers dated 2008 the written guarantee for Contracts, Amendment of the Executive Regulations of the Tender Documentation and Information System Approved in 2007 (Majlis Research Center, 2007), Quorum of Transactions Subject to Article 3 of the Law on Tenders Adopted in 2015 (Majlis Research Center, 2015), Executive Regulations Cabinet Resolution 2006 (Majlis Research Center, 2006c), Executive Regulations issue (a) Article 26 of the Law on Tenders Subject to Cabinet Resolution dated 2006, Executive Regulations Paragraph (e) Article 29 of the Law on Tenders Subject to Cabinet Resolution dated 2006 (Majlis Research Center, 2006a), List of Proposed Subjects Paragraph 2 of the 2009 Working Group Support for production The subject of the Commission's approval of Article 138 of the constitution (Majlis Research Center, 2009), the law regulating part of the government's financial regulations adopted in 2001, is considered one of the most important procurement laws in Iran. In addition to the rule on tenders approved in 2004 (Majlis Research Center, 2004), the rules governing sales and auctions in the Municipality of Tehran are subject to the Municipality of Tehran Transactions Regulations approved in 1976 (regulations governing development projects subject to Note 3 of Article 15), and in the case of lack of bylaw, the Municipal Financial Regulations approved by the Parliament in 1976 by the Senate (Senate, 1976). According to the definition of the rule of holding tenders approved in 2004 is a competitive process to provide the desired quality (according to the tender documents) (Majlis Research Center, 2004), in which the obligations of the subject of the transaction are allocated to the bidder who has bid the lowest appropriate price. The most important bases of this rule are transparency, competitiveness, attention to quality, consistency of procedure in spending credits, and resources belonging to the public sector. Despite satisfying the features in the definition in terms of the rules in two areas of utilizing the model of holding tenders and auctions, it seems that the current condition can be improved to the capacities of auction theory. Based on the results of previous theoretical and experimental research, two shortcomings can be detected in the legal framework. First, how to solve the Winner Determination Problem (WDP): the selection of the winner agent in the

rules is limited to the first-price sealed-bid auction. Holding a first-price sealed-bid auction in the space of independent privately-known values of those players in the simplest conventional auction arrangement, which has been accepted as a selected model in the rules of the Municipality of Tehran. The player's valuation is not affected by the designed model of information as well as the choices of other players, which is determined independently based on data analysis of each player. The model faces some challenges in terms of assumptions including bidding beyond predicting Nash Equilibrium (The Nash equilibrium: The idea of the Nash equilibrium is that a set of strategies, one for each player, would be stable if nobody has a unilateral incentive to deviate from their own strategy: A self-countering n-tuple is called an equilibrium point (Nash, 1950)) for the risk-neutral bidders (Engelbrecht-Wiggans and Katok, 2007), failure to optimize bid prices due to the truthful report (Vickrey, 1961). Thus, bidders offer lower prices because of the reduced risk of the winner's curse, and therefore earn less revenue for the auctioneer (The winner agent loses due to incorrect information and the optimistic overestimating of the auctioned asset. As such, one of the cases of renegotiation is to leave the project and pay the penalty or non-optimal options in the prior decisions at the time of investment in proportion to the estimated loss. This issue is different from the issue of changing market conditions and understanding the market) (Mochón and Sáez, 2015). Second, possible models to allocate the exploitation rights of the capital assets: choices in the allocation mechanism directly affect output. In addition to the dual efficiency-optimality in objective setting, there are other choices in holding that the choice of them can have a direct impact on the expected outputs of the designed process, especially in terms of revenue (McAfee et al., 1989). Employing the allocation mechanism of different financial instruments to solve the problem of choosing the winner agent prepares the flexibility in determining how to bid prices to market players. Considering the problems of the chosen model, some alternative methods can be utilized, which obtain from the combination of classic auction models or specific designs by the asset, in which its path has remained silent in the rule. The defined models can be defined to allocate the capital assets including the exploitation of urban land, the construction of parking, the construction and management of cultural and sports facilities, and the activities that require investment by

contractors. Dual choices of urban policymakers, which are the selected state of the Rule on Tenders adopted in 2004 and the Municipal Transactions Regulations adopted in 1976, compared to the choices of results on the allocation of rights exploitation of public resources and assets, are compared in Table 2.

