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Master's Thesis of Public Administration.

Colombia's procurement marketplace:

E-procurement implementation effects in Colombia.

콜롬비아의 조달 시장:

콜롬비아에서의 전자 조달 구현 효과.

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Abstract

Colombia's procurement marketplace: A quick glance to e-procurement implementation effects in Colombia.

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The beginning of this third decade in the XXI century seems to be questioning a big deal the structure and functionality of all the different forms of states and governments around the world. Global events such as COVID -19 pandemic and the warlike conflicts among nations, have urged many countries to start interpreting the different forms of governance and state functions with a different rationale, which includes the integration of all kinds of strategies, negotiations and instruments, in special those of the digital kind and IT related ones, to help comply in the inherent function to any government of security, economic stability and peace, shook off by the aforementioned situations.

Among those instruments, the particular use of e-platforms in the government function of procurement is of special interest for this study. Procurement as a necessary tool to comply with the government objective of delivering services to the community, is also a powerful tool to improve the conditions of the local market and effectively impact the national economy since the amounts of resources involved in them is considerable, as an example, in the OECD country members it accounts for a third of all government spending and 13% of all GDP (OECD, 2019).

For this reason, this study has focused on Colombian e-procurement system, trying to provide a quick but convenient glance into the influence that the implementation of its newest e-platform SECOP 2 has had on the procurement marketplace in Colombia, and to see how the

modalities of Direct Contract and Public Bidding affect the conditions of greater and better conditions of the procurement marketplace in Colombia.

In an initial moment, secondary data was collected from the open data source of the central purchasing body in Colombia CCE. This data had to be filtered and cleared since many inconsistencies were present in it. The data elements taken from both platforms had to be standardized into a singular form, so the analysis could be brought about.

Then, to evaluate the direct relation between the implementation of the SECOP 2 platform and the contracts and providers, a supply contracts and providers ratio was established to justify a simple relation between supply and demand. The statistical model was then proved by revising the tendencies of the variables available and a multiple regression model was run, including 3 special elements derived from the supply contracts issued by the Colombian state agencies between the years 2013 to 2022 for SECOP 1 and 2016 to 2022 for SECOP 2.

The first element for the analysis of the conditions of the procurement marketplace in Colombia as control of the model is the *time of execution* of the contracts averaged in days, from the day of the uploading the contract to the platform to the day the contract was settled. The second element is the *monetary resources* involved in the execution of the contract. This element was averaged to fit the model better, since the numbers are just too high given the fact the account for monetary resources in Colombian pesos. The third and final element are the platforms S1 and S2 themselves as dummy variables. Some other variables helped in controlling the model such as the modalities of contracts.

Finally, a sensitivity model was run given the limitations of the analysis. This model proves the analysis with robustness since the most important conditions of the marketplace for procurement were included in the model.

Keywords: Colombian Procurement, Supply Contracts, Providers, Modalities of Contracts,

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Abstract in Korean

이 연구는 특히 최신 플랫폼인 SECOP 2가 콜롬비아의 조달 시장에 미친 영향을 분석합니다. COVID-19 팬데믹과 국가간의 분쟁과 같은 전 세계적인 사건을 고려할 때, 세계 각국의 정부와 국가 체제의 구조와 기능이 심각하게 의문을 받고 있습니다. 디지털 전략과 IT 관련 도구의 통합은 정부의 안전, 경제 안정성, 그리고 평화를 보장하기 위한 필수적인 요소로 여겨지고 있습니다.

본 연구는 정부 조달에서의 전자 플랫폼 활용에 초점을 맞추고 있으며, 이를 통해 서비스 제공뿐만 아니라 지역 시장과 국가 경제에 상당한 영향을 미칠 수 있는 사항을 연구하고자 합니다. OECD 국가에서는 조달이 정부 지출 및 GDP의 상당 부분을 차지합니다. SECOP 2의 영향을 분석하기 위해 콜롬비아의 중앙 구매 기관에서 보조 자료를 수집하고 표준화하였습니다. SECOP 2의 구현과 공급 계약 및 공급업체 간의 관계를 평가하기 위해 공급 계약 및 공급업체 비율에 대한 통계적 모델을 개발하였습니다.

모델에는 계약 실행 시간, 관련된 금전적 자원, SECOP 1 및 SECOP 2의 더미 변수 등의 변수들이 포함되었습니다. 계약 모드 등의 다른 변수들도 모델을 제어하기 위해 사용되었습니다. 마지막으로, 한계를 해결하고 결과를 견고하게 하기 위해 감도 분석이 수행되었습니다.

SECOP 2가 콜롬비아의 조달 시장에 미치는 영향을 조사함으로써, 본 연구는 전자 플랫폼이 정부의 조달 프로세스를 개선하고 시장 조건을 향상시키며 경제 성장을 촉진하는 방법을 보다 포괄적으로 이해하는 데 기여합니다

List of Acronyms

ANCP	Agencia Nacional de Contratación Pública (<i>National agency for public procurement</i>)
CCE	Colombia Compra Eficiente (<i>Colombia Purchases Efficiently</i>)
CPBs	Central purchasing bodies.
CPI	Corruption Perception Index.
G2B	Government to Business
KONEP	Korean Online E-procurement System.
S	
OECD	Organization for Economic Co-operation and Development.
PAE	Programa de Alimentación Escolar (Public-School Meal Program)
PPP	Private and Public partnership.
PPS	Procurement for Public Sector.
SECOP	Sistema electrónico para la contratación pública / <i>Electronic system for public procurement.</i>
TVEC	Tienda Virtual del Estado Colombiano / <i>Virtual Store of the Colombian State.</i>
UNODC	United Nations Office on Drugs and Crime.

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1. Chapter: Introduction.

1.1. What is public procurement and e-procurement?

Public Procurement is “matching supply and demand” to accomplish the core function of the government to deliver goods and services to their country population. (European Commission and ICLEI - Local Governments for Sustainability, 2016). There is public and private procurement, but for our case we only focus on public one. This practice demands a high level of knowledge and specialization in different areas such as legal, supply chain management, economics, market, finance, logistics, inventory, and storage, and all the specifics on bidding and tendering. While acquiring any form of goods or service, organizations or governments need to consider many of these factors with expertise in many areas, priorities differ between public and private entities. For the case of this study, we plan to analyze the Colombian e-procurement market, which is basically the procurement system adapted to a digital and information platform that has been evolving to the pace of technological progress, adapting processes from paper-based form to digital and online accessibility.

E-procurement has become a global tendency and the way to go for all governments when implementing innovation in their procurement systems and the improvement of their local markets. This innovation is supposed to bring forward transparency, efficiency, and the improvement of competitiveness (OECD SIGMA programme, 2016, p. 2), allowing the public and private entities to initiate fair and high-quality market dynamics. Nevertheless, for the public sector it does not always work this way since the high levels of public expenditure involved make it a target function for corruption. Besides these, there are other concerns that have for long been a matter of discussion but not worth dwelling into for the case of this study, such as is the dilemma of centralization of decentralization, which conveys with the discussion if precisely

the adoption of digital platforms may improve control through centralization in benefit of transparency or render into inefficiency.

1.2. Study background:

The socio-economic situation of Colombia constitutes a particular case of study, given the history of the country, briefly explained as a 70-year civil war; A war with specific battles for the political leadership and control of the state in the 50s and 60s, the property of the land and the emerging illegal market of drugs in the 70s and 80s, the sudden and poorly planned opening of the country to the international globalization of the 90s, that suffocated an incipient industry, and also the emergence of paramilitary and state illegal forces colliding with drug cartels and guerrillas throughout the 90s and part of the 2000s.

Over the past twenty years, there has been a reduction in the intensity of the conflict brought about by various factors, which have included legal measures such as the enactment of the Justice and Peace Law (Law 975 of 2005) and the Peace treaty in 2016. However, a switch in the paradigm and in the form of a surreptitious improved interest to pervade the state and the economy and social interactions, including the still profitable and illegal market of cocaine, the productive land, and the political power by more sophisticated and ambitious groups, seems to have emerged. Colombian state has been incapable to control and rule over all these situations, and at times when public programs are implemented, additional to the normal complications that every program implementation, many of the problems that affect Colombian reality add to the complexity of the situation.

All of this adds importance to the idea that understanding how the highest efficiency can be achieved in every public program, since the situation of Colombia demands very efficient implementations. If the goals of development and social stability want to be achieved, as it's been proposed in most of the national plans presented by governments in the last decades, it is

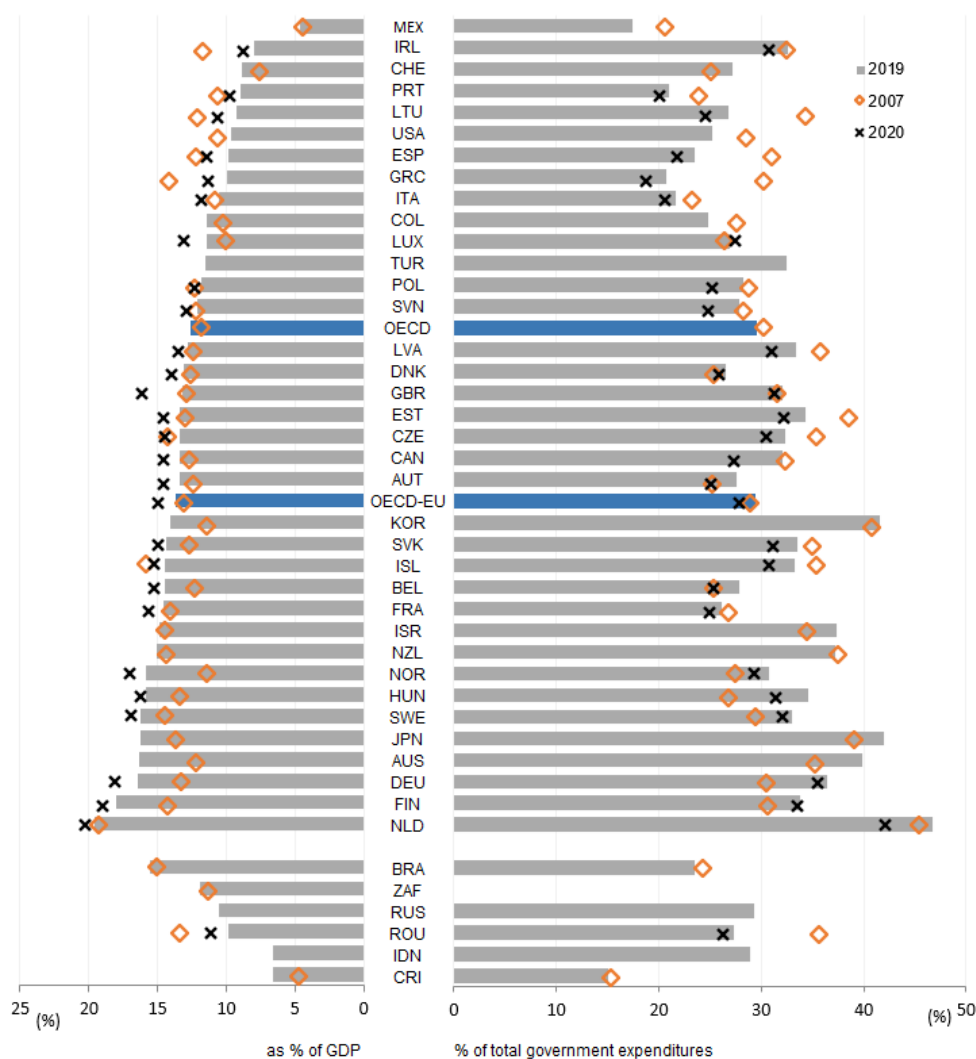
important to understand how to use government functions not only to accomplish specific policy goals, but also aim to work to improve a historical reality that demands solid solutions.

