

Using Microdata for Efficient and Strategic Public Procurement

By Serena Cocciolo, Sushmita Samaddar, Mihaly Fazekas

Abstract

The digitization of national public procurement systems across the world has opened enormous opportunities to measure and analyze procurement data. The use of data analytics on public procurement data allows governments to strategically monitor procurement markets and trends, to improve the procurement and contracting process through data-driven policy making, and to assess the potential trade-offs of distinct procurement strategies or reforms. This chapter provides insights into conducting research and data analysis on public procurement using administrative data. It provides an overview of indicators and data sources typically available on public procurement and how they can be used for data-driven decision-making, the necessary data infrastructure and capacity for optimizing the benefits from procurement data analytics, and the added value of combining public procurement data with other data sources. Governments can take various steps to create the conditions for effectively using data for decision-making in the area of public procurement, such as centralize public procurement data, periodically assess their quality and completeness, and build statistical capacity and data analytics skills in procurement authorities and contracting entities.

Acknowledgements

This report was prepared by Serena Cocciolo (Economist, World Bank), Sushmita Samaddar (Researcher, University of Kansas) and Mihaly Fazekas (Assistant professor, Central European University, and scientific director, Government Transparency Institute).

The chapter is based on academic research and operational experience from several World Bank projects that use data analytical tools in the area of public procurement, for example in Romania (led by Carmen Calin, Procurement Specialist), Croatia (led by Antonia Viyachka, Procurement Specialist) and Bangladesh (led by Ishtiak Siddique, Senior Procurement Specialist). The chapter greatly benefited for comments and inputs by Carmen Calin (World Bank, Procurement Specialist), Maria Arnald Canudo (DIME, Consultant), Daniel Rogger (DIME, Senior Economist), and Christian Schuster (Professor, UCL). Stephen Shisoka Okiya (DIME, Consultant) provided excellent research assistance.

Lessons for Practitioners

- **The increasing availability of public procurement administrative micro-data should be exploited for evidence-based decision-making.** The digitization of national public procurement systems across the world has opened enormous opportunities to measure procurement outcomes through the analysis of administrative data now available in machine readable formats on the e-Government Procurement (eGP) systems. The full potential of eGP reforms can be realized when data analytical tools are systematically applied at scale for the monitoring and evaluation of public procurement.
- **Procurement data analytics can be used for monitoring and characterize public procurement.** Public procurement data can be used in order to characterize national public procurement spending, describe time trends, compare procurement performance across procuring entities, regions, types of contracts, types of procedures, sectors or suppliers, and identify performance and compliance gaps of the national public procurement system. Interactive dashboards are increasingly widespread tools for implementing monitoring public procurement through descriptive analysis, since they enable procurement authorities to track, analyze and display key performance indicators through customizable and user-friendly visualizations.
- **Procurement data analytics can be used for data-driven policy making.** The analysis of public procurement data can enable procurement agencies to develop key procurement policies or refine and assess existing regulations. First, data analytics allows to assess existing efficiency gaps and understand the drivers of performance, and these empirical insights are useful to identify and prioritize potential areas of interventions and reform efforts. Second, data analytics allows to monitor the consequences of new policies, assess whether they are delivering the expected outcomes and understand potential trade-offs. Especially in cases where an eGP system already exists at the time of piloting and implementing new strategies, public procurement can also be a rich space for research and impact evaluations, since the necessary data for tracking key outcome indicators would be readily available from the existing eGP system.
- **Appropriate data infrastructure and capacity are necessary for effectively using public procurement data for decision-making.** First, procurement data should be homogeneously collected and maintained across procuring entities and connected to a centralized platform. Second, data generated from different stages of the procurement cycle (eg. tender process, bidding process, bid evaluation, contract award and contract signing) should be consistently organized and connected through key identifiers. Third, availability of data should be expanded to cover to the full public procurement and contract management cycle, including parts of the process that are not typically included in procurement data, such as data on public procurement planning and budgeting, tender preparation data, contract execution data, or complaints data. Fourth, data quality and completeness should be improved through some relatively simple and practical steps from the government, such as automated data quality checks in the eGP system and periodic data audits. Finally, the necessary capacity for statistical analysis should be built in the public procurement authority, potentially including the creation of a dedicated Statistical Unit.
- **A “whole-of-government” approach should be adopted in procurement data analytics.** Public procurement is multi-dimensional and it is critically interconnected with other functions of the public sector and public administration. Yet, the integration of e-procurement systems into other e-government systems is not yet a common practice. Data innovations should enable the integration of public procurement data with other administrative micro-data from other parts of the public sector, such as justice, firm registries and tax administration. This would provide a comprehensive picture

of the procurement function, holistically explore the environment within which procurement is conducted, and enable the government to develop innovative and impactful procurement strategies.

- **Procurement data analytics should move beyond traditional public procurement indicators and data sources.** While there is a widespread consensus on the measurement framework of public procurement dimensions related to costs, price efficiency, integrity risks, transparency and competition, other relevant aspects of public procurement currently lack well defined and commonly used indicators, such as the inclusiveness and sustainability of public procurement and the quality of contract implementation. Using non-traditional public procurement data can contribute to the development of new measures and expand the scope of public procurement data analytics, such as survey data with firms or procurement officers.

1 Introduction

While it is difficult to measure the size of public procurement transactions in each country, a global exercise by Bosio et al. (2020) estimated that around 12 percent of the global GDP is spent on public procurement i.e. the process by which governments purchase goods, services and works from the private sector. Given this massive scale, public procurement has the potential of becoming a strategic policy tool in three crucial ways.

First, improved public procurement can generate sizeable savings and create additional fiscal space through reducing prices of purchase and increasing efficiency of the procurement process (Bandiera et al., 2009; Singer et.al, 2009; Best et al., 2019).¹ Second, public procurement can support national socio-economic and environmental aspirations through encouraging the participation of local small firms in the public contracts market, promoting green and sustainable procurement, and creating jobs through large public works (Ferraz et.al, 2015 and Krasnokutskaya & Seim, 2011). Finally, efficient public procurement can improve the quality of public services through several channels, such as the selection of higher quality goods, more timely delivery of goods and completion of public infrastructures, and better planning of purchases and stock management. Given these strategic functions, efficient and effective public procurement can contribute to the achievement of the development goals of ending poverty and promoting shared prosperity.²

Data and evidence are necessary in order to monitor public procurement spending and identify the optimal policies and strategies for an efficient, inclusive and sustainable procurement. The use of data can contribute to a problem-driven iterative approach to strengthening and modernizing national public procurement systems through the identification of efficiency and integrity gaps, the analysis of the trade-offs associated to procurement alternative strategies, the development of data tools for monitoring the public procurement function, and the generation of knowledge and evidence on the impact of certain policies.

The digitization of national public procurement systems across the world has opened enormous opportunities to measure procurement outcomes through the analysis of administrative data now available in machine readable formats on the e-Government Procurement (eGP) systems. E-procurement refers to the integration of digital technologies to replace or redesign paper-based procedures throughout the procurement cycle (OECD, 2021). While countries are increasingly digitalizing public procurement processes, the functionalities covered by the eGP systems vary widely across countries, (Box 1), and this has implications on the access to and quality of procurement and contracts data for analysis and research. Figure 2.1 shows the advancements in eGP adoption globally, and it also highlights the different degrees of sophistication of national eGP systems, depending on the extent that the various procurement stages can be implemented electronically – advertisement, bid submission, bid opening, evaluation, contract signing, contract management, and payment.³

¹ The seminal paper by Bandiera et al. (2009) demonstrated that, in Italy, 83% of the total estimated waste in public procurement is due to passive waste, so that to inefficiencies related to constraints such as lack of skills, lack of incentives, or excessive regulatory burden.

² For example, with respect to the Sustainable Development Goals, public procurement can contribute to increasing access to markets for SMEs (Target 9.3), responsible consumption and production through sustainable public procurement (Target 12.7), reducing corruption and bribery (Target 16.5), developing effective, accountable and transparent institutions (Target 16.6), and ensuring public access to information (Target 16.10). Source: <https://uncitral.un.org/en/about/sdg>

³ Further details on the data shows in Figure 2.1 and on the level of eGP adoption across countries can be found here: <https://archive.doingbusiness.org/en/data/exploretopics/contracting-with-the-government>.

Box 1: Types of Digitization of Public Procurement Systems

The degree of digitization of the procurement process and its integration with other functions of the government play an important role in determining access and quality of administrative procurement micro-data and how it can be used for conducting data analysis and research on public procurement.

The digitization of the public procurement system has been implemented in different ways across the world, with implications on data availability and quality. Most commonly, eGP systems are used to publish and store public procurement information. For example, in Pakistan⁴ and Tanzania⁵ the online procurement system allows for the upload of tender and contract documents as scanned copies or PDFs. In these cases, the data would first need to be scrapped from the PDF documents and organized in a structured manner before any kind of data analysis can be performed. In fewer countries, the eGP system includes functionalities that are related to the transactional aspects of public procurement, such as e-tendering, electronic submission of bids, e-evaluation, e-awarding, and, in most advanced cases, electronic submission of invoices, e-catalogues and contract management. In these cases, the eGP system generates data in machine readable formats, readily available for analysis. For example, in Colombia a data management system has been implemented following the OCDS⁶ guidelines on data transparency, the data from the eGP system can be downloaded in the form of excel files and can be readily used for analysis.

