

Institutionalizing Auction-Based Procurement to Ensure Efficient and Sustainable Purchasing

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The Promise of Auctions for Global Health

Donor nations and foundations contribute substantial funds toward global health and procurement, with outcomes both of improving health conditions and of increasing the probability of success in eradicating diseases worldwide. However, the available donor funds are limited, and an important strategy in expanding the effectiveness of programs is to improve the efficiency of global health procurement. The ultimate goal of the procurement process is to enable donors to have a greater positive impact by reducing the cost of procurement without compromising supply security and other objectives.

While every sector has its own unique objectives and challenges, the goals in global health are not dissimilar from those in many other industries. Generally, governments, NGOs and commercial enterprises are concerned with maximizing their sales revenues or with minimizing their procurement costs. The use of a forward auction is a common strategy for increasing revenues and the adoption of a reverse auction is a frequent approach for reducing costs. In addition, while global health is especially conscious of supply security, other industries that have heavily utilized auctions, such as the electricity sector, also consider supply security to be a priority. And governments conducting asset auctions often have important subsidiary concerns about the resulting downstream market structure—a counterpart to global health’s concerns about the upstream market structure—which the auction design needs to respect and advance.

Auctions have been successfully used in many sectors around the world to promote these objectives, resulting in significant improvements over the sales and procurement approaches that they replaced. In the telecommunications sector, auctions are the most common mechanism for distributing spectrum licenses to providers of mobile phone service, producing technological innovation, efficient allocations of resources and significant government revenues.¹ In the electricity sector, auctions are used to procure generating capacity and energy in order to minimize cost while ensuring supply security.² Auctions have also been used successfully for a wide variety of other purposes, including the allocation of lease sales for offshore wind energy,³ the sale of various commodities, and the procurement of greenhouse gas emission reductions.⁴

¹ McAfee, R. Preston, John McMillan, and Simon Wilkie. 2012. “The Greatest Auction in History.” In *Better Living Through Economics*, edited by John J. Siegfried, 168–184. Harvard University Press.

<https://vita.mcafee.cc/PDF/GreatestAuctionHistory.pdf>

² Ausubel, Lawrence M. and Peter Cramton (2010), “Using Forward Markets to Improve Electricity Market Design,” *Utilities Policy*, 18(4): 195-200, <http://www.ausubel.com/auction-papers/ausubel-cramton-forward-markets-in-electricity.pdf>

³ CNN, “Potential largest offshore wind farm in the world auctioned off for record price,” Dec. 14, 2018. <https://www.cnn.com/2018/12/14/politics/huge-wind-farm-auction/index.html>

⁴ Ausubel, Lawrence M, Peter Cramton, Christina Aperjis, and Daniel N. Hauser. 2014. “Pilot Auction Facility for Methane and Climate Change Mitigation: Auction Design.” <https://www.pilotauctionfacility.org/sites/paf/files/Blueprint%20for%20Operational%20Structure.pdf>

The use of auctions has also been considered for global health procurement. Procurement officers for global health commodities often have deep knowledge of the suppliers for those commodities. They use this knowledge to reduce the negotiated prices, while taking into account other procurement objectives such as supply security. However, due to asymmetric information, it is often difficult to negotiate effectively without an institutionalized process for reducing procurement costs based on competitors' offers. An auction approach can be more effective, precisely because it institutionalizes competition to reduce procurement costs, while taking account of the other procurement objectives.

In 2014–15, in a study for the Bill and Melinda Gates Foundation (BMGF), Power Auctions LLC (PA) designed, evaluated and simulated auction mechanisms for vaccine procurement. The key takeaways of this project were that auctions are a feasible alternative to today's vaccine tendering process that may reduce costs without compromising supply security. At the same time, auction approaches should not be expected to be equally effective in all environments, and they can only be counted on to work under market conditions with adequate supply and sufficient competition. Specifically, if the total supply that can be produced by manufacturers is less than the demand (i.e., inadequate supply), then the demand cannot be met regardless of whether an auction approach is used. On the other hand, if one or more of the manufacturers is essential for meeting demand (i.e., insufficient competition), then even with adequate supply, an auction may not be effective because the auction will not apply much competitive pressure to the essential manufacturer(s).