When it comes to procurement policies, Colombia has worked in implementing innovative programs to update the country to the international standards and has made some important investment in this area. However, just as in any country in the world, procurement as a government function is most susceptible to corruption. The basic complications of this process, including the volume of transactions and the financial interest at stake, increases the corruption risk and exacerbates the complexity of the whole process. (OECD, 2016).

Colombia is located on the third quartile of CPI, above the 90th place. The position of Colombia in this regard will be later discussed, but it is reasonable to say that the multiple illegal interest dwelling in the country have a particular taste for public contracting and procurement. It is a logical thing to happen since the resources invested by the state as of 2019 in this function goes up to 11.4% of GDP and 24.8% of government expenditure (See figure 1). Moreover, the e-procurement system at this day does not properly integrate to many other digital systems and this prevents a more efficient way for identification and automation of the processes which end up being developed manually, allowing space for mismanagement and corruption.

The recent adoption of a next generation e-procurement platform that improves electronic availability and facilitates communication among the different actors of the process, despite the previously mentioned flaws, constitutes an update and improvement of the procurement procedures, opens multiple possibilities to facilitate the supervision and surveillance of public contract and allegedly allows for more competitiveness, which is the main objective of this study.

Figure 1 OECD Government Procurement Spending



Note: Percentage of GDP and total government expenditures, 2007, 2019 and 2020. Adapted from: Size of Public Procurement

(<https://www.oecd-ilibrary.org>)

1.1 Procurement in the world

Acquisition of goods and services is an inherent and vital part of the main objective of any state while developing its core functions; this activity becomes a fundamental process performed by governments to deliver their services to its society. While a huge quantity of resources is involved, an immense amount of human discretion is involved in it as well, turning it

into a potential combination of ingredients for a recipe of mismanagement or corruption, regardless the latitude or the degree of development of the community in case.

From a global perspective, procurement comprehends a massive capital activity, therefore its outcomes are of high importance as its impact is of great interest. Governments around the world spend on public procurement more than 9.5 trillion dollars a year ("Innovation in the Evaluation of Public Procurement Systems," 2019, 350). Current estimations made by OECD and UNODC claim that 10% to 30% of the total value of a public contract is lost to corrupted arrangements and practices. (Lannquist & Raycraft, 2020)

The current world panorama at times of pandemic, global warming, increasing poverty levels, and low-quality standards of life, may focus all lights on solving urgent issues by means of direct intervention, international cooperation acquisition, fiscal, monetary, and all kinds of policy at hand, disregarding procurement as a feasible tool by which these negative conditions can be relieved. The way governmental organizations invest their budget and acquire services and goods to bring about programs and projects, could have positive outcomes and impact the improvement of the conditions of life of citizens, reason why this expenditure should not be left disregarded as an operative function of the state but also can be seen as a socio-economic policy.

Given the challenges that states from all nations face, a few leading global organizations have decided to attend to the necessities in research and development in matters of procurement. Several organizations of international reach have invested in providing conclusive research to come up with strategies for governments to implement and take heed to prevent corruption and improve processes while trying to standardize optimal practices in the search for better control, flexibilization, predictability, and some other values brought into practices through e-government approaches including e-procurement and other FMIS alternatives (Financial management information system) including e-procurement. Among these organizations we find the world bank with its world procurement framework approved in 2015, that pursues the to

ensure the best value for money, promoting local industry development, increasing efficiency and effectiveness, improving transparency and accountability, and strengthening governance and reducing corruption. (Bank, 2023)

There is also the International Federation of Purchasing and Supply Management (IFPSM), the Chartered Institute of Procurement and Supply (CIPS), International Association of Public Procurement (IAPP), and the European Institute of Purchasing Management (EIPM) both private and public institutions aiming to improve and generate standards by which governments and private entities alike can perform better in procurement processes.

1.2 Colombian case: Economy, corruption, and procurement size.

Governments constitute one of the most important clients of the private sector economy in most nations of the world and Colombia is not the exception to that. This country invests around 15% in PPS of its GDP, which for the year 2019 was 323.4 billion (World Bank, 2020). This makes up a considerable portion of the national budget and of the capital flow in the whole country. Given the specific characteristics of this nation, this amount of resources is of special importance for the attainment of its development goals. As a reference, Korea's expenditure on PPS goes down to 7% of its GDP. Korean GDP for 2019 was 1.647 trillion USD and its procurement spending was 135 trillion KRW, about 120 billion USD. (Public Procurement Service & Kim, 2021).

Regarding corruption, in the last report made by transparency international in its CPI report, some recommendations are given considering the COVID-19 pandemic situation and its repercussions on the corruption levels in governments from different regions. For the Americas in the 2021 report¹, the tendency described is stagnation to the same pre-pandemic levels, in

¹ The CPI report is divided into specific reports by continent or groups of related territories; When referring to Americas it includes North America, Central America and South America.

most of the countries of this region, even those which do not have a democratic system. On its part, Colombia has held its perception of corruption stagnant for the last couple of years, and in the last decade, no major changes have occurred. The global position of Colombia out of the 180 countries participating in the rank is 92, and its score out of 100 points which means no corruption perception at all, is 39 points.

On the other hand, as a reference example, Korea has managed to sustain a good position in the global ranking inside the first quartile in the 39th position and a general score above 60 points out of 100, despite the size of the economy, and the big amount of resources that are involved in the PPS in the country.

1.2.1 Colombia's challenges:

The previous insight provides a basic frame to understand the position of Colombia in terms of corruption from a global perspective. Procurement itself is an activity that is vulnerable to corruption since the volume of business as well as the financial interest given in these activities surmounts many other areas where corruption may affect.

In our interest, the issues related to procurement and the challenges that Colombia faces in the implementation of an e-procurement system, are relevant to understand the effectiveness of diminishing the capacity of those interested in benefiting their particular interest at the expense of public resources. This can be achieved through the characteristics that a digital system may deliver to the procurement process, among the many, one of particular interest for the case of this study is competitiveness.

It is convenient to bring into context a more detailed description of the current situation through cases that have occurred in recent years and highlight the importance and necessity of a more comprehensive and quicker implementation of a system capable of maximizing transparency and efficiency. The following are particular cases involving public procurement and

constitute specific cases on how regular procurement can be pervaded by individual interest in search of a the appropriation of public resources.

PAE (Public-school Meal Program)

This program provides meals to children in compliance with the educational mandate of basic conditions for the development of the educational programs in charge of the national government. A program founded in 1936, that has been in the hands of different state agencies and for the time being, is under the responsibility of the Ministry of education. The program has nationwide coverage, and some regions suffer a great deal managing and implementing the program.

In the year 2016 in Cartagena, a famous touristic city on the north coast of Colombia, the PAE program was systematically abused by some participants at the different stages of the process. The resources were destined to provide meals for 83.974 students, but from its very planning stage, the program had already been sacked through arrangements between the local authorities and corporative conglomerates to whom the contract was awarded without any consistent criteria or competition-based scheme. Local authorities oversaw the bidding and bid evaluation stages. They awarded the tendering to a cooperative consortium bypassing some basic requirements such as the experience required in the meal and food sector, besides some documents provided were proved to be forged, and as obvious as it may sound, the awarded conglomerate supposedly experienced in meal and food sector, third-partied the acquisition and provision of some of the supplies from a hardware store; chicken breast were brought to a hardware store at a price 10 times higher of the price per unit in the public market at that time. The disconnection of the program from central supervision and the possibility of local authorities disposing of all the elements of control in the decision-making process without a valid or guiding structure, allowed all kinds of corruption to permeate the different stages of the program.

ICT National Internet Coverage Program Case

Recently, another national scandal took place in the ICT ministry. In May 2021, a major scandal took over Colombia national media because of a project related to the connection of urban school areas to the internet and access to digital information, which aimed to install 10.000 points of connection to achieve 70% of nationwide connection. This was a flagship project of the previous government included in its national plan for development, but it made headlines not for its achievements but for the upfront payments made worth 17.6 USD million, which were lost by the means of document forgery, contracts with unaccomplished terms, and supervision flaws.

By the year 2020, the ICT ministry had awarded the contract to a company called Union Temporal Centro Poblados, which bid alongside another 9 companies for the contract. The company was awarded the contract because according to the ministry tendering it, they accomplished all the technical, financial, and Juridical feasibility. A consultant from the ministry later in the process was found to be part of the bidding company, so presumably, leaking of information and influence in the decision-making process may have taken place in this framework of corruption. To this date, the 17.6 USD million were tracked to an overseas account in Delaware in the US, a well-known haven where the money is said impossible to be retrieved.

1.3 Colombia's public procurement system:

Colombia spent in 2020 around 15% of its GDP in public procurement. (Agencia Nacional de Contratación Pública, 2021, 12). Public procurement is undeniably an important factor for a nation like Colombia as well as it is for a country like Korea where the utmost importance to keep a dynamic and open market available for all its industries is a priority to connect domestically and internationally with suppliers, potential clients, as

well as to keep track of the transactions performed every day, avoiding collusive behavior and other forms of corruption which increases confidence and a positive boost in the economy, reaching higher levels of transactions, improving therefore in the development of the country.

In Colombia, public procurement may play, besides the above-mentioned reasons for Korea, some additional reasons that are definite for reaching a higher degree of development and solving some social problems that have affected the country for a long time. Among these, the fact that Colombia is in the top of the most unequal countries in the world, the need to identify its opportunities to reach the industrialization process required to exploit its resources in an efficient way, and in general to improve human indicators of development where the country is still lagging from most nations in the world.

1.3.1 Colombia's E-procurement system: SECOP

Colombia's e-procurement system is called SECOP which stands in Spanish for Electronic System of Public Purchase (Sistema Electrónico de Compras Públicas). This is the electronic system on which most Colombian government agencies are mandated to make public their procurement activities to comply with the law and the principles stated in it, such as transparency, economy, and responsibility. (Función Pública, 2012). At the time of writing this research, there are 3 platforms that comprise the SECOP platform, they are: SECOP I, SECOP II, and the TVEC which stands in Spanish for the Virtual Store of the Colombian State.