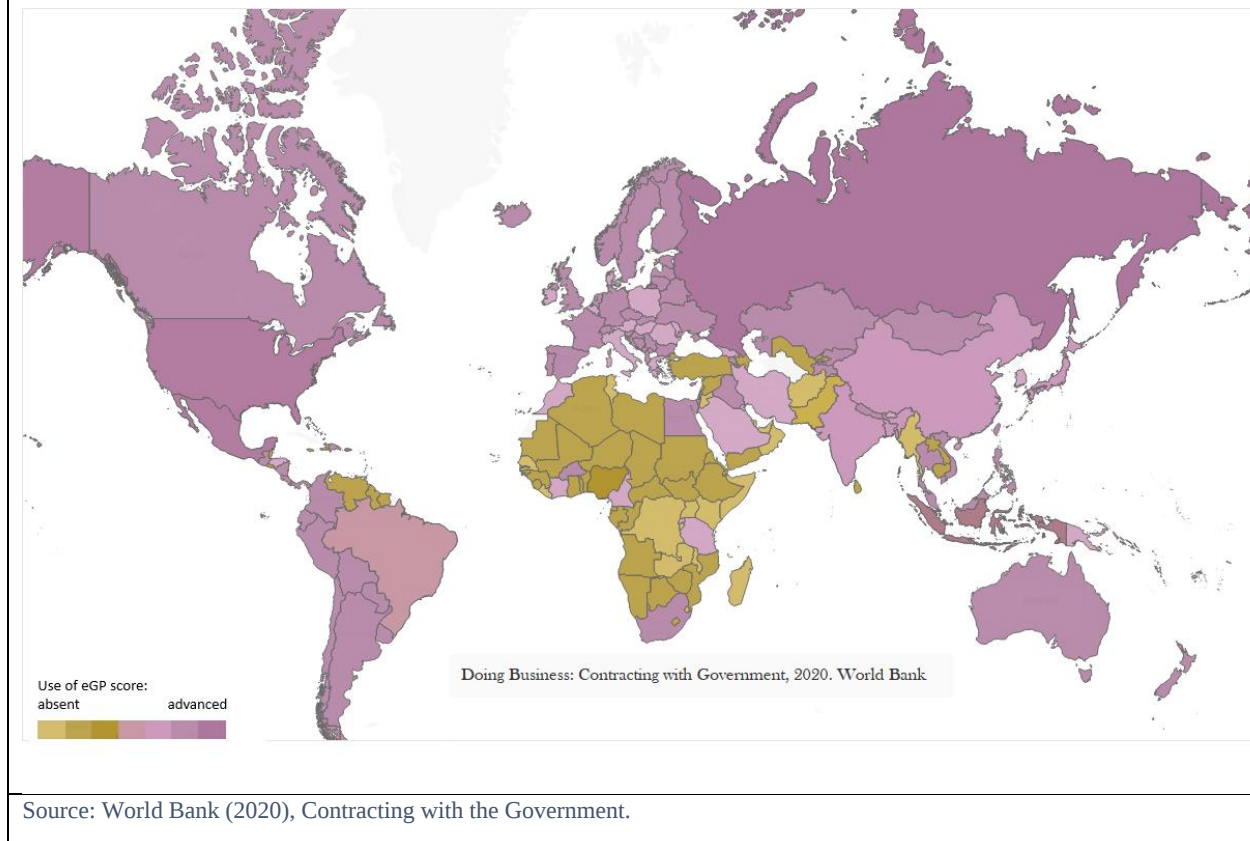
There are variations in the quality and completeness of data generated from the eGP system, and how well the data from different parts of the procurement process can be integrated or merged for a holistic view of government purchases. The integration of e-procurement systems into other e-government systems is not yet a common practice and further work is needed to promote this “whole-of-government” approach also from a data perspective.

⁴ <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/632241498842804246/pakistan-land-records-management-and-information-systems-project>

⁵ https://www.afdb.org/sites/default/files/documents/project-related-procurement/invitation_for_tenders_-_edms.pdf

⁶ <https://standard.open-contracting.org/latest/en/>

Figure 1.1: Use of eGP across the World



Governments can take various steps to create the conditions for effectively using data for decision-making in the area of public procurement, such as centralize public procurement data, periodically assess their quality and completeness, create the data infrastructure for integrating data from various stage of the procurement cycle and with other e-government systems, measure the socio-economic and environmental dimensions of government purchases, integrate procurement data and systems into other e-government data and systems, and build statistical capacity and data analytics skills in procurement authorities and contracting entities.

This chapter provides insights and lessons on how to leverage administrative microdata for efficient and strategic public procurement. The chapter first provides an overview of indicators and data sources typically available on public procurement and how they can be used for data-driven decision-making (Section 2), the necessary data infrastructure and capacity for optimizing the benefits from procurement data analytics (Section 3), and the added value of combining public procurement data with other data sources (Section 4).

2 How do we use public procurement data for decision-making?

2.1 Procurement indicators used for Data Analysis

Based on the perspective that public procurement is a strategic function contributing to efficient public spending, as well to the achievement of national socio-economic and environmental objectives, this chapter

provides a holistic view of public procurement. While the application of data analytical tools is often associated to the use of corruption flags to uncover malpractices, this focus risks to discourage governments from using and opening public procurement data. Data analytical tools have the main purpose of strengthening the efficiency of public procurement and government spending in achieving national objectives, and a stronger focus on these more comprehensive goals could help winning some on the resistances from the governments in adopting them.⁷ Following this view, in this section we present a broad set of procurement indicators and uses of procurement data analytics corresponding to a wide range of objectives, including but not only anti-corruption goals. Table 1 provides an example of public procurement indicators that can be used to measure the performance of the public procurement system in the dimensions further described in the next paragraphs: economy and efficiency, transparency and integrity, competition, inclusiveness and sustainability.

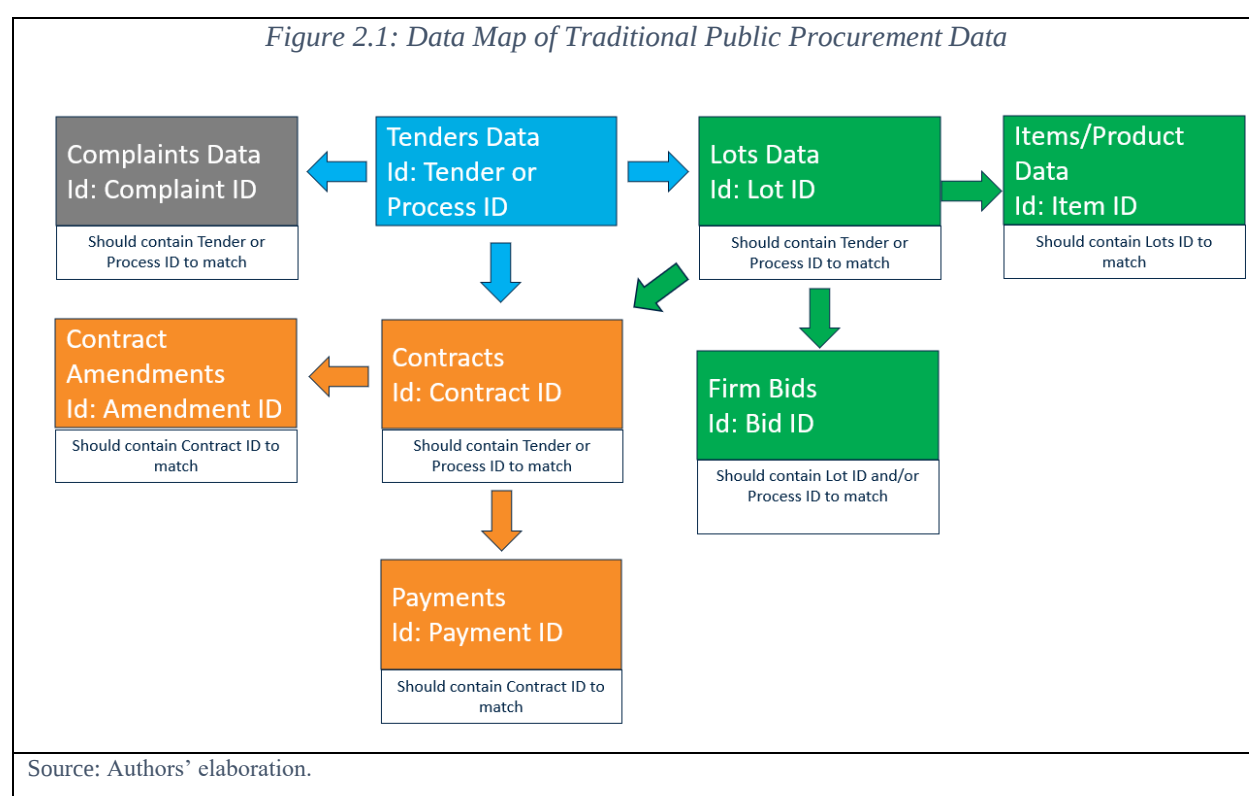
Table 1: Examples of public procurement indicators

Economy and Efficiency	Transparency and Integrity	Competition	Inclusiveness and Sustainability
Tender and Bidding Process			
• Total processing time • Evaluation time • Contracting time	• Time for bid preparation • Single bidder tender	• Open procedure • Number of bidders • Share of new bidders	• Share of SME bidders • Share of WOE bidders
Assessment and Contracting			
• Awarded unit price • Final unit price after renegotiation	• Share of excluded bids	• Number of bidders • New bidders	• Share of SME bidders • Share of WOE bidders
Contract Implementation			
• Final unit price after renegotiation • Time overrun	• Variation orders • Renegotiations		

The procurement and contracting cycle refers to the sequence of related activities, from needs assessment, through competition and award, to payment and contract management, as well as any subsequent monitoring or auditing (OECD, 2021). It is typically divided in the following stages: (i) budget planning and tender preparation; (ii) tender process, bidding process and bid evaluation; (iii) contract award and

⁷ Requirements from international organizations or international treaties could also be another strategy to incentivize governments in opening public procurement data and adopting transparent monitoring and reporting mechanisms. For example, EU member states are mandated to monitor and report key procurement indicators under the directives 2014/23/EU, 2014/24/EU and 2014/25/EU.

contract signing; (iv) contract execution and monitoring. Traditional public procurement data often only covers data between stage (ii) and (iii), since the other stages are typically managed by other units (budget and financial management) and therefore recorded in separate systems. This data can be organized at the tender, lot, item (product), bids, and contract level. Figure 2.1 provides a visual representation of how the different levels of public procurement data connects with each other. Specifically, tenders can be divided into lots and each lot can specify different product items; firms submit bids to specific tenders or lots and they can submit for specific tenders; tenders result in one or more contracts, which is linked to contract amendments and payments. Understanding the structure of the public procurement data and the links between different stages is the first step for effectively using and analyzing public procurement data. For example, the eGP systems for Brazil, Romania, Croatia, and Honduras organize the open procurement data at the tender, lot, contract and bid level allowing users to connect these different stages of the process through unique identifiers for each dataset.



The academic literature and practitioners in the field identified a common set of indicators that are typically used to measure the efficiency, effectiveness and integrity of the public procurement function. These indicators cover dimensions of public procurement related to the methods and procedures (eg. use of open methods), transparency and integrity (eg. time for bid submission), competition (eg. number of bidders), processing times (eg. time for bid evaluation), prices (eg. unit prices) and contract implementation (eg. time overrun) (a full list is provided in Annex A).

In addition of performance indicators, public procurement micro-data can also be used for the construction of red flags of corruption or collusion risks. The richness of data available on public tenders has allowed economists, anti-corruption authorities and competition agencies to develop different screening techniques

and offered the opportunity to test them empirically. Red flags can be useful to identify unusual patterns in certain markets but these patterns are not sufficient evidence of misbehaviors. Rather, red flags can be used as the starting point for further investigation, and as sufficient evidence for courts to authorize inspections of dawn-raids (OECD, 2013). One reason why red flags cannot provide sufficient proof of corruption or collusion is that, by design, these data-driven methods can produce false positives (flagging cases which do not merit further scrutiny) or false negatives (failing to identify cases which do merit further scrutiny). Given that corruption risk indicators and cartel screens do not directly point at illegal activities, establishing their validity is of central importance.⁸ Box 2 and Box 3 present the existing literature on corruption risk indicators and cartel screens and some recent advancements in these techniques thanks to novel machine learning applications.