Policy Implications - Designing a Bidding Model for Municipalities

Based on classical models, proposed innovations in the literature of public asset allocation, and lessons learned from employing auctions in the allocation of asset exploitation rights in empirical works, and the features extracted in Tables 1 and 2, as well as the silence of the rules of practice on how the allocation process, a composite model to allocate the exploitation rights of the asset in municipalities is proposed in this section. The main aim of the proposed changes is to decrease the process-related risks, which include multiple criteria to solve the winner problem, holding several rounds of bidding, and contractor participation. Selection from Table 1 aims to increase transparency and efficiency by reducing simplicity. The designed environment increases the possibility of players learning, which also improves and reduces the risks in the process. Although the same view of holding all asset allocation processes cannot be complete in the current economic situation despite the various commercial and non-commercial risks (For instance, the existing laws have the same view of process documents and information. Whereas deciding on the amount of information disseminated in each auction can affect the level of competition. Here, the key questions are: What is the optimal level of information provided by the auctioneer for each asset? Regarding that comprehensive information is not available, the evaluation gap of creation and design is incomplete and accompanied by uncertainty, and on the other hand, complete information leading to provide identical bids), at what cost should the information be provided to the bidders? At the same time, problems and challenges are not visible in the short time bidding, because there is not enough time to gather relevant information), the proposed bidding model contains the capabilities to fit the current situation and the endogenously of the valuation problem in proportion to the number of players. The bidding model utilizes the features of hybrid models with an emphasis on the clock auction model in price

Table 2: Comparison of the status of rules of practice and the findings of previous research

Feature	Variable	Description	Current Situation	Selected Status Of Previous Research Findings	Some Articles Confirm
Biddable Items	One item	homogenous assets	*	-	It is usually not recommended for real option auctions
	More than one items	Package bidding	-	The attractiveness of the bidding package of assets for the bidders	(Bichler and Goeree, 2017; Cramton, 2010; Griffin, 2013)
Proposed criteria	One item	Price is the only bidding factor	Other factors meet at pre-qualification	Pre-qualification in empirical researches	(Asker and Cantillon, 2008; Branco et al., 2017; Che, 1993)
	More than one items	Quantitative and qualitative factors	-	Biddable Factors	
Market sides	One-sided auctions		*	*	(Board, 2007; Brown et al., 2016)
	Double-sided auctions	-	-	This is not a literature selection due to the auctioneer legal status In some hybrid cases, open auctions use for the exploitation of public assets	
Bid type	Open	Each bidder has information of others	-		(Griffin, 2013)
	Sealed Bid	The only auctioneer has information of all bidders	*	Reduce collision risk in bidding	
The basis for payment of the price by the winning broker	Selected bid	The winner pays his bid	*	*	(DeMarzo et al., 2005; Sunnevåg, 2000)
	Nth bid among others	The winner pays the price bid by the nth-highest bidder	-	Increase the probability of truthfulness report	(Abhishek et al., 2013; Cong, 2018; Skrzypacz, 2013)