SECOP I is a platform that works as a mechanism for publishing state procurement and contracting. It started to operate as the exclusive e-platform for Colombian procurement on the 1st of June 2012. It is kept to this day as a platform for exclusive

publishing of contracts and documents, it differs from SECOP II in that the latter is a transactional platform on which actual market operations can be brought about whereas SECOP I is just an archive for public consultation. SECOP II covers a wider variety of activities including publishing of contracts, public tendering and bidding, feedback, and observations on contract publishing and awarding.

Finally, TVCE, which is the web portal part of SECOP can be used by the different state agencies to buy goods and services through framework agreements, demand aggregation contracts, and minimum amount contracts with wholesalers.

1.4 Contract modalities in Colombia:

One of the main issues to deal with in this research is to observe the impact that some of the contract modalities have in the procurement systems, for the case, the e-procurement platform SECOP 2. In this section we plan to briefly explain some of the core characteristics of these modalities, based on the legal document that contains them. The statistical analysis for the purpose of this research will only deal with two of the 5 contract modalities since they represent a special interest for public opinion.

Public bidding: It is the biggest modality of contracting in the Colombian public system. It is considered an invitation to all those interested in executing a contract with a public entity by competing on equal footing. They can tender to be the best fit for the bidding conditions. It is usually used in the acquisition of supplies and services, and the development of public infrastructure.

Abbreviated Selection: It is a modality of contracting used when certain conditions and situations are met and it is a priority to put forward the necessity to be efficient,

therefore some processes can be simplified. These contracts have special conditions and are destined for specific areas such as the acquisitions of goods that have uniform technical characteristics, contracts that were not awarded for lack of or tenders not meeting requirements, for some specific sectors such as health, military and governmental, contracts that benefit vulnerable populations and cover activities related to human rights, agricultural products for special programs and finally for selling state assets.

This modality has two ways to be performed; one is the abbreviated selection of minimum amount and abbreviated selection of minimum amount by reverse auction. The former focuses on price and quality and the evident demonstration of interest on the side of the bidders and the latter just focuses on price.

Minimum amount: This modality is based on the number of resources available annually by the public entity. It should be a contract where no more than the 1% of the annual budget of the entity is implied, regardless of the object of the contract. It is a very fast mode considered as a public invitation to bid for the contract.

Merit contest: This modality is mostly used when the public entity needs to contract consultancy services for investment projects, feasibility, and pre-feasibility studies and in general professional and technical advisory. It is possible in this modality to perform an open contest or a prequalification list contest.

Direct contracting: This modality of contracting is of special interest for this research since this is where we intend to project some of the possible issues that the e-procurement system fails to adjust to the values of transparency and efficiency, proclaimed by the law. This mode of contracting has a special characterization since for this there is a whole numeral in the law 1150 to specify the use that public entities can give to this mode of contracting therefore providing it with an ample range of applicability.

This contract modality can be used in the following cases:

manifest urgency which is when the public entity by reason of a calamity, be it war, pandemic or any major natural disaster that may need a swift reaction where a process without a plurality of biddings can be justified. Apart from this special condition, this kind of contract can also be used in the following cases:

- A. Manifest urgency is when the public entity by reason of a calamity, be it war, pandemic, or any major natural disaster may need a swift reaction where a process without a plurality of biddings can be justified. Apart from this special condition, this kind of contract can also be used in the following cases:
- B. Loans contracting.
- C. Interinstitutional agreements and contracts of public entities.
- D. Contracts for the development of scientific and technological qualities.
- E. Trust contracts are specified in the law 550 of 1999, and 617 of 2000.
- F. When there are not enough tenders.

- G. Professional services provision in support of public institutions projects or specific artistic works that can be performed only by specialized people.
- H. Real estate renting or purchasing.
- I. National intelligence direction agency (Dirección Nacional de Inteligencia DNI) contracts.
- J. Technical and professional advisory.
- K. Indigenous and special associations project to benefit from their own government and cultural identity to guarantee native people's rights.
- L. Black communities' contracts regulated by law 70 of 1993.
- M. Special community contracts that have been registered for more than 10 years in the interior ministry.

Special modality:

The special regime is established in Law 80 of 1993, which sets the general framework for public contracting in the country. This law allows for the establishment of special regimes through decrees, resolutions, or specific regulations issued by the competent entities. Some examples of special regimes in public procurement in Colombia are:

Procurement in cases of emergency or disaster: This regime is applied when unforeseen situations occur, such as natural disasters or health emergencies, that require a rapid and effective response from the State. In these cases, procurement procedures can be expedited to ensure the provision of necessary assistance or the recovery from the emergency.

Defense and security sector procurement: This regime applies to the acquisition of goods, works, or services related to national security or defense. Specific rules and procedures exist to guarantee confidentiality, protection of sensitive information, and the participation of qualified and authorized suppliers.

Procurement with territorial entities: This regime establishes special provisions for public procurement by municipalities, departments, and other territorial entities in Colombia. It may include specific requirements, simplified procedures, or the application of particular criteria for contractor selection.

These are just some examples of special regimes in public procurement in Colombia. It is important to note that each regime has its own rules and procedures, adapted to the specific needs of each case.

There are other modalities of contracting in Colombia where the private sector intervenes, these modes are known nationally as APP (Public and Private Associations) regulated by law 1508 of 2012 which are object of the private regulation and do not directly intervene in the e-procurement regulation, therefore, they are of no interest for this study.

1.5 Stating the issue

Procurement, as a public policy tool, wields significant potential to catalyze transformative changes and yield beneficial effects within the economic and social fabric of developing countries like Colombia. However, the realization of this potential is hindered by various prevalent corrupt practices, inadequate supervision mechanisms, and a weak infrastructure, collectively impeding the effective management and prevention of undesirable situations. This, in turn, allows vested interests to exploit public resources and infrastructure for their personal gains, resulting not only in misallocation of the national budget toward non-essential endeavors but also fostering an environment where public and private actors, operating within networks of corruption, manipulate and co-opt the public infrastructure for their own gains. One such pervasive malfeasance practice in Colombia is collusion, which thrives in an environment characterized by scarce public resources and limited competition within different

productive sectors (Agencia Nacional de Contratación Pública Colombia Compra Eficiente., 2023).

In light of the challenges posed by corruption and its detrimental impact on the national economy and societal well-being, the adoption of digital tools emerges as a promising avenue to revolutionize the procurement market. By fortifying the procurement infrastructure and promoting transparent practices, these digital solutions have the potential to disrupt the prevailing rationale of corrupt practices. However, for this transformation to be effective, it is crucial that these digital tools are not only implemented but also efficiently utilized.

To align with the principles outlined in Colombian decrees, which guide the implementation of these digital tools, becomes a critical aspect of public policy in the battle against corruption. These principles constitute a fundamental pillar in the concerted effort to eradicate or, at the very least, mitigate the pervasive corruption prevalent in procurement practices. The effectiveness of these principles in curbing corrupt activities can be gauged by examining how well they are integrated into the public contract law and the constituent decrees of the procurement system, as mandated by the CCE agency. A focal point of this study is to measure the degree to which the implementation of SECOP 2, a prominent digital solution, aligns with the prescribed principles and whether its utilization has contributed significantly to the purpose.

By scrutinizing the interplay between the established principles of public contract law, constituent decrees, and the operational efficiency of SECOP 2, this research aims to shed light on whether these digital tools have been genuinely effective in combatting corruption or whether there exist additional factors that influence their impact. Through a comprehensive analysis, we endeavor to draw nuanced conclusions that will not only contribute to the academic understanding of procurement policy but also offer practical insights for policymakers and stakeholders seeking to strengthen Colombia's procurement framework.

The confluence of procurement policy, corruption, and the adoption of digital tools presents a complex landscape with profound implications for Colombia's economic prosperity and social well-being. Understanding the intricacies of this relationship and evaluating the efficacy of digital tools in countering corrupt practices can open new horizons for policy interventions that holistically address the country's developmental challenges. It is our hope that this study will serve as a foundation for further research and policymaking endeavors, fostering a more transparent, efficient, and equitable procurement landscape in Colombia.

2. Chapter: Literature Review

This literature review pretends to contextualize the Colombian e-procurement system in terms of current global procurement measures and tendencies, such as the inclusion of digital technologies and the integration of systems to build a stronger environment that goes along with the tendencies of e-government, sustainable development, environmental, and social responsibility. However, the main focus is to find a way to widen the scope on the core matter of this study, which is the impact and benefits that e-procurement strategies had to integrate the Colombian private and public entities in the procurement marketplace in a proper way by the means of the market logics, this means for the case of study, how the conditions of the Colombian marketplace in terms of participation are justified and improved, when implementing these technologies in function of the law and objectives established by the institutions in charge of it, to regulate and improve procurement processes in Colombia.

For the specific case of Colombia there is not a vast amount of research explaining the current conditions in which the e-procurement technologies have affected the public procurement market, nor the system. There are some private initiatives to research on specific procurement including private and public partnerships (PPP) for procurement on different areas, specially identifying risk as for example (Ponz, Sastoque, & Arboleda, 2016), or some

experimental methods to prevent corruption and tailor systems that prevent malfeasance in public procurement as in the case described for Ecuador in (Fortuny, Guerrero, Riofrío, & Simon, 2023). The importance of efficiency in resource acquisition and the logistics improvement by using e-procurement systems were tested in other different studies, however, the public e-procurement system is not the objective of research, whereas the judicial and legal system ruling the system presents a more numerous amounts of research, (Alvares Patiño, 2020) and (Tello, D. C. V. 2021) evaluating under specific legal frameworks the convenience of the ruling on procurement systems or the struggle of the Colombian system against acts of malfeasance and corruption.

There are some major reports elaborated by the World Bank and the OECD, stating the conditions and the recommendations, aimed to advice the Colombian procurement system, to align with the international standards through specific processes. For the features that the Colombian socioeconomic conditions represent as challenges for the improvement of the values portrayed by these documents.

The OECD governance review issued on 2016², recommended the expansion of the information system, reducing duplication of information sitting outside the system, managing conflicts of interest by policy and management approaches, improving competition rationale by prioritizing competitive contracting methods to drive efficiency and streamlining for legal controls. There are other recommendations related to external factors to the system itself, which are the workforce and reforms to the sub-central level. (OECD, 2016)

Finally, some important and relevant studies on e-procurement implementation have been brought about in other areas of the world, very distant from the realities and conditions of that of Latin American countries, where the level of economical development is greater. A good example of this are the studies of transition between the implementation of 4.0 technologies in

² Towards efficient public procurement in Colombia (OECD Public Governance Reviews)

government entities, following the general framework of smart cities and e-governance, systematizing literature, and concluding on success factors and standardization of procedures in e-procurement implementation. (Mavidis & Folinas, 2022)

2.1. An approximation to jurisprudence and law for procurement in Colombia.

The complexity of commercial transactions in public procurement is exponentially increased by the special conditions and normativity compelling the state to accomplish and guarantee certain principles in the acquisition and expenditure of public funds. Regarding legal matters, Colombia's procurement is regulated by a considerable number of laws and normativity which may restrain it from efficiency and flexibility at times, even make it worse, when rules are not updated to the realities of the current situation and the dynamics of the global economy.