Box 2: What we know about Corruption Risk Indicators

The starting point for measuring any corrupt phenomena is to define the particular behaviors of interest (Mungiu-Pippidi & Fazekas, 2020). In public procurement, one definition widely used both by academia and policy considers corruption as the violation of impartial access to public contracts, that is a deliberate restriction of open competition to the benefit of a connected firm or firms (Fazekas & Kocsis, 2020).

Corruption risk indicators identify the factors and traces of corrupt transactions defined by deliberate competition restrictions favoring connected bidders. Widely used corruption risk indicators in public procurement include single bidding in competitive markets, restricted and closed procedure types, or lack of publication of the call for tenders (Fazekas et al, 2018). These risk indicators have been shown to correlate with already established indices of corruption such as the Control of Corruption scores in the Worldwide Governance Indicators (Fazekas & Kocsis, 2020), as well as with other markers of corruption, such as prices of auctions (Fazekas & Tóth, 2018) political connections of bidding firms (Titl & Geys, 2019), and proven cases of corruption (Decarolis et al, 2020).

Novel machine learning applications have been used in order to advance on the measurement of corruption risks. For example, machine learning approaches have been used on carefully curated datasets of proven corrupt and non-corrupt cases to train algorithms predicting corruption risks (Decarolis and Giorgiantonio, 2020; Fazekas et al, 2021). Advanced network science methods have also been increasingly used to detect high corruption risk groups of organizations (Wachs et al, 2020).

Corruption risk indicators have been used in numerous civil society and journalistic applications, as well as by multilateral banks and national authorities for policy design and implementation. For example, the European Commission and OECD Sigma (OECD, 2019) regularly monitored some risk indicators, such as single bidding and publication of call for tenders. The IMF has endorsed corruption risk indicators and models predicting the price impacts of such risks as valuable inputs to addressing macro-critical risks. The European Investment Bank uses public procurement risk indicators, combined with internal financial risk assessments, to select projects for prior integrity reviews (Fazekas et al, 2019), an approach highlighted as a good practice by the European Court of Auditors (European Court of Auditors, 2019).

⁸ The literature has pointed at 3 different strategies for measurement validity (Adcock & Collier, 2001): content validity (the measurement captures the full content of the definition), convergent validity (alternative measures of the same corrupt phenomena are correlated), and construct validity (well established empirical relationships are confirmed by the measurement).

Box 3: What we know about Collusion and Cartel Screens

The characteristics of collusive behavior in public procurement markets are similar to that of conventional markets: companies coordinate their behavior regarding price, quantity, quality or geographical presence in order to increase market prices.

Cartel screens are defined according to two key competition and economy principles. First, it is expected that in competitive tender processes, bids are submitted independently, and therefore signs of coordination between bidders can be interpreted as signs of collusion. Second, bids submitted by independent competitors should appropriately reflect the costs of each bidder in a competitive market. Based on these two criteria, various elementary collusion risk indicators have been developed for the early detection of collusive bidding, such as submission of identical bids, high correlation between bids, lack of correlation between the costs and the bid submitted by each bidder, relative difference between lowest and second lowest bid price per tender, relative standard deviation of bid prices per tender, and range of submitted bid prices per tender.

Increasingly, more advanced statistical technics are used for the definition of cartel screens as well as for the development of algorithms that minimize the probability of both false positives and false negatives. For example, Conley and Decarolis (2016) developed statistical tests of coordination based on randomization inference methods. These tests identify unexpected firms behavior conditional on their characteristics, for example unexpected joint entry of firms within a group of bidders given observed firms and process characteristics. Huber and Imhof (2019) study the performance of different screening algorithms, specifically a lasso logit regression, and a weighted average of predictions based on bagged regression trees, random forests, and neural networks. Most interestingly, these recent examples use machine learning techniques to identify optimal algorithms thanks to the combination of public procurement data and judicial and auctions data for validation.

Moving beyond a transactional view of public procurement, there is an increasing interest in measuring dimensions of public procurement related to the strategic role that it can play to promote inclusive and sustainable growth and for the achievement of socio-economic and environmental objectives. Recent studies and research on these topics focus both on the development of new procurement indicators (e.g. on green procurement and socially responsible procurement) and on linking public procurement data with other data sources to promote a holistic approach to data analytics (e.g. firm registry micro-data). These topics are discussed in more details in Section 5.

An area that would require further development and research is on the measurement of contract implementation quality. Various approaches have been experimented with in the literature, but there is no agreed upon strategy yet, and this is a dimension where data constraints are particularly binding. One option would be to use audits data, but the limitations are that audits often focus on compliance with procurement regulations rather than actual project implementation, and audits data are not typically integrated with public procurement data. Contract supervision data and project management reports could also be used to generate information on contract implementation. The potential of integrating data from various stages of the public procurement cycle and from other functions of the state is further discussed in Section 4.2. Ad-hoc data collections could also be considered for specific sectors, for example through engineering assessments of the material used for the construction of infrastructure projects (Olken, 2007) or through visits to hospitals to verify the availability of medicines and their quality. With respect to the construction sector, recent advancements in technologies (ie. the use of drones or satellite images) can be considered for monitoring the progresses – but not necessarily the quality – of construction works, while information on

the quality can be obtained from citizens monitoring. More work is needed in order to assess the pros and cons of different measurement strategies, in particular in terms of the objectivity of different measurement approaches and their scalability.

2.2 Government monitoring of public procurement

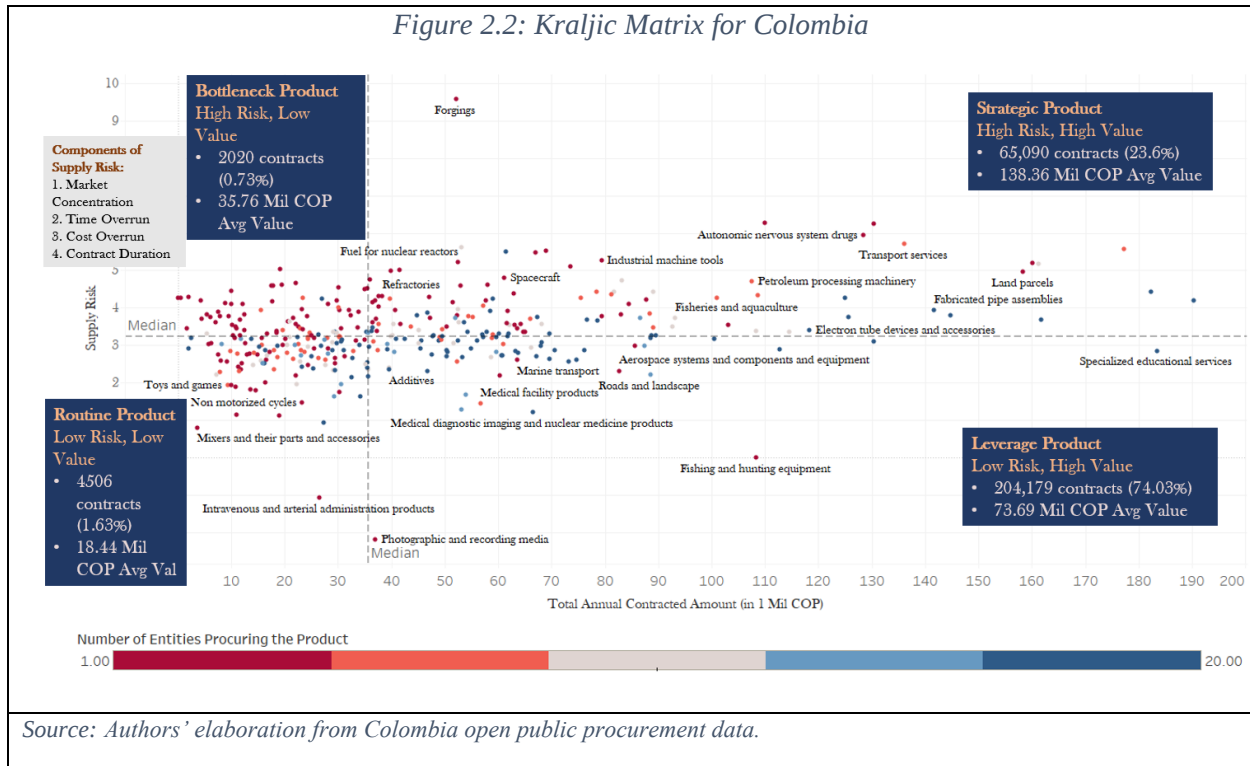
With the increasing use of eGP and the access to structured procurement data, public procurement authorities are often using common procurement indicators discussed in Annex 1 to monitor the performance of their own public procurement system. These public procurement authorities use the available procurement data in order to characterize national public procurement spending and identify performance and compliance gaps of the national public procurement system. This descriptive analysis can include time trends or comparisons of performance indicators across procuring entities, regions, types of contracts, types of procedures, sectors or suppliers. In some cases, this exercise may be mandated by international treaties,⁹ international organizations or a pre-requisite to access financing from multilateral development banks. The results of this monitoring are often reported in the form of annual reports on the functioning of the procurement system and they can be used for informing and guiding reform efforts and the development of new strategies and policies in public procurement. For example, in Poland the Public Procurement Office prepares the annual report on the functioning of the procurement system, which is posted on the PPO website¹⁰ following approval by the Council of Ministers.

Public procurement agencies may use certain tools or mechanisms to describe their procurement data and trends. For example, Spend Analysis is a widespread approach for monitoring and assessing public procurement, and it consists of various tools (e.g. Kraljic matrix, see Figure 2.2) that provide a first overview of the procurement market and specifically, what is being purchased, by who and from which suppliers. This analysis is used to identify the areas (products, entities, and suppliers) for which improving efficiencies is expected to have the largest budget implications, to define procurement strategies, and to adapt relationship management for different types of suppliers.