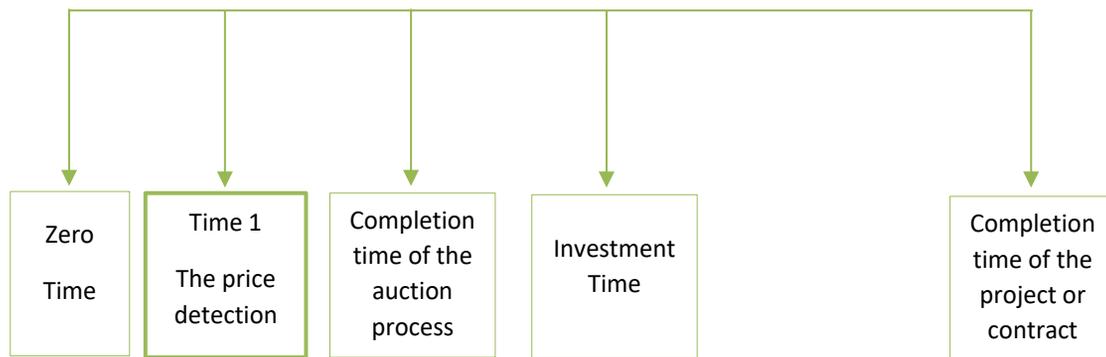


Fig. 3: Scheduling based on the proposed mechanism

detection. The clock auction model is a repeating auction that the auctioneer announces the prices, and then based on prices, players announce demand for each asset. After that, in the case of assets with excess demand, increasing-price is predicted, and then demand is recorded again. This process continues until no assets are left. All bids are recorded by the players themselves. In the following, a brief overview of the basic rules and procedures is described. The process is expected to be able to be registered on the Internet and run on an electronic auction software platform. The following points should be considered regarding the choices and conditions set for the bidders in the designed model:

- ✓ Model of holding simultaneously and in different periods,
- ✓ Relationship between contingent revenue and incentive adjustment (the use of various financial instruments including bonus and royalty rate).
- ✓ The non-financial bidding criteria before the auction to determine the qualifications of bidding;
- ✓ Cons bids provided in different periods,

In terms of scheduling, the scheme of the bidding process in terms of the allocation of exploitation rights of the asset can be illustrated as follows in Fig 3.

Zero-time

The auctioneer strategically begins the process, and then sets the rules and chooses how to solve the winner problem. In the proposed mechanism, a two-step auction is set. After repeated periods of the price detection step, the remaining players provide their bids in a sealed package so that they can have the strengths of both mechanisms. The decision-

making process of the players can be simplified as follows. There is no requirement to bid on all provided assets. Players can leave during various steps due to strategic reasons, viewing preliminary data, predicting the participating of other players, and technical and engineering analysis.

Time 1

The price detection step: based on the definition, the bids are provided by the players based on the chosen model of the auctioneer in the specified format, and then the winner agent is selected in this step. Due to the importance of the price detection problem in the first step at the zero-time step, the clock auction mechanism step is defined as a few increments, with the possibility of withdrawal and the possibility of presenting the bid package. In each round, two choices are available for the bidders: providing their bids in cash at current round prices, or exit the process at the same price as before or above. It should be mentioned that this price increase process continues as long as there are at least three maximum price bids in the process. In this step, the players can direct the calculations regarding the package auction. Mainly, determining preferences in package auction is costly and this model would lead to cost reduction. In each round, the number of received bids qualified to provide the bids in the next rounds is announced. The new price contains a percentage increase compared to the minimum acceptable price announced in the previous round, which will be announced as the new price by the auctioneer to provide the bids. In each step, those players who have offered the highest price are faced with three choices. Failure to provide a bid