There is also a major concern for the purpose of this study, which is with the different modes of contracting, stated as the regulated methods to standardize the tendering and bidding process in Colombia. The validity of these modalities of contracting is sustained in law 1150 of 2007 and entities must give good use to them, depending on the criteria to award the contract that varies depending on the entity, the kind of service or good to be acquired.

The backbone for the legislation on public procurement and most matters related to public contracting in Colombia is the Law 80 of 1993. This one goes by the principles of Transparency, Economy, and Responsibility. Other additional normativity adding to this are:

- The national constitution of 1991 in its article 334 reaffirmed the state as the head and responsible for the economy.
- Law 80 of 1993 already mentioned that it contains and regulates all the different contractual methodologies except the one with a special statute.

- Law 2150 of 1995 (Anti-paperwork law) by which the necessary procedures or formalities existing in the Public Administration are suppressed and reformed.
- Ley 527 de 1999 through which the access and use of data messages, electronic commerce, and digital signatures are defined and regulated, certification entities are established, and other provisions are issued.
- Law 1150 of 2007 or better known as the transparency statute. This one adds to the different modes of public bidding for the selection of service providers, especially professional services. This one pretends to provide celerity to the hiring process.
- Law 1474 of 2011: Anti-corruption statute, a compilation of penal and disciplinary norms to avoid corruption in state contracting.
- Decree 4170 of 2011 by which the Creation of CCE is carried out.
- Decree 1082 of 2015, this one rules in specificity the law 80 of 1993. Explanation of every modality for tenderers to present offers to state agencies. Moreover, elaborates on auctions, preliminary studies, and on how auctions, feasibility studies, contract specifications, and annexes can be made.
- The administrative responsibility linked to public contracting is stated in Law 1778 from 2016
- Law 1882 of 2018: Offer rectification regime, whereby provisions aimed at strengthening public procurement in Colombia, the infrastructure law, and other provisions are added, modified, and enacted.
- Decree 324 of 2019: tender documents to establish the use of this kind of document on SECOP.

Most principles ruling over the procurement system in Colombia are stated in Law 80 de 1993 (Law 80/1993). These principles are a starting point. We must take the principles proposed in the process of constitution of the CCE to gain some scope on how to evaluate and assess the reach and performance of the agency. These values will be considered in the analysis proposed to measure the effectiveness of the implementation of the e-procurement system.

2.2. Theoretical Framework

The primary motivation behind this study is to assess whether the digitalization of public procurement in Colombia has had a discernible impact on the procurement marketplace, while also examining its alignment with the fundamental principles enshrined in Law 80, which serves as a critical regulation for public procurement.

However, the lack of quality in the available information poses a challenge in developing an effective model to measure the main principles outlined in Law 80, which emphasize transparency, economy, and responsibility in state contracting. To gain insight into the governing body responsible for organizing and coordinating the procurement marketplace in Colombia, we refer to the Law 4170 of 2011, which defines the objectives of the National Public Procurement Agency - "Colombia Compra Eficiente."

The agency's objectives include developing and promoting public policies and tools aimed at enhancing the efficiency, transparency, and optimization of state resources within the procurement and public contracting processes. To achieve this, the agency is tasked with implementing mechanisms that facilitate greater and better participation for bidders in public purchasing and contracting processes of state entities.

In light of these objectives, the concept of "greater and better participation" suggests that the implementation of e-platforms, such as SECOP 2, should play a pivotal role in achieving

these goals. Greater participation entails an increased number of companies participating in procurement, while better participation reflects improvements in the utilization of two critical procurement conditions: time and monetary resources.

Thus, for the purposes of this study, the implementation of the SECOP 2 platform should ideally demonstrate improvements in the relationship between the increase in providers, the number of contracts, and the resources involved in their clauses, including efficiency in time and an increase in financial terms.

Given the nature of the topic and the data available, this study adopts a descriptive analysis approach in its discussion. By describing the current state of Colombia's e-procurement system and the approaches taken by the government to build and implement such a system, the paper seeks to provide insights into the legal framework governing the system's validity while also identifying potential barriers to achieving a more efficient system.

A statistical analysis will follow, aimed at understanding how the participation of private and public actors can be explained based on the data, including the impact of the e-procurement platform and other relevant components influencing the tendering and bidding process.

Throughout the study, critical questions will be addressed, such as whether the tools and methods employed by the accountable agencies are conducive to achieving the state's pre-established objectives for the e-procurement system and whether they uphold the principles mandated by law for interactions within the e-procurement context.

Finally, the study will draw conclusions and offer recommendations based on the data analysis conducted in the initial part of the paper. A performance analysis will be presented to comprehensively evaluate the outcomes and validity of deploying these technologies in such a significant process as the exchange of services and goods within Colombia's public apparatus.

Through this comprehensive examination, the study aims to shed light on the effectiveness and alignment of Colombia's e-procurement system with its stated objectives and

legal principles. Ultimately, the findings and recommendations can inform policymakers and stakeholders, ensuring that the country's procurement processes benefit from technological advancements while maintaining transparency, efficiency, and adherence to legal mandates.

2.3. E-government and public Value:

To provide a useful framework for this research, two main scopes were considered to analyze in a logical framework the problem at hand. Of course, e-government, as a widely and popular framework of analysis to understand the dynamics of the implementation of IT tools in the state and government functions. On the other hand, the impact of a policy implementation in terms not only of numerical or monetary benefits, but a more diverse criteria such as that of “public value”.

Regarding the value component, it is important to define the value that the e-procurement is giving at this specific moment to the Colombian corpus of public administration. The approach chosen to evaluate such elements is that proposed by Professor Mark Moore in the vision of the public value based in three core philosophical ideas, that help us understand the utility of the implementation beyond the economic benefits, but also in terms of arbitrage, authority, accountability, and deontological values, accordingly positive elements to measure utility in the public administration dynamics.

Since the main concept to be dealt with in this paper is that of the analysis of “public” adoption of a system that assembles in favor of more competitive procurement, the considerations taken into account by professor Mark Moore in the vision of Public Value become useful, given that from this perspective it is not only a matter of the efficiency in resources, understood in the case of public value approach as the proper use for individual and collective welfare, but also the use of others assets and tools by governments such as the capacity to exert justice through the authority bestowed by the society to institutions, and the

search for the collective benefit. Public value theory is a comprehensive theory in that regard, given that aims to evaluate the benefit of public action.

The principles proposed by public value theory also try to provide a framework to understand an effective approach to measure the effective performance of any institution in terms of a real benefit, a collective one, rather than one where just a small group of interests' benefits. Professor Moore states, with high altruistic character, that to envision society and try to find the parts of it that require an improvement, demands at the same time, discovering how this improvement can be achieved and measured, but using solely a collective vision of benefit not an individualistic one. Moore uses the strategic triangle which is the approximation to understand public value from 3 angles: First, Public value as a goal or what is the objective of the public action. Second, Operational capacity which is the method by which these goals can be achieved, and finally legitimacy and support which are the resources, materials, and humans that are required to perform the job. (Moore, 2014)

This highlight is considered for the purpose of this thesis, alongside the definition of the creation of public value, which is to be defined from the perspective of collective well-being. For the case of the implementation and proper management of a procurement network, the evaluation that is to be performed on the results that this system brings, won't be only for the case of the benefit created, either from the implementation of the system itself, or the one created from the savings this transactions and transparency provided in the implementation it brings, but also the idea that a benefit for the whole Colombian society must be brought about, otherwise this projects lack a real mean of value.

One component that preoccupies its absence and to some extent has made this study complex, is the lack of interest in researching the conditions for a proper adaptation of digital systems into procurement environments in developing countries. Being this the case for Colombia, considered a medium-high income country according to the latest world bank classification (World Bank, 2021),

E-government irreversibly is the new frontier where all state structures of most nations of the world must move forward to, despite the great challenges it implies, especially for those countries that do not still have the base infrastructure to create the minimal conditions for the development of the basic digital services a country citizenry may aspire to.

E-government is defined by the world bank as “the use of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that can transform relations with citizens, businesses, and other arms of government. (World Bank, 2015). The inclusion of IT tools to improve the delivery of services and benefits governments are to bring to their society constitutes the core of what e-government means and implies a great deal of a challenge since this demands the coordination and adoption of this IT technology to all the spectrum of different services that all the variety of government agencies delivery to the citizenry.

For the interest of this research, it is important to understand the implications of e-government in a socio-economical context of a developing country as it is Colombia, specifically paying attention to the principles and objectives that should rule the implementation of ICT for this country and more specifically in terms of e-procurement, as mentioned by the law of this country, how coincident efficiency and transparency may be as the two principles that rule the implementation of digital technologies, including the proper communication platforms, the digital protocols, the security technology, and all the technology capacity that can determine the success or failure of this process.

2.4. Research questions:

- Has the implementation of SECOP 2 helped to increase the participation of public and private entities in the procurement marketplace in Colombian as stated in law 1140 of 2011 for CCE?

- Can the current tendency in the procurement participation of public and private actors be explained by the direct contract or the public bidding modality?

2.5. Hypothesis Formulation:

For this research, we have the main objective of understanding if the number of providers and public agencies partaking in the system can be predicted by the implementation of SECOP 2, as well as by the conditions in terms of time and monetary resources in the procurement marketplace in Colombia. There are two key elements to this analysis which are: First, the greater participation of providers in the procurement activities because of e-platforms, specifically SECOP 2 as a transactional portal. Second, the increasing relation in terms of resources executed through these contracts and number of contracts offered by the state agencies and their modalities in the different public organizations through these e-platforms, in the allegedly more efficient and accurate manner, specifically the direct contract and public bidding modality and finally the third element is time efficiency, key element to determine competitiveness since the speed with which contracts can be awarded and executed.

Hypothesis 1 (H1): With the implementation of SECOP 2 participation of suppliers and public agencies increased at a higher rate!

Hypothesis 2 (H2): Direct Contract modality negatively affects the conditions of the participation and contract supply in the marketplace by reducing the entrance of new providers into the market.

Hypothesis 3 (H3): Public Bidding modality positively affects the conditions of the participation and contract supply in the marketplace by increasing the entrance of new providers into the market.

3. Chapter: Research Methodology

3.1. Research Framework

For the type of topic and the availability of the data at hand, this paper approaches the issue in the discussion by means of descriptive analysis. While describing the current conditions of procurement systems in Colombia, it is trying to reference in different frameworks the status of procurement in this nation, given the conditions of adoption, regulation, and the performance of the system. This paper aims to provide a quantitative analysis, without disregarding data and qualitative approaches in its analysis to test its hypothesis. The core issue, however, is the implementation effect in the participation of public and private entities in the market in the procurement system in Colombia. According to the constitutive decree of the CCE, the implementation of SECOP 2, should have improved the system in terms of better and higher participation of bidders, since the technological instruments facilitate participation. The unit of analysis for this study are the contracts executed by the different public agencies in both platforms SECOP 1 and 2, while at the same time establishing the differences in the market conditions considering the different elements that may help to understand if the expected tendencies in the behavior of the market, given as a ration, increased, or decreased.