⁹ EU member states are mandated to monitor and report key procurement indicators under the directives 2014/23/EU, 2014/24/EU and 2014/25/EU

¹⁰ www.uzp.gov.pl

Figure 2.2: Kraljic Matrix for Colombia



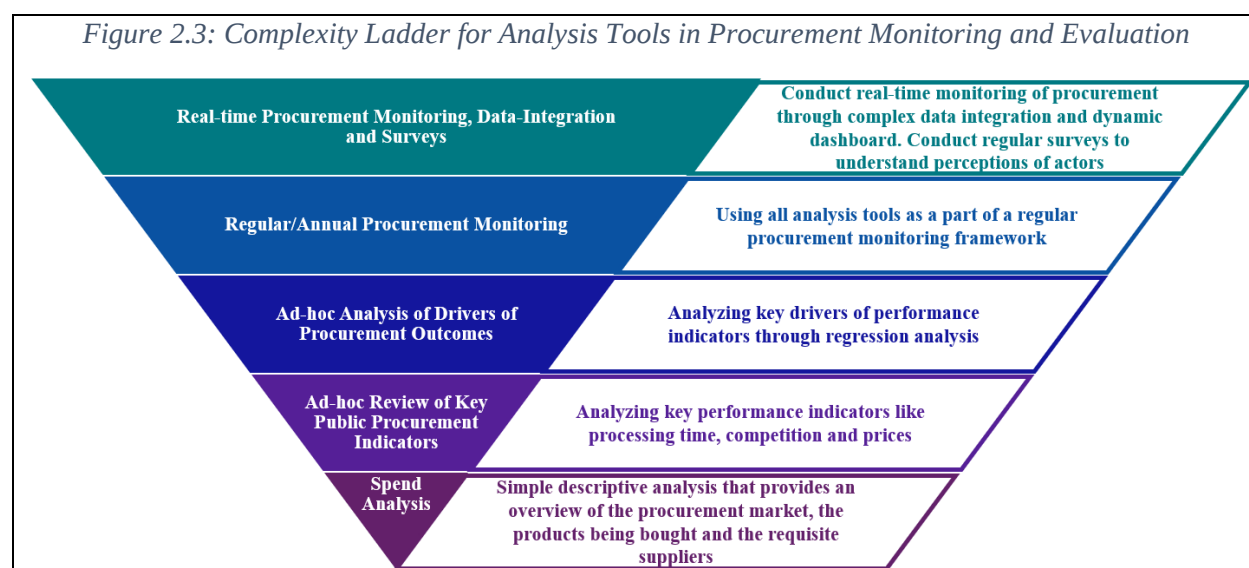
Source: Authors' elaboration from Colombia open public procurement data.

The analysis of performance and compliance is another set of tools typically used by public procurement authorities and audit authorities to monitor the national public procurement system. This monitoring may include compliance of procurement regulations as reported by procurement agencies¹¹. This type of descriptive analysis explores efficiency indicators like competition, prices, and processing time, as well as the extent to which procurement regulations (e.g. regulations on contract thresholds, use of open participation methods, or use of centralized procurement methods) are met. This type of analysis is useful in order to describe the efficiency gaps that exists in the public procurement system and to help prioritizing audit activities. For example, Best et al. (2019) show that, in Russia, individuals and organizations of the bureaucracy together account for more than 40 percent of the variation in prices paid, and that moving the worst-performing quartile of procurers to 75th percentile-effectiveness would reduce procurement expenditures by around 11 percent, or USD 13 billion each year.

As illustrated in Figure 2.3, these descriptive analysis tools are the least complex uses of public procurement administrative data. Figure 2.3 shows a ladder for analysis tools in procurement monitoring where each step of the ladder represents analytical tools conducted on procurement at different levels of complexity. Beyond descriptive analytics, diagnostic analysis (eg. regression analysis) can be used in order identify the drivers of performance, and therefore inform the government on the potential strategies to improve efficiency and integrity. Section 2.3 discusses in detail diagnostic analysis tools for data-driven policy making. However, descriptive analysis tools can still be among the most advanced uses of public procurement when they are systematically embedded into the public procurement monitoring and reporting function, for example for

¹¹ The Bulgarian Public Procurement Agency, the Polish Public Procurement Office (PPO), the Office for Public Procurement in Slovakia, and the Romanian National Agency for Public Procurement (ANAP) are examples of institutions that conduct audits of compliance and performance monitoring.

the preparation of annual reports or through interactive dashboards, which typically require an institutional reorganization and the acquisition of the necessary skills in the public procurement authority.

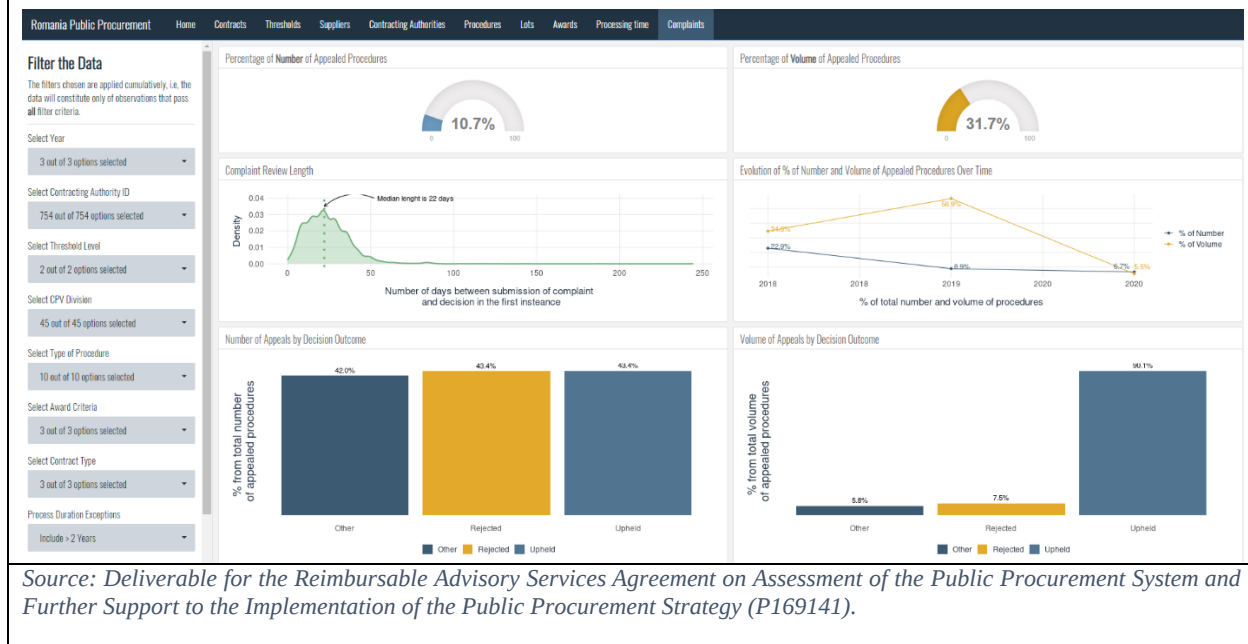


Interactive dashboards are increasingly widespread tools for implementing monitoring public procurement through descriptive analysis, since they enable procurement authorities to track, analyze and display key performance indicators through customizable and user-friendly visualizations. One of the greatest advantages of these dashboards is that they allow users to focus their analysis at different levels of government or in specific markets. Depending on how the public procurement system is set up, these interactive dashboards can be connected directly with the underlying eGP system or can be regularly updated. These dashboards can be built for the use of the national public procurement authorities and of individual procuring entities for monitoring their procurement activity, or they can be made public for greater accountability of the public procurement system.

For example, between 2020 and 2021, the World Bank worked with the Romanian National Agency for Public Procurement (ANAP)¹² to develop a monitoring mechanism in the form of a dashboard that would enable the public procurement agency to track their own key performance indicators and enable easy reporting to the EU. The dashboard (Figure 2.4) was developed in close collaboration with the public procurement authority to ensure that the most relevant indicators were captured in the dashboard. Regular data analysis workshops conducted by the World Bank ensured that the staff in the National Agency for Public Procurement had the capacity and training to replicate and add to the dashboard to ensure its sustainability in the long run.

¹² Reimbursable Advisory Services Agreement on Assessment of the Public Procurement System and Further Support to the Implementation of the Public Procurement Strategy (P169141)

Figure 2.4: Snapshot of the Romania Dashboard



2.3 Data-driven policy making

The analysis of public procurement data can enable procurement agencies to develop key procurement policies or refine and assess existing regulations. Data analytics allows to assess existing efficiency gaps and understand the drivers of performance, and these empirical insights are useful to identify and prioritize potential areas of interventions and reform efforts. For example, in 2019 the World Bank conducted a complete and comprehensive analysis of Uruguay's public procurement data that generated discussion and space for policy recommendations to improve the performance of the procurement system. This analysis identified demand consolidation as the most significant potential source of savings, with Framework Agreements being the most effective instrument to implement the strategy. Based on these empirical insights, in 2021 the World Bank worked with the Regulatory Agency for Public Procurement and the Central Procurement Unit within the Ministry of Economy and Finance in order to implement these recommendations, specifically building capacity in the generation and management of Framework Agreements, and supporting the development of pilot Framework Agreements for goods and/or services with greatest savings potential.

Data analytics is also a useful tool in order to monitor the consequences of new policies, assess whether they are delivering the expected outcomes and understand potential trade-offs. For example, in 2020 the World Bank worked on an assessment of the national public procurement system in Bangladesh¹³, whose objectives were to identify its strengths and weaknesses, formulate appropriate mitigation measures for the identified gaps and develop action plan for future system development. The assessment built on various data-driven components, such as an analysis of the so-called "10-percent rule" (rejecting tender that is 10% below or above the estimated cost) introduced by the Government of Bangladesh (GoB) in December 2016 for the procurement of works using Open Tendering Method (OTM). The primary objective of this policy was to improve the quality of construction works and reducing the risks of cost overruns by restricting

¹³ World Bank (2020), "Assessment of Bangladesh Public Procurement System", available at: <https://openknowledge.worldbank.org/handle/10986/33882>

bidders from quoting very low price. However, procuring entity officers largely expressed the opinion that the quality of works had not improved after the introduction of the 10-percent rule, and the quantitative analysis of time trends also revealed that this rule had undesired consequences, such as decreasing competition (Figure 2.5). These empirical insights were instrumental to provide factually-based recommendations to the government on re-evaluating the 10-percent rule.

Figure 2.5: Assessment of the Bangladesh 10-percent rule

Figure 3.3: Fall of average number of bidders per package
Data Source: All OTM works packages in e-GP (135,179 Nos.)