The study analyzed and simulated the likely outcomes of adopting auctions for procuring two of the most important vaccines for developing countries: the pentavalent vaccine and the rotavirus vaccine. For the pentavalent market (a mature vaccine market), PA concluded, using cost data, that an appropriately-designed multi-round auction could obtain strikingly lower vaccine prices than the traditional procurement process that was being used at the time. The results were taken into consideration by UNICEF and GAVI, and contributed to the decision to use a multiple-round tender approach and to take a more aggressive position in the next procurement cycle so as to leverage a very competitive market. The 2016 tender resulted in pentavalent prices being nearly halved: the weighted average price was reduced from \$1.65/dose to \$0.84/dose.⁵ This translates to \$366 million in expenditure reductions over the three-year procurement period, given that UNICEF procures 150 million doses of the vaccine each year. Moreover, supply security was maintained, as UNICEF obtained purchase agreements from six pentavalent suppliers.

The study also examined the rotavirus vaccine market, a newer and less mature market. PA concluded that the rotavirus vaccine market was not sufficiently competitive at the time for auctions to have a significant impact on procurement goals. The reason was that, unlike the pentavalent market, the rotavirus market was supply constrained and, in order to fulfill demand, GAVI would need to procure from both of the two large suppliers in that market. In general, auctions are expected to be more effective in reducing procurement costs when no single supplier is essential for satisfying market demand.

Reasons for Low Uptake of Auctions in Global Health

Despite the potential of auctions to significantly improve global health procurement, the uptake of auctions in this sector is relatively low. Global institutions appear to be averse to auctions due to concerns about unintended consequences. The concerns are that auctions

⁵ See "Supply of children's five-in-one vaccine secured at lowest-ever price," UNICEF press release, 19 October 2016, available at: https://www.unicef.org/supply/files/UNICEF_release_penta_pricing_19OCT16.pdf.

might negatively affect the market structure or compromise supply security. However, these concerns can be attributed largely to misconceptions about auctions.

One common misconception is that auctions would recklessly minimize the procurement cost without taking into account supply security considerations, and thus that auctions could be detrimental to supply security. However, there are various instruments that can be used within an auction design to respect and advance supply security and other objectives. One approach is to set aside part of the demand for certain bidders. Another approach is to favor bidders with a history of reliability; e.g., the bid of a reliable bidder could be preferred if it is at most 10% higher than the bid of a less reliable bidder. Alternatively, the auction design can aim to allocate positive quantities to at least a certain number of suppliers, as is the case with the two-stage scalar clock format described below.

Across sectors and industries, it is not uncommon for the beneficiaries of the status quo to warn of the dire consequences of change and to be proved wrong when the change occurs. As an example, when it was first proposed to conduct rough diamond sales with auctions instead of the status quo at the time of a non-transparent discretionary mechanism with take-it-or-leave-it offers, a number of stakeholders objected to the change. Nevertheless, auctions were implemented in 2008 and have been very successful.

Key Design and Implementation Considerations

The key steps in designing an auction are (1) to identify the appropriate performance metrics (such as minimizing cost and achieving supply security) and any relevant tradeoffs, (2) to specify the products that will be auctioned and how they will be structured (product design), and (3) to fully specify the auction format. The auction format determines how bidders are permitted to bid during the bidding process, how winners and prices are determined, and what bidders learn at each point in the bidding process (information policy). A large variety of auction formats exist in the economics literature and many of these formats have been used in practice.