To address the research question and to test the proposed hypothesis, a quantitative approach has been run. The main reason for this choice is to measure how robust the model is and to provide a plausible analysis regarding the public policy implementation of e-procurement in Colombia.

3.2. Variables

During the analysis of the Colombian procurement system and its incorporation of an e-platform, we encountered the need to dissect the system into subsets for a more systematic approach. The most apparent division was that of Public and Private actors, as participants in procurement processes typically fall under one of these two categories. From this point, the goal was to understand the extent of involvement of these actors and the unique elements they contribute to procurement interactions. The subsequent table provides an outline of this analysis:

Table 1 Research framework components

Dependent variable	Procurement participation
Unit of measure	Contracts awarded and executed from SECOP 1 and SECOP 2.
Attributes of the variable	The increase in interactions between providers with public agencies, as evidenced by executed contracts, demonstrates that the implementation of the e-platform is positive based on the principles of procurement stated in Colombian law and international standards.
Implications in the analysis for SECOP1 and SECOP2	Increase in ratio understood as increased participation of providers justified in more resources executed through the contracts and a time component as a control variable which would be added considering the time the contracts are uploaded to the platform to the time the contract is finished.
Elements of the analysis:	<p>Two components are crucial for this analysis:</p> <p>Elements of the Public Sector: These are elements in the procurement process provided by the public sector which for the present analysis are:</p> <ol style="list-style-type: none">1. Demand of services and goods as contracts bidding represented in the data as Total Contracts2. E-procurement platform where procurement takes place, these are SECOP1 and SECOP23. Resources executed and their average which are represented in the data as APC (Colombian Pesos)4. Contract conditions understood as Time and modalities of Contract.

	<p>Elements of the Private Sector: These are elements in the procurement process provided by the private sector which for the present analysis are:</p> <ol style="list-style-type: none"> 1. Supply of good and services by private entities which participation is understood as Providers.
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The table illustrates the varying degrees of involvement of Public and Private actors in the procurement system and the respective elements they bring to the interactions. Public actors, such as government entities, play a significant role, influenced by policies, budget allocation, regulatory compliance, and the mandate to deliver public services while representing public interests.

On the other hand, Private actors are driven by profit motives and engage in market competition. They contribute product/service quality, innovation, and efficiency, responding to market demands and striving to meet customer needs. Additionally, there are instances of collaborative efforts between Public and Private actors, such as joint ventures, public-private partnerships, and selected public-private projects. These arrangements often involve shared resources, expertise, and decision-making between both sectors.

Finally, some interactions between Public and Private actors are relatively low in intensity, involving activities like observing procurement, conducting market research, networking, and exchanging information.

By analyzing the procurement system in this manner, we gain a deeper understanding of the roles played by different actors and the dynamics that govern their involvement. This analysis can serve as a foundation for further investigation into the effectiveness of e-platform implementation and its impact on the various interactions between Public and Private actors within the Colombian procurement landscape.

3.3. Measurement for Dependent Variables (Procurement Participation):

The central focus of this study lies in comprehensively examining the implementation of SECOP 2, which constitutes the primary objective of analysis. To elucidate the intricacies of this implementation, our investigation takes as its unit of analysis the contracts awarded annually by public agencies through the e-platforms SECOP 1 and 2. However, a straightforward assessment based solely on the numbers of participating public and private entities, as well as the volume of awarded contracts, falls short in capturing the true essence of the impact. To ensure a robust and nuanced understanding, a more multifaceted analysis is imperative, encompassing various dimensions of the procurement dynamics, including resource allocation, timeframes, and contractual conditions. This multifaceted approach is necessary to derive a more precise and insightful measurement of the implications arising from the SECOP 2 implementation.

In pursuit of a comprehensive measurement framework, we propose the adoption of an index variable, which best encapsulates the two fundamental aspects of the principal concept under examination – the involvement of private and public entities in e-procurement attributable to SECOP 2. The first facet involves examining the direct correlation between the demand for goods and services by public entities through contract tendering and the subsequent supply of these contracts by private entities following successful fulfillment of specific conditions and requirements laid out within the contracts themselves. This interplay will be effectively represented as a Ratio, providing an in-depth understanding of the mutual dependencies and synergies between the demand and supply sides of the procurement process.

The second key concept to be quantified pertains to the net variation in these interactions. This dynamic can be conceptualized as the historical iterative process that

characterizes the recurrent interplay between demand and supply. Remarkably, this intricate interplay is often influenced by external factors, which may not be directly tethered to the contractual conditions. The identification and measurement of this variation are instrumental in ascertaining the broader contextual factors that impinge upon the e-procurement landscape, shedding light on the overarching patterns that shape its evolution over time.

Embracing this multifaceted measurement approach, we endeavor to unravel the intricate relationships between SECOP 2 implementation, private and public entity participation, and the underlying factors that govern their interactions. By holistically scrutinizing the diverse dimensions of e-procurement dynamics, we seek to advance the academic understanding of the complex interplay between policy initiatives, procurement practices, and external forces shaping the e-procurement ecosystem in Colombia. The findings of this study hold considerable implications for policymakers, as they offer crucial insights into the efficacy and implications of SECOP 2 implementation, paving the way for informed decisions that can bolster the efficiency, transparency, and effectiveness of public procurement processes in the country.

3.4. Measurement for Independent Variables:

3.4.1. Measurement for Average Price of Contract

(APC):

The average price per contract was obtained from the item of “contract value”, that is presented in its exact value per each contract. In the SECOP 1 and SECOP 2 this specific data presented some errors since the numbers presented huge numbers, and exorbitant prices that fortunately could be corrected through a link directing to the online repository of contracts on SECOP platform, so the ones that presented a huge difference and affected the average a great deal were corrected.

3.4.2. Measurement for Average Time Contract (ATC):

Time as an independent variable intends to measure for a component of better conditions in the Colombian procurement marketplace. The measurement derives from the awarding period to the contract settlement of the contracts in SECOP 1, and in SECOP 2 it derives directly from the clause of time of every contract, which was standardized in days of execution.

3.4.3. Modalities of Contract:

These modalities were subtracted from the total of contracts executed every month. The modalities were classified according to the 5 modalities of public contracting available in Colombia according to the law 1150 of 2007. They are:

- Public Bidding
- Direct Contract
- Minimum Amount
- Merit Contest
- Abbreviated Selection
- Special

3.4.4. Dummy variable Secop 1 and Secop 2

The implementation of SECOP 2 after 2015 is shown in the data as the records of contracts that started to be registered during 2016. So it makes the first registers of data, meaning periods 2013 to 2015 for SECOP 1 and the other years referring to SECOP 2 implementation.

4. Chapter: Data Analysis and Results

This chapter focuses on evaluating and presenting descriptive statistics, conducting hypothesis tests, and performing multiple regression analysis to explore the relationship between dependent and independent variables. The primary objective is to examine the impact of various factors on the behavior of public and private entities participating in the procurement marketplace, with specific attention to the implementation of SECOP 2 and the use of contract modalities.

To facilitate a comprehensive analysis, a multiple regression approach is employed, considering the diversity of variables under consideration. The dependent variable is created as an index variable named "Procurement participation," which serves to capture the combined effects of supply and demand iteration and tendencies. By comparing this index variable with the various independent and control variables described in the study, a more robust understanding of their influence on procurement participation behavior can be established.

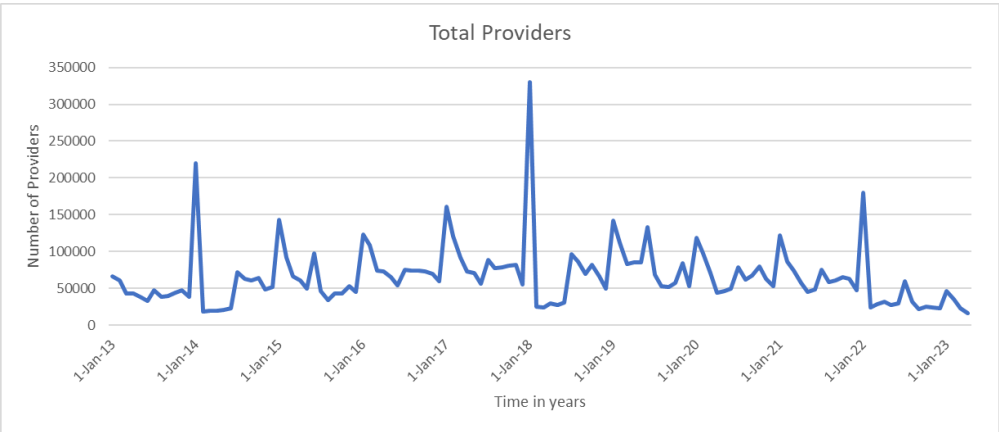
The central question addressed is whether the introduction of SECOP 2 and the utilization of different contract modalities have had any significant impact on the overall performance of the procurement marketplace. Preliminary observations indicate that the general levels of private supplier participation in the marketplace did not demonstrate any noticeable or significant increase following the implementation of SECOP 2 (Figure 5). However, it remains essential to investigate whether SECOP 2 influenced the degree of variation in the relationships between supply and demand for goods and services traded through procurement channels. Furthermore, identifying the key factors that hold greater

importance in shaping these tendencies, as reflected in the "Market behavior" variable, is of utmost significance.

To shed light on these matters, the multiple regression analysis will delve into the intricate interplay between the different variables, unveiling their respective contributions to the dynamics of the procurement marketplace. This analysis will offer valuable insights into the underlying factors that influence market behavior and the extent to which SECOP 2 and contract modalities play a role in shaping procurement participation patterns.

A rigorous and comprehensive analysis, this study aims to contribute to a deeper understanding of the impact of various elements on the procurement ecosystem in Colombia. The findings from this research have the potential to inform policymakers, public agencies, and private sector stakeholders on strategies to optimize procurement processes, enhance competition, and foster a more transparent and efficient marketplace. Ultimately, the practices from this investigation can aid in the continuous improvement of procurement practices, aligning them with global trends and best practices, and promoting the overall economic growth and development of Colombia.

Figure 2 Total providers participating in Colombian procurement (January 2013 – April 2023).



Note: The number of providers here accounts for the total of providers awarded a contract in one of the SECOP platforms.

Figure made by the author.

4.1. Data Gathering:

The main source of data for the analysis of this research was collected from the open sources offered on the website of the CPBs of Colombia. The data there is divided into 4 sections including SECOP I, SECOP II, TVEC, and an integrated database from the two SECOP platforms which does not seem to be completely updated, so it was not consulted.

The data selected presents various challenges since the database from S1 does not follow the same format as that of S2, therefore the standardization of the data demands clearance, and the creation of a new file or dataset, that collects the sample that can be analyzed.