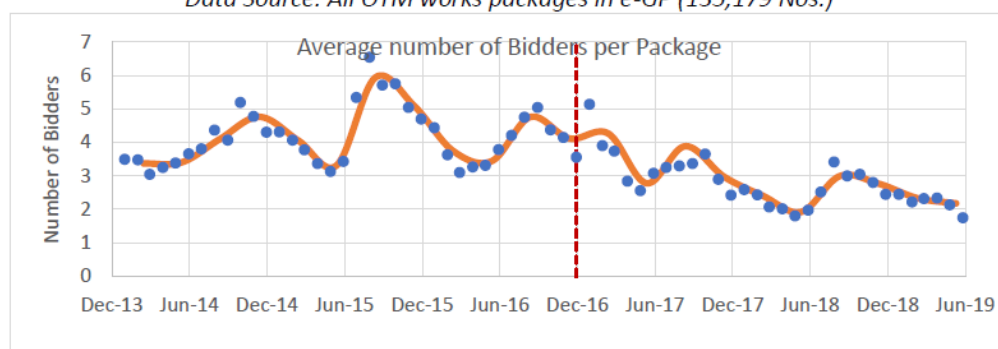
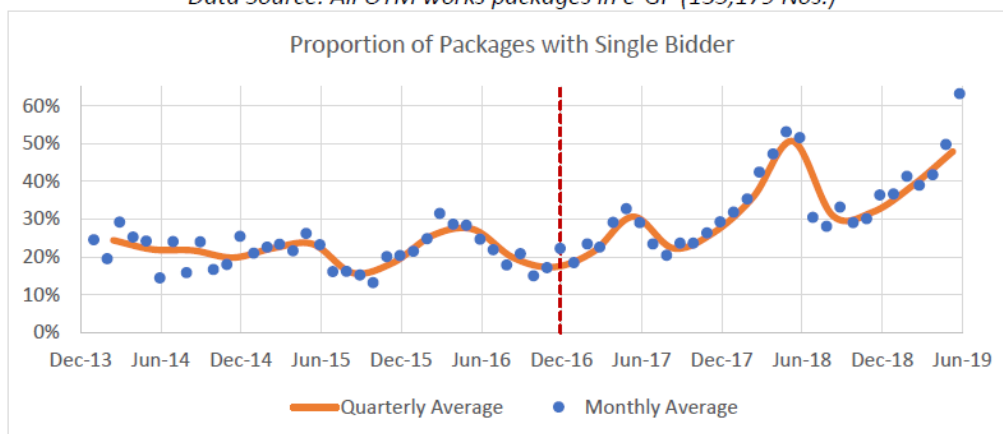


Figure 3.4: Rise of single bid
Data Source: All OTM works packages in e-GP (135,179 Nos.)



Source: World Bank (2020), “Assessment of Bangladesh Public Procurement System”.

With respect to understanding potential trade-offs, the increasing attention towards the multi-dimensional nature of public procurement implies that policies and strategies should be assessed based on a variety of considerations, including efficiency, integrity, value-for-money, socio-economic and environmental aspects. There are many trade-offs associated to the public procurement function and in connection to the private sector and public service delivery, and a comprehensive approach to procurement data analytics allows to correctly assess the potential trade-offs associated to procurement policies and provide complete and accurate policy recommendations. For example, a 2021 the World Bank report on the use of Framework Agreements¹⁴ shows that in Brazil the use of Framework Agreements can reduce unit prices and avoid

¹⁴ Deliverable under World Bank Project, “Framework Agreements For Development Impact: Lessons From Selected Countries For Global Adoption” (P173392).

repetitive processes, but it can also discourage SMEs participation and the likelihood that they are awarded a contract (Figure 2.6).

<i>Figure 2.6: Regression Analysis, FA vs other Open Methods, Brazil</i>		
Outcome of interest	Unit price (log)	SME winner
Framework Agreements vs other open methods	-0.0919** (0.0407)	-0.0198*** (0.00582)
Observations	172,605	166,399
R-squared	0.910	0.566
<i>Notes: Model Specifications: Comparing FAs and non-FA open methods for the purchase of the same product by the same entity (product – entity FE), with year and quarter FEs. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.</i>		
<i>Source: World Bank (2021a), “Econometric Analysis of Framework Agreements in Brazil and Colombia”.</i>		

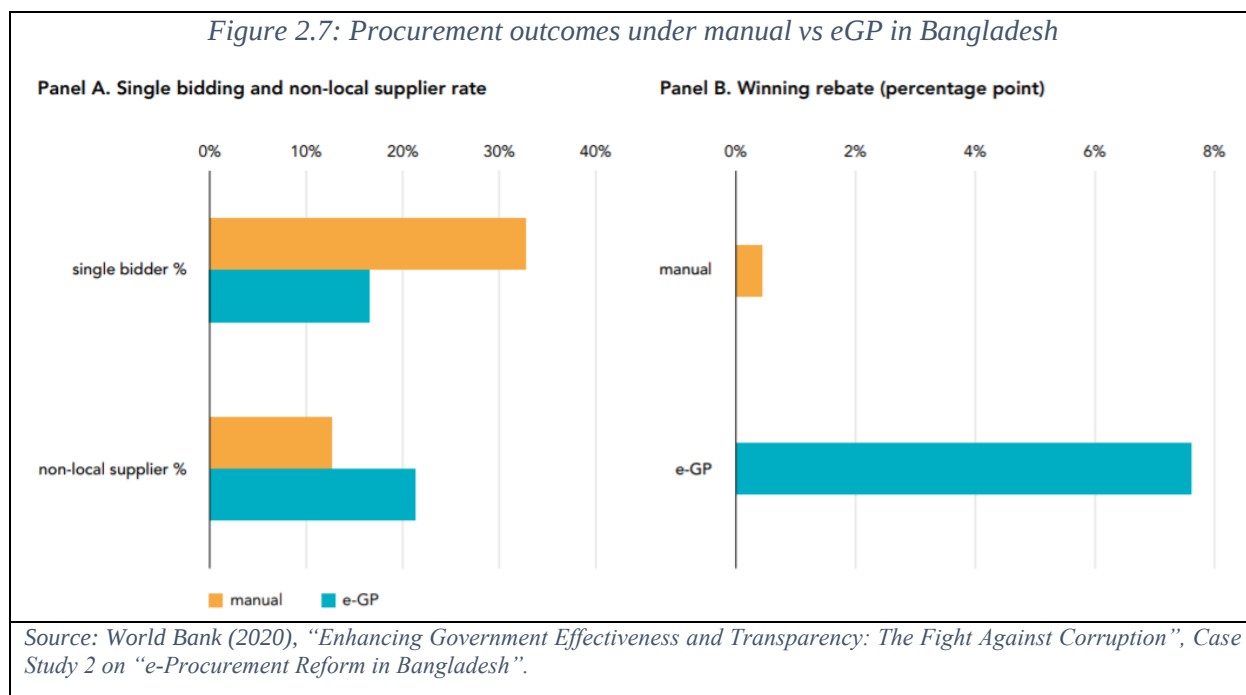
These examples show that quantitative analysis can be quite powerful in identifying key procurement trends in a country and can be foundational in developing and evaluating procurement policies. Given the abundance of micro-data in countries with eGP, public procurement can also be an ideal space for implementing impact evaluations of specific procurement policies. Impact evaluations represent one of the most reliable forms of policy assessment since they allow to contrast the actual outcomes with counterfactual scenarios by comparing units subjected to a given policy intervention to otherwise similar units that have so far not been treated. For example, in Bangladesh, starting in 2011, the government began the roll-out of a comprehensive eGP system, and the World Bank worked with the Central Procurement Technical Unit to evaluate the impact of the new system¹⁵ on procurement outcomes.

The evaluation revealed that the implementation of the eGP system led to an improvement of public procurement performance, as demonstrated for example by the increase in winning rebates, the decrease in single-bidding and the increase of contracts awarded to non-local suppliers (Figure 2.7). During the piloting stage, the preliminary results from the evaluation helped demonstrating that the new eGP system was having a good impact on efficiency, transparency, and competition, and this was extremely useful in order to build consensus and political support around this difficult reform.¹⁶ This example demonstrates the feasibility and usefulness of using impact evaluations for navigating the political economy of reforms. Specifically for public procurement, the abundance of data generated by the eGP system creates a rich space for research, since the data already available from the existing eGP system at the time of piloting and implementing new strategies allows tracking procurement outcomes, from baseline to endline, with no additional costs for data collection.

¹⁵ Report under the project, Impact Evaluation Of E-Procurement In Bangladesh (P156394)

¹⁶ World Bank (2020), “Enhancing Government Effectiveness and Transparency: The Fight Against Corruption”, Case Study 2 on “e-Procurement Reform in Bangladesh”. Available at: <https://thedocs.worldbank.org/en/doc/115291611673413993-0090022021/original/eProcurementReforminBangladesh.pdf>

Figure 2.7: Procurement outcomes under manual vs eGP in Bangladesh



2.4 Monitoring of public procurement by the public

Public procurement is one of the public administration functions with a greater prevalence of publicly available data. With an increase in the use of eGP systems, there is a higher potential to increase transparency and accountability in public procurement processes through monitoring by the public. Open data can be used by civil society, the media, and citizens in order to acquire information on specific contracts, buyers or products.¹⁷ Increased transparency and accountability can enable citizen engagement in monitoring public procurement, and therefore enhance trust between citizens and the State, strengthen the social contract and improve quality of contract execution. For example, a citizen engagement project was implemented by the World Bank in collaboration with the Central Procurement Technical Unit in Bangladesh¹⁸ to enable and support the monitoring of civil works projects by local community groups. Through the project, Citizen Committee members frequently visited project offices and reported anomalies in the civil works projects to the engineer’s office. The project reduced information gaps and increased trust between government officials and local community leaders on civil works projects in their area, and it also reduced monitoring related transaction costs through higher citizen engagement.

Making public procurement data available to the public has a great potential of increasing transparency and accountability. However, even when online and publicly available, it may be challenging to extract useful and actionable information from open public procurement data, which requires connecting data sources

¹⁷ The role of civil society in monitoring public procurement is widely recognized. For example, within the EU project “Integrity Pacts – Civil Control Mechanism for Safeguarding EU Funds”, Integrity Pacts are established between a contracting authority and economic operators bidding for public contracts on abstaining from corrupt practices and conducting a transparent procurement process, and a separate contract with a civil society organization entrust it with the role of monitoring that all parties comply with their commitments.

¹⁸ <https://wbnpf.procurementinet.org/featured/citizen-engagement-during-public-procurement-implementation-bangladesh>

from different stages of the procurement cycle, the construction of relevant indicators, and the analysis of micro-data for large numbers of tenders and contracts. In light of these challenges, various international organizations have been developing dashboards to ease access to public procurement data for citizens, civil society and researchers.

For example, in 2021 the World Bank, in collaboration with the Government Transparency Institute¹⁹, launched the prototype of a global dashboard²⁰ that provides access to open data from national electronic procurement systems from 46 countries and to open data on World Bank and IDB financed contracts for over 100 countries. Similarly, the opentender²¹ dashboard provides access to tenders data from the Tenders Electronics Daily (TED), which covers 33 European Union jurisdictions including 28 EU member states, Norway, the EU Institutions, Iceland, Switzerland, and Georgia. The creation and maintenance of these global public goods, and in general the use of open public procurement data, would be simplified by the adoption of common data standards globally, and the Open Contracting Data Standards by the Open Contracting Partnership²² provide a promising starting point.