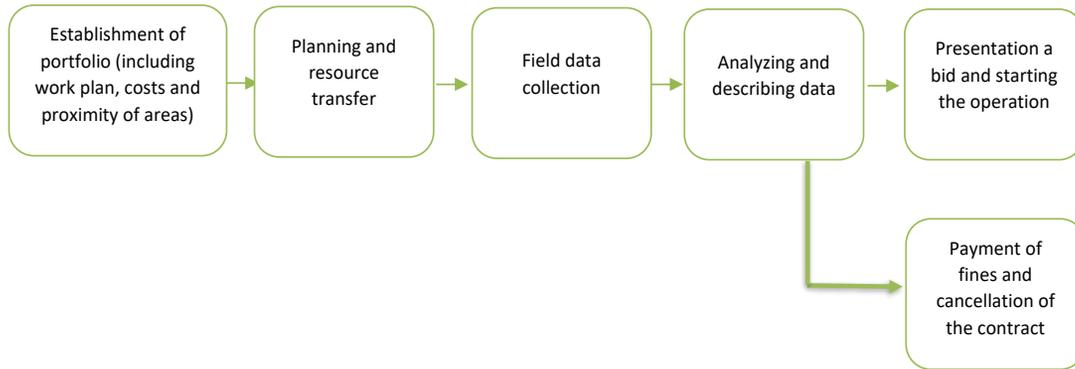


Fig. 4: The process after the auction until the end of the auction

means maintaining the previous bid. Moreover, it is possible to bid an exit between the previous bid, the minimum acceptable price of the second round, and the disqualification to participate in the next rounds, as well as to provide a new and higher bid and attend the next rounds if necessary. Furthermore, other players can bid an exit price or a higher bid.

Supplementary stage

This section aims to ensure the efficiency and optimality of the allocation. There is no incentive to reduce demand, which eliminates the chance of collusion. Besides, the activity rules can be eliminated in this section, meaning that if there is a possibility of expanding demand, there is no incentive to reduce demand and therefore it eliminates the chance of collusion. In this way, there are two ways to exploit this step as follows:

- ✓ Providing the bids in the form of a first-price sealed-bid auction
- ✓ Providing the bids on proxy models, especially when the competition is restricted and the complementary assets are different among players, leading to a rapid end to the price detection step. In the proxy model, the maximum bid and how to increase the announced prices, and the bidding, are simulated by expert systems.

Time 2

The movement of the players in the two-time step, which covers the subject of investment and exploitation of assets, is summarized as follows. One step after the auction, the agent can decide whether to continue the process. Accordingly, it can be assumed that a

final bidding step can be considered after the initial round of commitments based on the attractiveness of the first step as well as the evaluation of operational capacities and commitment strategies. Note that this step can be considered as renegotiation or completion of the selection process.

CONCLUSION

Regarding the long-term duration of contracts, the capital-intensive nature, and the integral role of urban areas, preparing adequate infrastructure is a constant problem for national and local governments. One of the ways of financial supporting the infrastructure and decreasing the running costs of the outsourcing route is to utilize the power of the private sector in the creation and operation of urban projects. Urban policymakers must seek to formulate policies to attract more companies via higher financial and technical capacity. The use of auction theory can largely cover the shortcomings of the current status. As result of this paper, it focuses on understanding the impact of legal frameworks on auctions involving private sector participation to allocate the exploitation rights of public assets. In addition to surveying the characteristics and challenges of the current rule by applying the results of previous researches, it has focused on policy bids to improve the investment attractiveness using the participatory methods, and also to decrease the uncertainties in the current status. As such, this paper proposes the bidding mechanisms that can be employed based on the current rules. After determining the qualifications of the contractors, a two-step model can be utilized to provide the set of assets. The first step is carried out by the auctioneer

to identify the most desirable combinations as well as to detect the base price. Afterward, the players who have remained in the process by following the rules can compete with each other based on the first-price sealed-bid auction mechanism. This model can take advantage of both open and closed models to some extent.

Research limitations

This research, like other researches, has some limitations, which are mentioned below:

- Impossibility of evaluating an alternative model based on field data in the allocation of municipal assets
- Lack of access to past auction results

While the rules used focus on the use of the classical patterns, the advantages of alternative and hybrid patterns have been overlooked. Accordingly this study faced empirical challenges in evaluating the results. It is hoped that future researches will face fewer limitations and provide more accurate results.

AUTHOR CONTRIBUTIONS

A. Faridzad has reviewed the research literature. A. Ghasemi has collect the data and has performed the data corrections. S. Shahhosseini has analyzed the data and has prepared the manuscript. A. Taklif has aided in performing the methodology. Proofreading and final corrections have been done by A. Raghfar.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

ABBREVIATIONS

CP	Contingent Payment
DP	Dynamic Pricing

FPSBA	First Price Sealed Bid Auction
MH	Moral Hazard
NCAS	Non-Concessionary Allocation Systems
RTC	Reducing Transaction Costs
WDP	Winner Determination Problem

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