Something to consider is that the data is presented in months rather than in years, for reasons of the size and manageability of the data. S1 database as downloaded from the web source files 14GBs approximately, S2 dataset is about 2GBs. This kind of file size represents an obstacle for its analysis given the power processing capacity of the computer where this study is being developed.

The total data content for SECOP 1 file included 11.2 million rows, each row representing a contract, however not all these contracts were awarded or presented a final successful negotiation. The data set also presented 72 columns containing a wide range of data, including dates and prices estimated for the contract, as well as information on the bidders and the public entities in charge of the tendering.

For SECOP 2 the data set was smaller with 2.15 million rows and 59 columns. Each row also represents a process or a contract. As it can be assumed, there was no standardization between the two data sets found, therefore a cleaning process was

required to standardize the data and be able to obtain a net total of contracts awarded per each platform, as well as the average prices, the average times and all the variables that have already been explained in the previous chapter.

One more reason for the monthly representation of the data is the seasonal characteristic of the procurement system in Colombia. Colombia has presidential elections every 4 years, and 2 years after local authorities and congress elections are held. For this reason, the country has an election period restriction called “Electoral guarantees law”³ which prohibits the public entities to develop any procurement transaction during the 4 previous months to the election of the president. This can only be observed in the data through a seasonal analysis in months.

One more reason for the selection of the monthly data is the iteration this presents during the end and beginning of every year. There is a great deal of variation that is worth paying attention to, during the statistical testing. It seems execution and new tendering and bidding is increased as local and national agendas are planned and implemented during the first months of the year.

One final reason is that given the S2 implementation is treated as a treatment sample, its representation presents a valuable iteration during its first stages, and it is only observable during the first months of its initial periods.

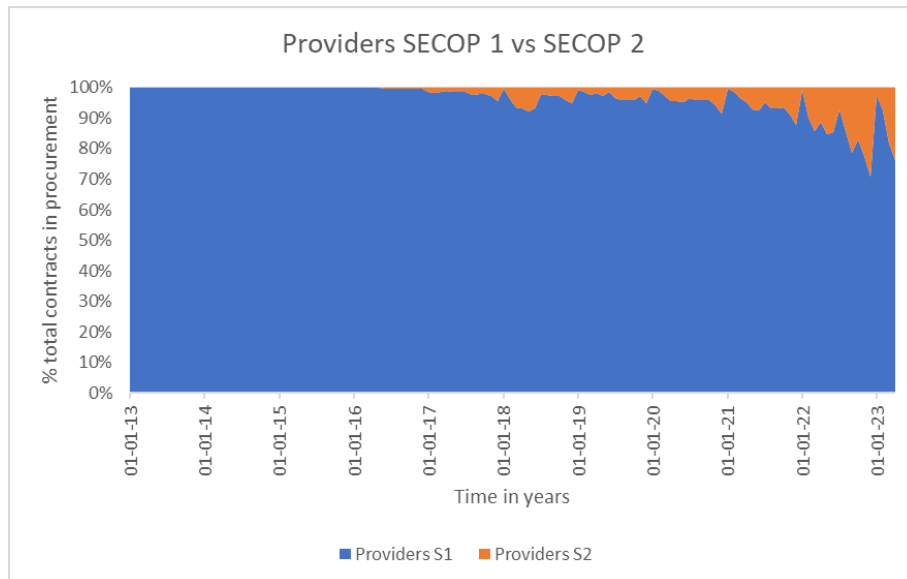
³ Law 996 of 2005 Colombia.

4.2. Descriptive Statistics:

Dependent variable:

The Unit of measure for this research is the contracts awarded through the e-procurement systems studied. We have managed to extract the single number of contracts and the net number of suppliers for those contracts. For the statistical analysis we have designed an index variable, to relate those two components to understand the way the supply (Private actors delivering services and goods) and demand (public agencies tendering contracts to acquire those services and goods) behaved over the years for each e-platform.

Figure 3 Providers total per platform.



Note: The figure describes the percentage of private suppliers participating in contracts awarded per each platform. The figure was created by the author.

The distinction between the two platforms has already been described. SECOP 1 (S1) as an informative and SECOP 2 (S2) as a transactional platform. With a simple look, it is easy

to infer that a significant increase in the total amount of providers in the e-procurement systems is not greater after the implementation of S2, however, it is important to understand that not only a direct increase in the total number of providers can be seen as a improvement of the competitive factor, but also, the behavior of the number of the contracts tendered by public agencies, which is a determinant factor of the conditions to increase that competition. For this reason, the index can be interpreted as conveying measurement, relating the direct relation between the number of providers against the number of contracts and also the variation that the net number of providers and the net number of contracts have.

4.3. Descriptive statistics for the dependent variable (*Index variable as procurement participation*)

Index variable (Procurement participation):

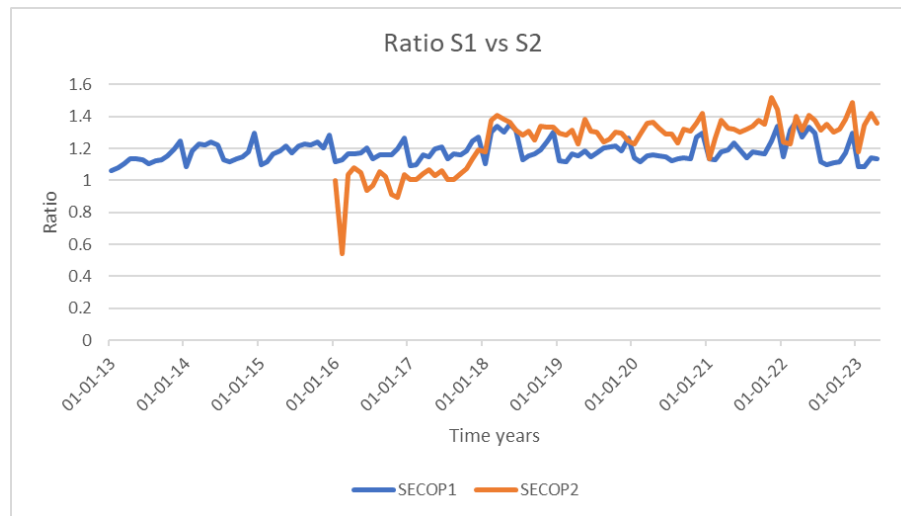
For the construction of this variable, it was first necessary to obtain a ratio that measured the direct relation between the number of contracts tendered and the total number of providers awarded those contracts. Therefore, we have:

$$\frac{\sum \text{contracts}}{\sum \text{providers}} \Rightarrow \text{Ratio (Relation of number of contracts per provider)}$$

The creation of the ratio as one of the elements to measure the procurement marketplace conditions, comes from the direct relationship between the demand through contracts and the supply of those contracts by providers, establishing a direct relation of supply and demand. In the conditions of a normal market, these relation has a different elasticity since price regulates and modifies the curve of relation, however, in procurement this relation is more rigid, allowing the consideration that basically the concepts of supply and demand establishes a relation that portraits the number of supply contracts by each provider, giving us understanding

precisely on the focal points of this study, which is the amount of providers in the marketplace explained by the implementation of the SECOP 2 platform, which is what we are trying to determine. This relation fits very conveniently the articulation of the number of providers given the provision of demand represented as contracts, one of the elements depending on the public sector.

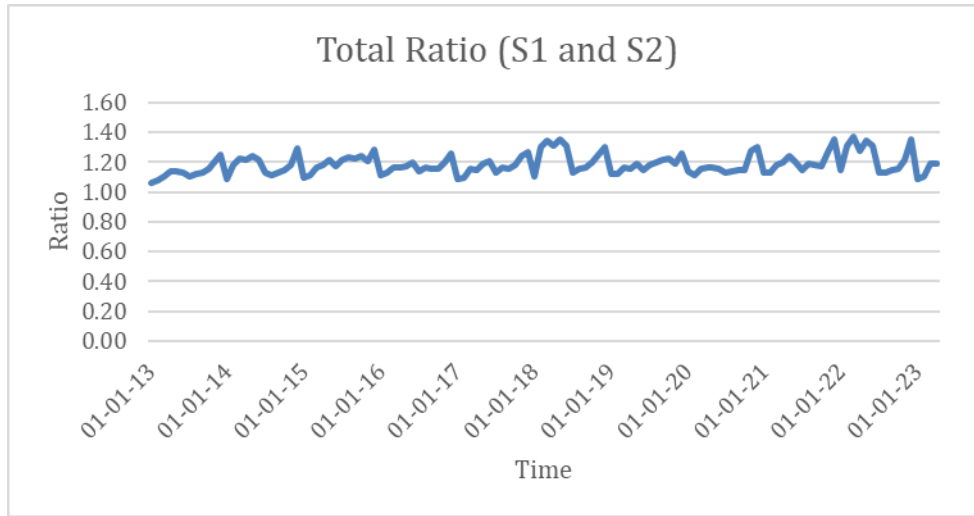
Figure 4 Ratio behavior comparison S1 Vs S2



Note: Comparison between ratio in S1 and S2. The figure was created by the author.

To consolidate this ratio as a unique element of measure to conform the index variable, the measurement was performed on the total providers and contracts of both platforms added as one, therefore a unique measure was obtained per each period like this:

Figure 5 Ratio of the total contracts over total providers



Note: Ratio as a relation between the number of contracts over the number of providers. Figure generated by the author.

After this, to include in the variable the net variation of number of contracts and number of providers, we calculated the variation according to this:

$$\frac{(\sum \text{Providers}_{x2} - \sum \text{Providers}_{x1})}{\sum \text{Providers}_{x1}}$$

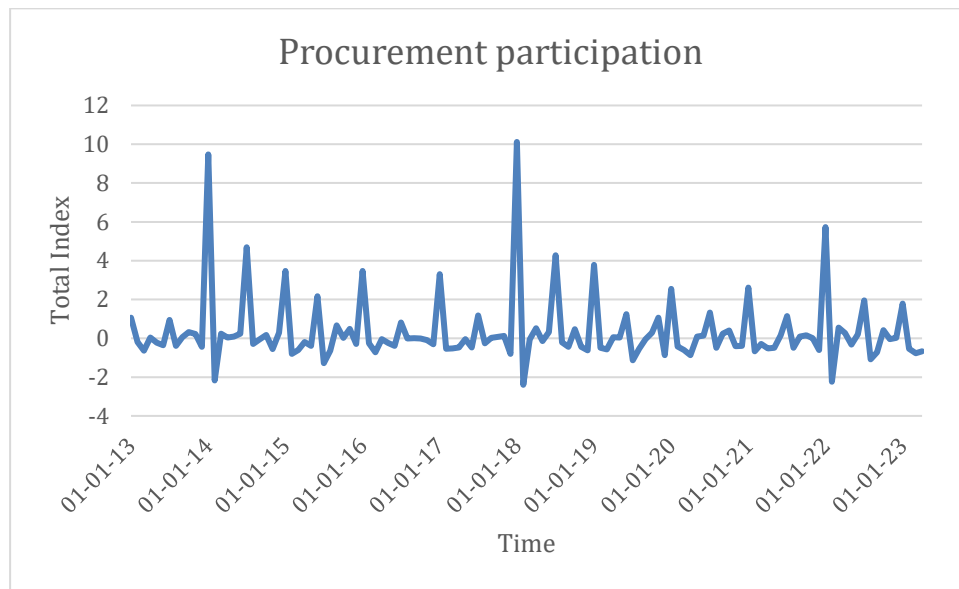
In the previous formula, total providers refer to the total number of providers in one month, including both platforms S1 and S2. With this operation we obtain the percentage difference from one month to the previous one, this in terms of net providers and contracts.