Some governments are also creating public dashboards using their own public procurement data. For example, an intuitive and simple dashboard²³ prepared by the National Informatics Centre in India and hosted on the Central Public Procurement Portal allows users to get some key performance and compliance indicators on public procurement in India. This dashboard not only allows the government to monitor some key procurement trends, but also reports these indicators to the public for greater transparency and accountability. The public procurement authority in Ukraine also designed and published a public dashboard with the objective of increasing transparency and accountability in public procurement²⁴. The Covid-19 crisis prompted some more countries to increase transparency and enable public scrutiny on purchases made under the health emergency, such as Brazil,²⁵ Moldova²⁶, Lithuania²⁷ and, South Africa²⁸.

3 Setting up data infrastructures and capacity for measurement on procurement

3.1 Centralize public procurement data

In order to ensure that public procurement data is effectively used for decision-making, it is necessary that data is homogeneously collected and maintained across procuring entities and connected to a centralized platform. This is necessary both for external users and researchers, as well as for the national agency or central procurement authority. Public procurement data is often decentralized or housed by different institutions responsible for managing different parts of the procurement process, and this may complicate the process of data harmonization and centralization, especially in countries without an eGP system and where reporting of procurement activities to a central authority is not mandatory or audited. For example, in 2021 the World Bank team conducted a data collection exercise of paper-based procurement records in St. Lucia, Dominica, St. Vincent, and Grenada in order to assess the public procurement systems in the four

¹⁹ <http://www.govtransparency.eu/>

²⁰ <https://www.procurementintegrity.org/>

²¹ <https://opentender.eu/start>

²² <https://standard.open-contracting.org/latest/en/>

²³ <https://eprocure.gov.in/eprocdashboard/KPI.html>

²⁴ <https://bi.prozorro.org/hub/stream/aaec8d41-5201-43ab-809f-3063750dfafd>

²⁵ <https://www.gov.br/cgu/pt-br/assuntos/noticias/2020/07/cgu-lanca-painel-para-dar-transparencia-a-contratacoes-relacionadas-a-covid-19>

²⁶ <https://www.tender.health/>

²⁷ <https://vpt.lrv.lt/kovai-su-covid-19-sudarytos-sutartys>

²⁸ <http://ocpo.treasury.gov.za/COVID19/Pages/Reporting-Dashboard.aspx>

countries. The key constraint for the data collection was the decentralization of the information in multiple institutions, and ultimately the data had to be collected by enumerators from different procuring entities and national authorities.

Enabling factors for the centralization of public procurement data include legislation, administrative structure, and data infrastructure. Simple mechanisms like having an annual data collection exercise at the central level, where procuring entities send excel files to a central authority (the central authority audits a sample for data accuracy), can help slowly transfer local data storage mechanism to more efficient centralized data management systems. For example, this was recommended in the case of St. Lucia, Dominica, St. Vincent, and Grenada, with an additional recommendation of conducting regular audits of the quality and accuracy of data provided by each procuring entity to the central authority. This step can be a key foundation on which an appetite for data literacy and digitization can be created among governments. From data sitting in physical files in different procuring entities, a centralized data collection mechanism can allow for easy access to procurement data even in cases where an eGP system has not been implemented yet.

3.2 Integrate data from various stages of the public procurement cycle and contract management

Data integration can be an important step in exploring all the stages of the public procurement and contract management cycle. This can be done through two related steps i) matching data from various procurement stages and ii) expanding the availability of data to study procurement more holistically. With respect to the first step, public procurement data typically covers the following stages: tender process, bidding process, bid evaluation, contract award and contract signing. In order to meaningfully use this data, it is necessary that the tenders data, lots data, bids data, and contracts data are consistently organized, and they can be connected (see Figure 2.1).

The second aspect about data integration is related to expanding the availability of data covering to the full public procurement and contract management cycle, including parts of the process that are not typically included in procurement data, such as data on public procurement planning and budgeting, tender preparation data, contract execution data (eg. data on subcontracting and payments to vendors), complaints data, or proprietor information and beneficial ownership data.

There is great scope for using these additional data sources for procurement data analytics, and some countries are taking steps in these directions. The development of integrated data systems requires close engagement and partnership of multiple government institutions that house different parts of the procurement and contract management cycle. For example, as part of the design and development of the monitoring mechanism delivered to the Romanian National Agency for Public Procurement (ANAP) (Section 2.2), the World Bank was able to add data on complaints registered on public procurement processes to the dashboard by leveraging existing data sharing agreements between ANAP and the National Council for Solving Complaints. While the establishment of streamlined data management systems is a necessary technical requirement for a data integration process, the most significant constraints often lie in the administrative and bureaucratic structures that may complicate collaborations and data sharing agreements between different institutions.

3.3 Data quality and completeness

Data quality and completeness are crucial determinants on the quality of the empirical analysis that can be performed on public procurement data. Common issues in public procurement data are noted across

countries both in the data obtained from open sources as well as in the data obtained from the governments. Some of these common issues are listed in Box 4, and they may range from missing data to incorrect or ambiguous data structures that restrict or hinder comprehensive empirical analysis.

Box 4: Examples of Common issues with data quality and completeness

- **Missing observations or variables and data errors that pertain to important aspects of the procurement process.** In most countries, eGP data are not created directly from digitized tenders and contracts, but rather separately inputted by procuring entity officers. In these cases, the procuring entity officers may still have the option to leave certain data fields blank. This generates gaps in data and it can also indicate strategic behavior by the procuring entity officers that may systematically choose to leave more sensitive data fields blank. Data quality and completeness should be systematically reviewed by a central authority, including for data disclosed to the public.
- **Ambiguity in the level of observation for the data.** Data from the different stages of the public procurement cycle (Figure 2.1) should be meaningfully connected for analysis through unique identifiers, such as the tender ID or the entity ID. The absence of unique identifiers creates ambiguity in the interpretation of the data and risks to hinder comprehensive empirical analysis. For example, in the case of Framework Agreements, where there can be multiple contracts, buyers, and suppliers under a tendering process, and multiple orders can be associated to the same umbrella contracts. Having a clear and unambiguous data structure is necessary to correctly represent Framework Agreement processes and enable accurate analysis.
- **Correction of incorrect entries in the eGP system through entering the entire tendering process again.** This issue can be observed in countries where the eGP data is not created directly from digitized tenders and contracts, but rather separately inputted by procuring entity officers. Possibly because of integrity concerns, some of these eGP systems do not allow officers to correct information already entered into the system in case of data entry errors. In these cases, officers have the only option to create a new entry, but the system does not record which entry is correct and which entry is wrong.
- **Poor data integration during transitions from one eGP system to another.** Throughout the digitization of public procurement, countries may shift from one eGP platform to a new one. For example, Romania transitioned from a platform called SEAP to an upgraded platform called SICAP, and Colombia from a platform called SECOP I to an upgraded platform called SECOP II. In case of transition between eGP systems, it would be necessary to ensure that the data from both platforms can be integrated together and that procuring entity officers cannot enter data for procurement processes in both platforms during the transition.

Some of the data quality and completeness issues could be mitigated through some relatively simple and practical steps from the government. The eGP system could include automated data quality checks during data entry by procuring entity officers, for example checking that the procurement process dates follow a logical order and that the contract amounts are within reasonably expected ranges. Detailed audits of the data entered by procuring entity officers may also be conducted on a regular basis to ensure that the official tender and contract documents reflect the data entered in the system. The central procurement authority can also review the data maintained in the procurement system to assess its completeness, especially in light of the compliance and performance indicators the government is interested in monitoring. Lastly, implementing a fully transactional system that manages the entire procurement process from start to finish

and allows multiple government agencies and ministries to engage with at different parts of the procurement process, may allow for the ideal data integration environment to holistically analyze the full procurement process and all related parts in public administration.

When planning for the public disclosure of procurement data, the same principles on data quality and completeness would apply to ensure data transparency and accessibility. In addition, in this case, it would be important that the raw data entered into the system is made public, not only the indicators and the measures constructed from the administrative micro-data. Observations across several countries also show that open data and good policies for data openness/transparency do not necessarily correlate with data quality and completeness. For example, the Open Contracting Data Standards²⁹ developed by the Open Contracting Partnership provides guidelines on the effective disclosure of public procurement data to the public, with the ultimate goal of increasing transparency in procurement and allowing analysis of procurement data by a wide range of users. While an increasing number of eGP systems follow the Open Contracting Data Standards for the public disclosure of procurement data, how well disclosure is implemented largely depends on the quality and completeness of the data made publicly available.

3.4 Building capacity for statistical analysis and a culture for data-driven policy-making

The adoption of eGP has created a great wealth of data, but it is not obvious that their use and impact are currently being maximized by governments. The development of the capacity for statistical analysis and a culture of data-driven decision-making can help maximize the potential of such micro-data available through eGP platforms. This may include the creation or strengthening of a dedicated Statistical Office within the public procurement authority.

For example, as part of the design and development of the monitoring mechanism delivered to the Romanian National Agency for Public Procurement (ANAP) (Section 2.2), the entire monitoring mechanism was co-created in close collaboration with the ANAP staff through weekly capacity building workshops and meetings to discuss the operational workflow for the monitoring mechanism. This close collaboration and co-creation of the interactive dashboard to visualize key procurement indicators allowed the government to engage with the data cleaning and visualization process and built an appetite for data analysis. The ANAP staff were provided the necessary skills and knowledge to edit and develop the code that was used to create the interactive dashboard. Engagements like this can allow products like an interactive dashboard to be hosted in a data-curious and analytical environment that builds long term sustainability through empowerment of its users.

Beyond statistical capacity and data analytics skills, the proactive use of data and evidence to drive policy-making decisions also requires the necessary organizational culture, institutional arrangements and system of incentives. For example, data and empirical evidence can be used in order to improve the performance of procuring entities. This requires the necessary skills and tools to exploit the potential of data analytics, but it also depends on other systemic factors such as whether and how the performance of procuring entities is evaluated, whether there are consequences of performance evaluations, whether procuring entity officers are incentivized to improve their efficiency and effectiveness, and whether procuring entity officers have space to take discretionary decisions or instead they are expected to merely execute regulations. These considerations are related to a broader discussion on the management practices in the public administration

²⁹ <https://standard.open-contracting.org/latest/en/>

and specifically in procuring entities, and Section 4.2 provides more details on how some of these aspects can be studied empirically.