The selection of the appropriate auction design requires auction theory expertise as well as knowledge of the industrial organization of the relevant markets and the status quo (e.g., the current procurement processes). For certain applications, existing auction formats may not be appropriate and it is then important to design a new auction format that is tailored to the application. This was the case for the 2014–15 vaccine work of PA for the BMGF.

Vaccine procurement (as well as many other procurements for global health commodities) have the following two key elements. First, the suppliers may have high fixed costs and low marginal costs, up to a determined capacity. Second, because supply security is critical and capacity constraints are important, it may be desirable or necessary to procure from multiple suppliers. Due to the cost structure, efficient procurement occurs at non-uniform prices; that is, firms that supply a smaller quantity require a higher per unit price in order to recoup their fixed costs. Consequently, a successful auction must elicit a range of acceptable quantities and prices from each firm in order to make this determination. As part of the work for BMGF in 2014–15, PA devised two auction formats that are appropriate for vaccine procurement: the descending clock auction with interval bidding and the two-stage scalar clock. Both of these formats ensure that the quantity and payment allocated to a winner are sufficient for that supplier to recoup its fixed cost.

The descending clock auction with interval bidding consists of multiple rounds. In each round, the auctioneer announces a price (the clock price) and each bidder reports the range

of quantities that it is willing to supply at that price per unit. A bidder that is not willing to supply any quantity at the round's clock price drops out of the auction. If the overall quantity that bidders are willing to supply at the round's clock price exceeds the demand, then the auctioneer starts a new round with a lower clock price. The auction concludes when the overall quantity that bidders are willing to supply at the round's clock price is less than or equal to the demand. Then, each bidder is allocated the maximum quantity that it was bidding for in the last round and its payment is equal to the last round's clock price times that quantity. Any residual demand is allocated in a way that minimizes the procurement cost.⁶

In the two-stage scalar clock format, bidders receive base payments for supplying some fixed quantity q (e.g., q could equal 20 million doses of a vaccine) and marginal payments for supplying additional quantities. In the first stage, suppliers bid to be one of the K suppliers selected to provide the minimum quantity q . In the second stage, suppliers bid to supply the residual quantity. The second stage can be a clock auction without interval bidding, where each bidder responds to the clock price with a single quantity (not a range of quantities) and bids may be prorated by the auctioneer. There is no need to enforce minimum quantities in the second stage, because most participants will have already been selected to provide the quantity q . The parameters q and K can be chosen based on supply security considerations and the efficient scale for the market.

Practical Steps for Global Institutions to Adopt Auctions

A global institution that is considering to transition to using auctions for some of its procurements would start by determining the appropriate procurement goals and performance metrics. The global institution together with the auction design experts would then identify the commodities for which auctions are expected to be the most effective and have the greatest impact with respect to these goals and metrics. These would be commodities that are not supply-constrained and where no single supplier is essential for satisfying demand. It is important to be aware that it may not be appropriate to use auctions in some scenarios due to supply constraints.

Once the appropriate procurement goals and candidate commodities have been identified, the next step is to determine the auction designs that would be expected to achieve these goals. An appropriate commodity and auction design would then be selected for a prototype auction. The prototype auction would entail doing the necessary preparatory work, drafting detailed auction rules, implementing the auction rules in auction software, providing bidder training, and running the auction. After the prototype auction, the global institution would communicate lessons learned and could then use auctions for the procurement of other appropriate global health commodities.

Frequent interaction between the auction design experts and the subject matter experts of the global institution throughout the project is essential for success, for two reasons. First, these interactions will enable the auction designers to identify the specific characteristics of the commodity market that will guide the determination of the auction design. Second, through these interactions, the auction designers will be able to assure that the auction format takes account of the special features of the particular commodity market—and to respond to any misconceptions about the auction process.

⁶ One variant of the descending clock auction with interval bidding has been analyzed in Baranov, Ausubel, Aperjis, and Morrill (2017), "Efficient Procurement Auctions with Increasing Returns," *American Economic Journal: Microeconomics* 9(3): 1-27.