The same operation goes for contracts as follows.

$$\frac{(\sum \text{Contracts}_{x2} - \sum \text{Contracts}_{x1})}{\sum \text{Contracts}_{x1}}$$

After these operations were carried out, the results for each period were added considering that some of the net variations have a negative tendency, which will help to reflect the real variation and effect that the reduction in net numbers occurred, something that could not be reflected in the first ratio obtained.

Figure 6 Index variable (Ratio + Σ net variation)



Note: The final participation variation represented in an index as the total participation of public and private entities. Figure generated by the author.

The creation of the index variable as Market conditions is necessary due to the interpretation that there is a general decrease in the total number of contracts, when its variation may be of more interest than the actual net decrease or increase either of contracts or providers participation.

4.4. Descriptive Statistics for independent Variables

In the biggest interest for this research, it is to understand if the implementation of S2 increased the participation of providers in the procurement marketplace, besides considering the reasons that explain that increase or decrease, whatever be the case, and try to find a precise approach to explain the factors that may have influenced such an outcome.

Among the variables used to control the model, the best elements to explain the tendency and strength of the behavior in the tendency of the conditions of the market that affected the participation of private and public entities we could find: (APC) Average Price per

Contract, (ATC) Average time per Contract, all the modalities of contract including (DC) Direct Contract, (PB) Public Bidding, (MA) Minimum amount, (MC) Merit contest, (AS) Abbreviated selection and the categorical dummy variable Platform which divides in SECOP 1 and SECOP 2, which is fundamental to justify the implementation as a positive or negative effect in the tendency of the ratio.

Table 2 Descriptive statistics for independent and control variables.

Variable	Observations	Std. Dev	Min.	Median	Mean	Max
Direct Contract	124	36834.2	1806	30820	38420.25	284542
Public Bidding	124	279.56	91	555	562.51	1573
Average Price per Contract ⁴	124	\$ 3.137	\$ 72.417	\$ 783.077	\$ 1.719.612	\$ 19.685.977
Average Time per Contract	124	126.84	11.9	233.6	256.5	769
Minimal Amount	124	279.56	91	555	562.51	1573
Abbreviated Selection	124	552.59	34	788	891.29	3375
Special	124	15359.5	2355	26872.5	25503.4	91610

Total Average Price per Contract:

As for the monetary resources, it is the monthly amount of money spent on procurement, in relation to the total number of contracts for that specific month. This average first had the intention to facilitate the processing of the information provided by this data, since the values available in the currency of Colombia (COP / Colombian Pesos) were too extensive and have too many digits, even after reported as an average, it remains as a large digit value.

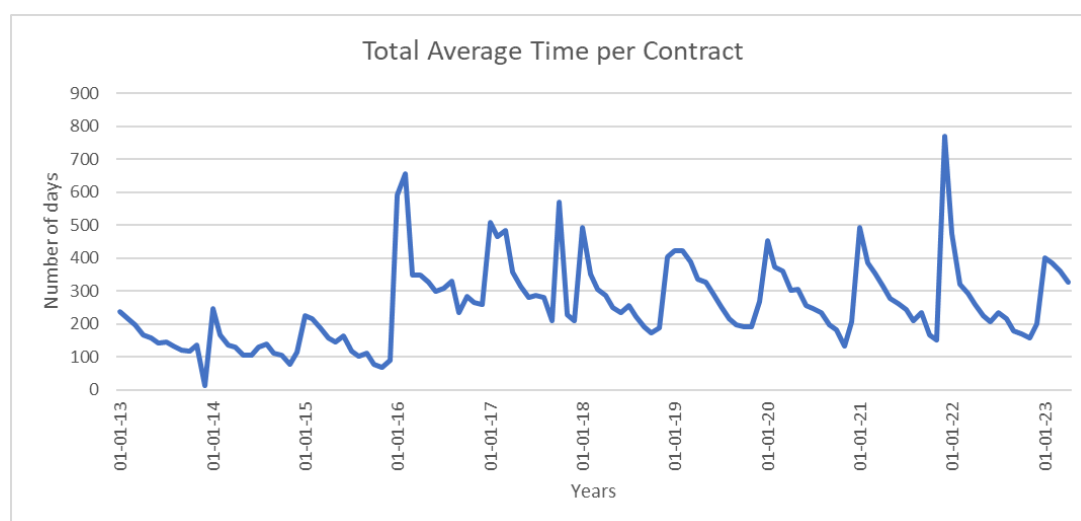
⁴ The amounts mentioned are given in thousands of millions of Colombian pesos.

This one was also intended to control over one of the elements that better explains the market conditions as resources offered in the supply contracts to execute them, for the obvious rationale that generates in the providers to participate in the e-platform.

Total Average Time per contract:

We can also see another key element for the analysis which is the time of execution of Contracts ATC. This time variable was taken from the data through two different methods for each variable. For SECOP 1 the time variable refers to the difference between the awarding date of the contract and the final date of execution of the contract, which is the settlement date. For SECOP 2, the time lapse is taken as the duration of the contract itself, provided by the conditions prearranged in the contract and reflected in the database as “Duration” literally translated from Spanish.

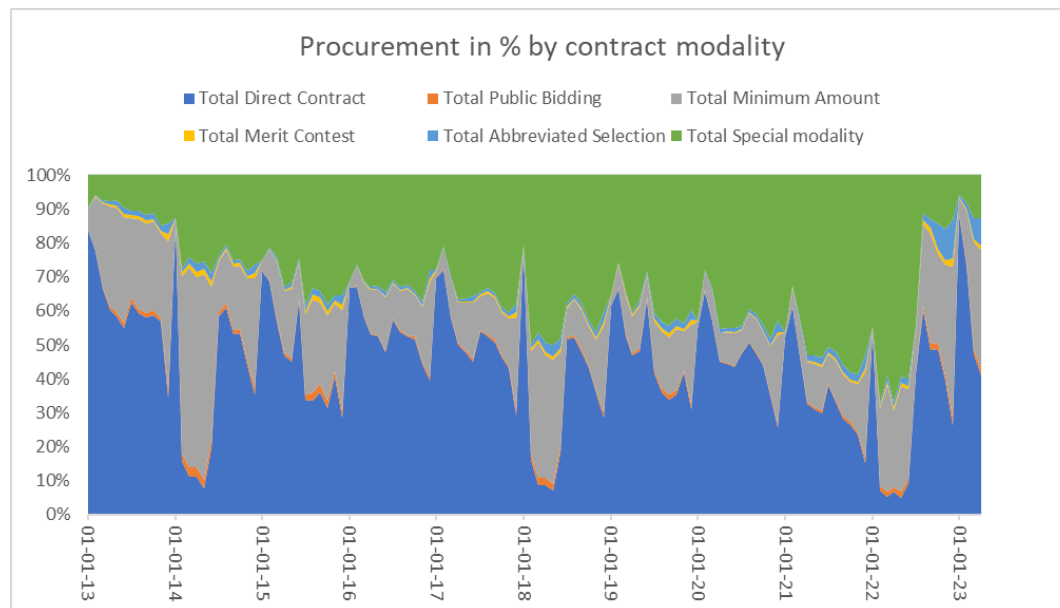
Figure 7 Average time in days each contract takes to be executed.



A decrease in this variable explains efficiency as the time lapse between the awarding and settlement of the contract is reduced. A significant increase does not seem to be taking place along the graph presented, however, it is important to understand that an increase could also be explained in long term contracts which are high investment, a kind of contract that is only tender by large providers.

There are for the case of this study 6 modalities of contract in the procurement system in Colombia as explained before. The figure 8 shows the total percentage of each one of those modalities as each contract is executed under one of them, these conditions are established by the public agencies and those conditions are extensively explained in the law 80 of 1993, the updates made in law 1150 of 2007 and their compilation and latest issuance in the decree 1082 of 2015.

Figure 8 Percentage of total participation of contract modalities in procurement system.



Direct Contract:

This modality is very controversial as explained before since this allows, under the rule of exception, to directly award contracts to specific providers, allowing at times to skip the rationale of competition that is embedded in the purpose and objectives of the implementation of SECOP 2 and also the Colombian decree. Direct contract does provide a time benefit regarding the time in which contracts are awarded and during the procurement process, however this benefit is overridden by the transparency and corruption that causes the rationale of contracting

under the agency of just a particular interest, for the case, the state agency and the group in charge of it.

This variable is used in the model to understand the relevance and effect that this situation may have in the conditions of the procurement marketplace in Colombia. It shows the tendency followed by the number of contracts on both platforms with the modality of public bidding. This modality, contrary to the Direct contract one, is seen as a very secure and proper form to tender and bid contracts in Colombia. Around these two modalities there is a great debate of interest, since many claim that the sacrifice made in efficiency in terms of time through this modality is compensated for by the high level of transparency that provides the public bidding rationale.

Total Minimal Amount:

As described before, this mode is designed to streamline the procurement process for small-scale projects or purchases, where the estimated value falls below a predetermined threshold. In this mode, the Colombian government aims to simplify procedures and reduce bureaucratic requirements to facilitate efficient and cost-effective procurement. The minimal amount mode allows for expedited procedures, enabling swift decision-making and quicker implementation of projects. These characteristics make it an efficient and middle point between the direct contract and public bidding.

Merit Contest:

The merit contest mode emphasizes the evaluation of technical capabilities and merits, rather than solely focusing on the lowest price. It aims to select contractors who demonstrate the expertise, experience, and capacity to successfully execute the project or provide the required services. It does not seem to be a preferred or popular way to contract in Colombia.

On the other hand, it portrays a high level of iteration following the patterns of annual cycle variation. Of the most extended and possible uses for this modality is the hiring process of personal and professionals in the different public agencies in Colombia that change and are modified on a yearly basis. Once again, these modalities follow a pattern of yearly variations. High peaks during the end of the year and low troughs by the beginning of the new period.

Abbreviated Selection:

The Abbreviated Selection mode is applied in cases where the estimated value of the contract falls below certain thresholds, or when specific circumstances, such as emergencies or the need for urgent execution, justify its use. It allows for a more simplified and agile process compared to other modes of public contract.

It is easy to observe certain regular variation following the patterns of a yearly change, quite similar to other modalities of contracts presented before, however, this one present and interesting increasing tendency along the years, especially after the year 2020, right after the pandemic COVID-19 had arrived to Colombia in March 2020.