4 A whole-of-government approach: strategic complementarities to public procurement data

4.1 Measuring the socio-economic and environmental dimensions of public procurement

Increasingly, governments consider using public procurement as a strategic tool to sustain the private sector, especially groups of firms that are traditionally underrepresented in public procurement, such as SMEs and women-owned enterprises. Similarly, governments are increasingly adopting green public procurement (GPP) strategies, such as green evaluation criteria, green eligibility criteria, or life-cycle approaches to costing (Box 5).³⁰

However, there is no clear evidence on the best public procurement strategies and policies to achieve these socio-economic and environmental outcomes yet. For example, from a theoretical point of view, it is not clear how to incentivize the participation of SMEs in public procurement effectively and efficiently. While this might be achieved through targeted policies (e.g. preference policies, set-aside quotas), these policy tools might be distortionary (World Bank, 2021d and OECD, 2018) or suffer from poor implementation and compliance. Relying on untargeted policies can be an alternative, but perhaps it is a less impactful approach. Two studies conducted on the same preferential treatment program for small firms in California elucidate these potential trade-offs, with [Marion \(2007\)](#) finding that procurement costs are 3.8 percent higher on auctions using preferential treatment, and [Krasnokutskaya and Seim \(2011\)](#) finding that those distortionary effects are not huge in comparison to benefits to firm growth. With limited evidence on the impact and trade-offs of these different policy options, there is no clear guidelines on the best strategies to involve SMEs and other under-represented groups in public procurement.

As another example, some public procurement legislations mandate the application of green criteria for bid evaluation, especially in sectors such as transport (e.g. type of vehicles and emissions) and construction (e.g. construction materials) (Palmujoki et al., 2010), but it is unclear what the direct and indirect cost implications of these requirements are. By design, GPP introduces additional legislations and regulations, requirements for firms, and more complex criteria for bids evaluation. Therefore, it is natural that there might be concerns about whether the use of GPP can compromise the efficiency of public procurement procedures and reduce the attractiveness of public procurement contracts for firms. Providing robust knowledge on the costs and benefits of GPP will support government in taking informed decisions and might remove some of the concerns that prevent broader adoption.

This focus and strategic approach to public procurement requires that public procurement data is expanded in order to include the necessary information to allow measuring the socio-economic and environmental dimensions of public procurement, such as associating an SME tag to bidders and suppliers, or labelling tenders that follow green procurement principles. For example, Nissinen et al. (2009) developed a detailed list of environmental indicators to measure green public procurement, including indicators on product characteristics, policy attached, level of emission of the company, chemistry, or amount of energy used. In practice, across countries there has been some progress for tagging SME firms for example in Croatia, Romania, and Colombia but very limited on green public procurement (see Box 4 on Green Public Procurement). This impedes advancing the empirical literature on the effectiveness of different policy

³⁰ Green criteria can be included at different levels of procurement, and at the bidding process by setting technical specifications, specific qualifications, contract requirements, selection criteria and/or award criteria (Testa et al. 2012).

alternatives, and it also prevents governments and the civil society to monitor the actual use and implementation of GPP legislation.

Box 5: What we know about Green Public Procurement

Green public procurement (GPP) is defined by the European Commission (2008) as “a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared with goods, services and works with the same primary function that would otherwise be procured”.

GPP can take different forms, and different measurement options should be considered depending on the GPP approach adopted for each specific tender. A first categorization of GPP approaches is as follows (World Bank, 2021c):

- **Contract performance clauses** can ensure winning suppliers deliver the contract in an environmentally-friendly way and continuously improve their environmental performance through the contract duration. Examples of these clauses are: requirement to deliver goods in bulk to reduce packaging, requirement to optimize delivery schedules, or requirement to recycle or reuse packaging after delivery.
- **Award criteria** can include optional environmental criteria to encourage and reward bidders that propose solutions with improved environmental performance. (e.g. higher % of recycled content, functional criteria that allow supplier innovation). This approach requires procuring entities to set weights to evaluate the various dimensions of a proposal, such as environmental criteria and prices.
- **Qualification criteria and technical specifications** prescribe core environmental criteria that bidders and/or offers must meet to satisfy the requirements of the tender (e.g. minimum recycled content, bans on toxic chemicals).³¹ For example, supplier selection criteria aim to ensure that participating bidders have the technical capabilities, ethics and management processes in place to deliver on the desired environmental outcome. Examples of these criteria are: proof of compliance with environmental laws and regulatory standards, existence of qualified staff with environmental expertise, or environmental certifications.
- **Life-cycle approaches.** The “Total Cost of Ownership” (TCO) of a good, service or work considers not only the purchase price, but also the operational and maintenance costs over its entire life-cycle. The “Life-Cycle Cost” (LCC) goes further than TCO by also taking into account the cost of environmental externalities that can be monetized (e.g. GHG emissions, pollution fees).

Given the speed of innovations in this field, it may be challenging for procuring entities to define appropriate environmental criteria that corresponds to the current benchmarks and environmental criteria that can be expected and met by private sector actors. There are various mechanisms that can help procuring entities to determine the “environmentally friendliness” of a good, service, work or firm (World Bank, 2021c):

- **Ecolabels**, labels of environmental excellence that are awarded to products and services meeting high environmental standards throughout their life-cycle. Ecolabels can be awarded based on third-part certification, supplier claims of environmental conformity, or third-party validation of an environmental product declaration.
- **“Green” product lists.** Governments can create lists or online databases of pre-approved green goods, works and services and make these available to procurers across government to choose from.
- **Framework agreements.** Central procurement authorities can adopt GPP approaches when setting up framework agreements, making it easier for all procuring entities to purchase green without incurring into difficult processes for market analysis, tender design and bids evaluation.

4.2 Linking public procurement data with other dimensions of the public sector and public administration

Public procurement is multi-dimensional and it is critically interconnected with other functions of the public sector and public administration. For example, the participation of small firms in the public procurement market may be influenced by the ease of access to finance or tax subsidies provided to certain disadvantaged firms. Similarly, the administrative burden of public procurement processes may be influenced by the staffing, training, and resources in the local procuring entities. The incentives of participants in a procurement process may be influenced by several factors. A promising area for extensions in public procurement research would be to collect and integrate data from other parts of the public sector, justice, and tax administration to create novel integrated datasets that provide a holistic picture of the procurement function. This would provide governments with comprehensive information to develop innovative and impactful procurement strategies, as well as allow researchers to holistically explore the environment within which procurement is conducted, and enable governments to develop innovative and impactful procurement strategies.

There are many potential datasets that could be used to extend the analysis on public procurement through other dimensions of the public administration. One example is about linking tax registries and public procurement data. Data on tax filings by firms could be useful to characterize the firms operating in the public procurement markets, such as their size, and the link between public procurement and the growth of firms (Ferraz et.al, 2015), and to assess the effectiveness of policies that intend to favor the participation of SMEs in public procurement.

Another example is about linking public procurement data with audits data. If properly designed, audits can be an effective tool to disincentivize malpractices in public procurement. However, as demonstrated by Gerardino et al. (2017), the design and targeting of audits can distort incentives of procurement officers. For example, procurement officers may be less likely to use competitive methods if they expect these procedures to be more likely to be audited due to their complexity (Gerardino et al., 2017),³² or they may be less likely to comply with regulations that are difficult for auditors to monitor, such as the application of preferential policies for SMEs or the application of green award criteria.³³

Public procurement data can also be complemented with complaints data and judicial data. Box 3 already discusses the potential of matching public procurement data with judicial data to validate collusion screening algorithms. Beyond this type of applications, there is also space for further research on how performance in the public procurement functions is affected by efficiencies and performance of the judicial sector. Coviello et al. (2018) already demonstrated, in the context of Italy, the implications of inefficient courts on procurement outcomes, such as longer delays on the delivery of public works, higher likelihood that contracts are awarded to larger suppliers, and higher shares of the payments postponed after delivery.

³¹ An example of these criteria is detailed by the European Commission: https://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

³² Gerardino et al. (2017) investigate the impact of the audit selection process in Chile, using public procurement data during 2011-2012. Under the existing audit protocol in that period, open auctions underwent more than twice as many checks as direct contracting. The authors find that, given this protocol, procurement officers shifted towards direct contracting methods and reduced the use of open auctions, especially in procuring entities that experienced more audits and therefore had more opportunities to learn about this targeting design.

³³ For example, in some countries procuring entities are required to reserve a given quote of their spending for SMEs, but it is challenging for auditors to monitor the compliance with this requirement if the public procurement data does not include a tag to identify contracts awarded to SMEs.

Further studies on the link between public procurement and the justice sector would be necessary in order to advance our understanding on how these two functions of the state influence each other, for example whether judicial investigations have an impact on processing and contract execution times, which types of procedures are more likely to result in complaints/investigations, whether the risks of complaints and appeals is a barrier to firm participation, and whether the efficiency of courts has an impact on the propensity of enforcing late penalties by procuring entities.

The integration of public procurement into overall public finance management, budgeting, auditing and services delivery processes has high potential to lead to better utilization of public resources through better information transmission, standardization and automation, and increased accountability (OECD, 2017). Despite this potential, the integration of e-procurement systems into other e-government systems is not yet a common practice. For example, based on a 2016 review of public procurement systems, in OECD countries eGP systems are most often integrated with business registries (8 countries), tax registries (7 countries), budgeting systems (6 countries) and social security databases (6 countries) (OECD, 2017). Data integration is an area where further work is needed to promote a “whole-of-government” approach also from a data perspective.

4.3 Insights on public procurement data from survey data

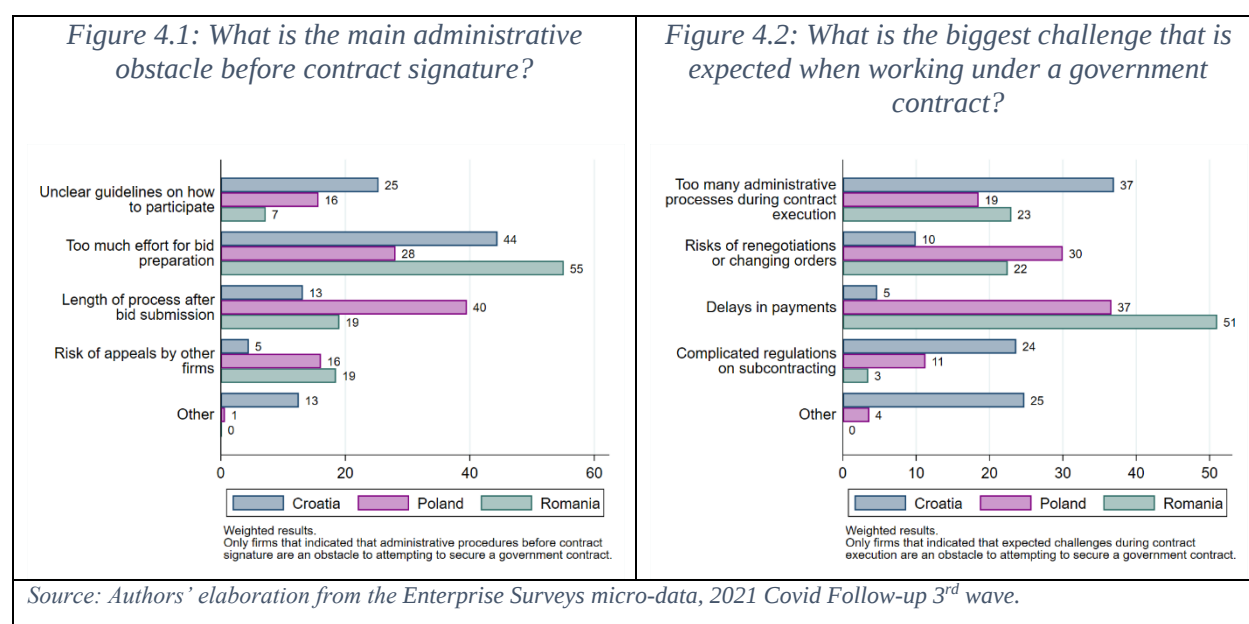
Along with using administrative data on public sector and public procurement, surveys of procuring entity officer and firms can provide important context to the environment in which procurement is being conducted. Surveys of procuring entity officers can be used to measure procurement-related information otherwise unavailable in the administrative data, such time for tender preparation, contract execution quality and firm performance. For example, in an assessment of the public procurement system in Croatia, the World Bank collected survey responses from procuring entity officers on the quality of delivered goods and services by firms and on contract management deadlines such as date of delivery and final payment amount for contracts. These indicators were not available in the publicly available data in Croatia and this data collection exercise was successful in identifying constraints during the contract management phase.

Surveys of procuring entity officers may also help in measuring perceptions and behaviors of procuring entity officers on overall organizational management, administrative burden from conducting and reporting on procurement regulations, human resource management, roles, and incentives within the team they are working in. For example, the 2021 World Bank report on the use of Framework Agreements³⁴ relied on both administrative micro-data and survey data. Procuring entity officers in India and Ethiopia were surveyed on the perceived administrative burden of using Framework Agreements relative to other public bidding methods. While the quantitative analysis revealed some savings in prices through the use of Framework Agreements, the survey provided some more context on the burden that officers may feel when implementing different types of procurement methods. Similarly, several studies on GPP have been conducted through surveys in order to understand the incentives of procuring entity officers to adopt the GPP criteria in the award process or to map the difficulties and challenges that entities face with GPP regulations at different stages of the procurement process.

In addition to surveying procuring entity officers, reaching out to firms participating in the public contracts market can also provide complimentary information to understand public procurement from the perspective of private sector actors. For example, Uyarra et al. (2014) found that for firms in the United Kingdom the main barriers to entry into the public procurement market are lack of interaction with procuring organizations, low competences of civil servants and poor management systems, and Knack et al. (2019)

³⁴ Deliverable under World Bank Project, “Framework Agreements For Development Impact: Lessons From Selected Countries For Global Adoption” (P173392).

found that firms are more likely to participate in public procurement in countries where public procurement systems are more transparent and complaints systems are more effective. Surveys with firms can also be a useful tool to analyze special groups of firms (eg. SMEs, WOE) in countries where the public procurement data does not allow to identify bidders and suppliers' characteristics and cannot be linked to other administrative data, such as firms registries. In 2021, the World Bank designed a procurement module as part of the Enterprise Surveys to better understand the barriers and challenges experienced by firms with respect to public procurement and piloted it in Romania, Poland and Croatia.³⁵ The survey data reveals that the main administrative obstacle to participation is the length of the process between bid submission and contract signature in Poland and too much effort for bid preparation in Croatia and Romania (Figure 4.1), while the biggest challenge when working under a government contract is delays in payments in Poland and Romania and too many administrative processes during contract execution in Croatia (Figure 4.2).



Using survey data in public procurement is relevant from a policy perspective in order to complement administrative data measurements, but also from a research point of view. HRM practices, attitudes and motivations are typically measured in the public administration through surveys with civil servants. Public procurement can be an ideal area to study the link between these dimensions and outcomes, and therefore advance our understanding on the impact that HRM practices, attitudes and motivations have on performance and compliance.

5 Concluding section

This chapter provided an overview on how public procurement data can be used for monitoring and evaluating public procurement, and for informing reform efforts and definition of new policies and strategies in public procurement. It included a description of various data analytical tools that can be applied

³⁵ The survey micro-data are publicly available from the Enterprise Surveys Data Catalog.

to public procurement, typical challenges encountered in public procurement data and potential solutions, and a discussion of recent innovations, such as the development of interactive dashboards.

The chapter included various lessons for practitioners and the governments on using and analyzing public procurement administrative data, including centralizing public procurement data, integrating data from different procurement stages and from data systems related to other government functions, ensuring data quality and completeness, and building capacity for statistical analysis, such as creating a dedicated Statistical Unit in the Public Procurement Authority.

The chapter also highlighted various areas where there is need for further development and research, specifically on measuring the quality of contract implementation, integrating public procurement data with other administrative micro-data or survey data, measuring green public procurement and, more generally, generating robust empirical evidence on effective ways to improve efficiency, integrity, inclusiveness and sustainability of public procurement. For example, the World Bank Governance Global Units and DIME-Governance have been collaborating on a research agenda on the link between public procurement and private sector growth,³⁶ which includes a series of research projects and data innovations such as connecting public procurement data, payments data and tax registries data.

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7 Annexes

7.1 Annex A. Traditional public procurement indicators

Indicators	Data Inputs	Notes/Description
Dimension 1: Time effectiveness of the tendering process		
Preparation Period (2-1) Bid Submission Period (3-2) Tender Evaluation Period (4-3) Approval Period (5-4) Contract Signing Period (6-5) Contract Effective Period (7-6) Contract Validity Period (8-7) Contract Duration (9-8)	1. Initiation Date 2. Publishing Date 3. Submission Deadline 4. Evaluation Signing Date 5. Evaluation Approval Date 6. Contract Signing Date 7. Contract Effective Date 8. Contract Validity/End Date 9. Contract End/Revised Date	Data Source: Tender or Contract Data All periods need not all be covered however some key periods should be included; 1. Preparation Period 2. Tender Evaluation 3. Contract Signing Period 4. Contract Duration
Dimension 2: Accessibility and Openness of the tendering process		
Accessibility during Submission	1. Number of Documents Sold 2. Number of Bid Submissions 3. Number of Responsive Bids 4. Number of Bids Withdrawn 5. Tender Security Amount and Validity	Data Source: Bids and Tender Data
Accessibility through Eligibility	1. Technical Qualifications needed 2. Past experience needed 3. Bid security requirement 4. Firm Turnover Requirements 5. Length of Eligibility Criteria (nr. Words) 6. Length of Assessment Criteria (nr. Words)	Data Source: Tender Requirements and Qualifications
Accessibility through Location	1. Location of procurement 2. Regional eligibility for contract	Data Source: Tender Data
Accessibility through Publication	1. Advertisement of Tender on Newspapers 2. Newspaper Publication Date 3. Advertisement of Tender on Website 4. Portal Publication Date	Data Source: Tender Data
Dimension 3: Efficiency in procurement size and consolidation		
Procurement Size	1. Estimated Value 2. Lot Value 3. Number and type of lots 4. Quantity of Items in Lots 5. Unit Price	
Dimension 4: Procurement Planning Efficiency		
Expected Preparation Period Expected Bid Submission Period Expected Tender Evaluation Period Expected Approval Period Expected Contract Signing Period Expected Contract Effective Period	1. Planned Initiation Date 2. Planned Publishing Date 3. Planned Submission Deadline 4. Planned Evaluation Signing Date 5. Planned Evaluation Approval Date 6. Planned Contract Signing Date	Data Source: Annual Procurement Plans

Indicators	Data Inputs	Notes/Description
Expected Contract Validity Period Expected Contract Duration	7. Planned Contract Effective Date 8. Planned Contract Validity/End Date 9. Planned Contract End/Revised Date	
Budget Allocation	1. Total Budget for Procuring Entity 2. Total Budget for Procurement 3. Planned Value of Procurement by Item	Data Source: Budget
Dimension 5: Transparency and integrity of bidding, evaluation and approval		
Transparency in Process	1. Time for bid preparation 2. Use of the “emergency” exemption 3. Opt-out of a centralized procedure 4. Re-launch of annulled procedure 5. Call for tender modifications 6. Complexity of tender description 7. Length of product description 8. Single bidder tender	Data Source: Tender Data
Transparency in Evaluations	1. Share of excluded bids 2. Time for handling complaints 3. Weight of non-price evaluation criteria	Data Source: Bids and Evaluations Data
Transparency in Awards	1. Notification of Award Date 2. Where the notification was published	Data Source: Contract Data
Dimension 6: Competition and collusion		
Process	1. Open procedure	Data Source: Tender Data
Participation	1. Number of bidders 2. Share of incumbent bidders 3. Share of SME bidders 4. Share of WOE bidders 5. Share of local bidders 6. Share of international bidders	Data Source: Bids Data
Competition	1. Winning rebate 2. Supplier is an incumbent firm 3. Supplier is an SME firm 4. Supplier is a WOE firm 5. Supplier is a local firm 6. Supplier is an international firm	Data Source: Contract Data
Market	1. Winning advantage of incumbent 2. Winning advantage of local firms 3. Market share of successful bidders 4. Market concentration	Data Source: Bids and Contract Data
Dimension 7: Contract implementation		
Number of Variations by Type	1. Contract Variation Date 2. Nature of Variations	Data Source: Either as wide in tender level data or as long in variations/modifications level data
Number of Modifications/Cancellations	1. Modification Date 2. Cancellation Date	

Indicators	Data Inputs	Notes/Description
	3. Type of Modification/Cancellation	
Time overruns	1. Planned Contract End Date 2. Revised Contract End Date	
Cost overruns	1. Planned Contract Amount 2. Revised Contract Amount	
Data needed to show heterogeneity in indicator/outcomes		
Purchaser	1. Contracting Authority Name 2. Location of CA 3. CA Officer Name and Designation on Tender	
Procurement	1. Category of Proc Process (Open, DC, RFP) 2. Type of Procurement (Goods, Works, Services) 3. Procurement Product: a) Description/Name of Works b) Product code (eg. CPV) if any	
Evaluation Committee and Approving Authority	1. Name, Designation, Office of EC Member and Chair 2. Name, designation, office of approving authority	
Firms	1. Name and address of Firm 2. Proprietor Name, if any 3. History and Status of Debarment 4. Tax and Registration Details	