Special mode:

In Colombia, the special regime in public procurement refers to a set of rules and provisions that apply to specific and particular cases of procurement. These cases generally involve situations that require a differentiated approach due to their specific characteristics or needs.

As described before, this modality is usually employed in activities of great importance for the Colombian state. The use according to figure 18 explains the great importance it has in terms of procurement. The following figure shows its extended use, however in last periods it seems to be declining in its use. In terms of behavior after the implementation of SECOP 2 does

not seem to there to be a relevant change in the tendency nor in the common pattern, as evidenced in the figure.

4.5. Data observations:

The structure of the analysis as mentioned before, will be performed through a multiple regression analysis considering the multiple variables available from the data collection. The multiple regression will be performed to determine the degree of influence of each one of the independent variables in respect of the dependent variable and get a consistent measure of the degree of relation between each of the independent variables specially the dummy variable “platform” which equates to the implementation of SECOP 2.

4.6. Multiple Regression.

Table 3 Multiple Regression Analysis.

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.233	0.484	-0.482	0.630
Average Price Contract⁵	-2330	4840	-0.482	6300
Average Time Contract	-0.001	0.001	-1.501	0.135
Direct Contract⁶	355.0	37.8	9.401	6.90E-12
Public Bidding	0.0027	0.0009	2.716	***0.0076
Minimal Amount⁷	-17.0	4.4130	-3.873	1.70
Merit Contest	-0.0019	0.0013	-1.447	0.150
Abbreviated Selection	0.00065	0.00028	2.336	**0.0211
Special modality⁸	1.59	0.9072	1.753	82.0
SECOP 2 (Dummy Variable)	-0.483	0.369	-1.307	0.193

^{5, 6, 7, 8} These variables were multiplied by 10.000 to help simplify the presentation of the numbers while still retaining their proportions.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

'***' indicates a very high level of significance, with a p-value less than or equal to 0.001.

'**' indicates a high level of significance, with a p-value less than or equal to 0.01.

'*' indicates a moderate level of significance, with a p-value less than or equal to 0.05.

'.' indicates a low level of significance, with a p-value less than or equal to 0.1.

' ' (blank) indicates that the result is not statistically significant, with a p-value greater than 0.1.

To test the hypothesis that the participation of public and private actors in the e-procurement system can be explained by the implementation of SECOP 2, the previous multiple regression was performed. The price and time per contract, as well as 6 different modalities of contracts and one dummy variable representing the presence SECOP 2, were entered into the model alongside the E-procurement participation variable.

The test revealed that the combination of the platforms, time, monetary resources, and modalities of contract explained 69% the level of participation of public and private entities in e-procurement in Colombia. $R^2 = 0.69$

The predictor variables of the direct contract modality was a strong predictor of the participation in procurement $\beta = 3.78211E-06$, $t(99) = 9.4$, $p < .001$. This means that the overall procurement participation increases $3.5557E-05$ for every contract performed with this modality.

The predictor variables of the public bidding modality was a strong predictor of the participation in procurement $\beta = 0.000994433$, $t(99) = 2.71$ $p < .001$. This means that the overall procurement participation increases 0.002700929 for every contract performed with this modality.

Regarding the dummy variable which is of utmost importance for the purpose of this research, it did not present a statistical significance in the model.

4.7. Summary of Hypothesis test:

Table 4 Hypothesis testing outcomes

<i>Supported</i>	<i>Not Supported</i>
<p>Hypothesis 2. The analysis indicates that the stagnation in the participation of private and public actors in e-procurement in Colombia can be explained with reasonably significance by direct contract modality.</p> <p>Hypothesis 3. The analysis indicates that the stagnation in the participation of private and public actors in e-procurement in Colombia can be explained with reasonably significance by public bidding modality.</p>	<p>Hypothesis 1. SECOP 2 has a higher impact than SECOP 1 in the conditions of the Procurement marketplace in Colombia.</p>

5. Chapter: Conclusions and Policy

This final chapter provides an insight into the results and conclusions of this study. It summarizes the principal findings and states some policy recommendations based on the outcome of the research. The limitations of the research and a prompt of future considerations were added as well for interest and reference.

5.1. Conclusions

The implementation of new digital tools in procurement has become a global trend, with many governments around the world endorsing such initiatives. Colombia, too, is striving to align its public policies with these evolving patterns. However, achieving this alignment requires extensive research and planning to identify the most suitable e-procurement model that caters to the specific characteristics of Colombia's procurement marketplace.

The introduction of SECOP2 was intended to be a transformative transactional e-platform, not simply an upgrade of its predecessor, SECOP1. Regrettably, SECOP2 has not fulfilled its objective of fostering greater participation from both public and private actors. The slow and ineffective adoption of the new technology is impeding the platform's potential impact, as many procurement-involved actors remain anchored to the familiarity of SECOP1. While a gradual adaptation process is essential for stakeholders to comprehend and utilize the new tools effectively, the Colombian procurement authorities' prolonged transition has hindered this progression.

This study focused its analysis on the parameters outlined in Colombia's law 80 of 1993, which emphasizes principles of increased and improved participation, and the constituent decree of CCE (4170 of 2011), which mandated the creation of SECOP as a platform to enhance private and public entity participation. However, the evidence gathered suggests that the implementation of SECOP2 has not significantly contributed to current participation levels in the procurement landscape, at least not to a greater extent than the former and solely official SECOP1 e-platform.

Furthermore, the examination of contract modalities revealed their significant influence on the behavior of agents participating in public procurement in Colombia. Notably, the direct contract modality stands out for its predictive impact, serving as a potential hindrance to the growth of participation in public procurement.

To address these challenges and promote effective e-procurement practices in Colombia, certain recommendations are essential. First, the Colombian government must expedite the adaptation process for public and private actors to fully grasp and utilize the capabilities of SECOP2. This could be achieved through comprehensive training and guidance programs, ensuring that stakeholders are equipped with the necessary skills to harness the potential of the new platform.

Second, policymakers need to reassess the modalities of contracts to encourage fair competition and broader participation. In the case of the direct contract modality, measures should be devised to mitigate its stagnating effect on the procurement marketplace and explore ways to enhance transparency and accountability.

Furthermore, it is crucial to develop a robust framework for evaluating the impact of e-platforms like SECOP2 on participation rates in public procurement. This could involve setting specific performance metrics and regularly assessing progress to ensure that policies and platforms align with the intended goals.

Moreover, collaboration between government entities, private sector actors, and academic institutions can play a pivotal role in devising tailored e-procurement strategies that suit Colombia's unique market dynamics. By leveraging expertise from diverse stakeholders, policymakers can design more effective policies that drive innovation, competition, and efficiency within the procurement ecosystem.

Lastly, knowledge dissemination and awareness campaigns should be conducted to emphasize the long-term benefits of embracing digital procurement tools. Demonstrating success stories from other countries and showcasing the positive impact of e-platforms on transparency, cost-effectiveness, and overall efficiency can help instill confidence and enthusiasm among potential users.

Colombia's journey towards effective e-procurement practices requires a thoughtful and well-coordinated approach. By addressing the challenges in the adoption of SECOP2,

reconsidering contract modalities, establishing robust evaluation frameworks, fostering collaboration, and raising awareness, the country can pave the way for a more transparent, competitive, and inclusive procurement environment. These efforts will not only benefit public and private entities but also contribute to the nation's economic growth and development on a broader scale.

5.2. Policy Recommendation

In conclusion, the Colombian procurement context is currently faced with significant challenges that hinder the widespread adoption of e-platforms and the realization of a fair and competitive marketplace. Despite its national importance, many companies still view participation in the procurement system as a burdensome and complex process, given the prevalence of contracts tainted by corruption and fraudulent practices. This prevailing mindset fosters a culture of low competition and facilitates collusion and bid rigging, further perpetuating the existing flaws in the system.

To address these issues, it is imperative to prioritize the extensive use of e-platforms and invest efforts in educating stakeholders about the advantages that the latest versions of these platforms offer. Such platforms can substantially facilitate and enhance the reliability of tendering and bidding processes, promoting transparency and efficiency within the procurement system.

Drawing inspiration from successful models like that of Korea, Colombia should develop a structured plan to encourage the participation of Small and Medium-sized Enterprises (SMEs) and interest groups. By implementing various programs that support and benefit SMEs and companies with specific characteristics, such as women-owned businesses, environmentally sustainable projects, and those promoting innovation and resource efficiency, the country can

foster a more inclusive and beneficial procurement practice in line with international standards and expectations.

The significance of contract modalities as a predictor for market participation must not be overlooked. To optimize and simplify the process, it is essential to explore adjustments that amalgamate the best qualities of different modalities. By doing so, the complexities associated with certain modalities can be mitigated, and the system can be protected from exploitation by actors seeking to commit fraud. Such modifications should aim to encourage higher participation among providers, ultimately contributing to the overall growth of the national economy.

In addition to these recommendations, attention must be paid to the quality and availability of information shared through open data resources and the platform SECOP itself. Procurement actors could gain a considerable advantage by accessing and utilizing the available information to strategize effectively and meet the requirements of tenders issued by public agencies. This, in turn, would foster fair competition between larger and smaller providers, leading to better outcomes for the procurement process.

It is worth noting that the database provided by SECOP currently suffers from several errors and inconsistencies, necessitating significant efforts to clear and standardize the information. To adhere to international protocols and ensure the success of these recommendations, it is essential for Colombia to establish clear and formal protocols for data accuracy and consistency.

To sum up, the adoption of e-platforms, the support for SMEs and interest groups, the improvement of contract modalities, and the enhancement of open data resources are crucial steps for transforming the Colombian procurement system. By addressing these issues and implementing the proposed recommendations, Colombia can foster a more competitive, transparent, and efficient procurement marketplace that aligns with international standards and contributes to the nation's overall economic growth and development. It is essential that

policymakers, public agencies, and all stakeholders collaborate to implement these changes and build a robust and fair procurement environment for the benefit of the nation.

5.3. Limitation of the Study and Recommendation for future studies

During the process of data collection and analysis, numerous failures and inconsistencies were uncovered, requiring extensive efforts to clean the data and extract the specific information essential for the analysis. Instances were found where processes that were expected to be unique and identifiable through the ID Process column were duplicated across different entries, hinting at potential manipulation of the system. Such duplications could raise concerns about the impartiality of the system's adjudication process.

Moreover, the formatting of date-related data was found to be non-uniform, posing challenges in standardizing and analyzing the time differences between contract uploads and completions or awards. While the platform boasts automation capabilities, certain contracts displayed varying formats for date information, making it arduous to perform precise time-related measurements during the analysis.

Additionally, data arrangement in the dataset proved inconvenient, particularly for measurements that required accuracy and consistency. Notably, discrepancies in the total values of contracts within the CCE category were observed, where numbers did not align with the assigned contract values on the platform. This made it difficult to work with some items and raised concerns about the reliability of the data.

In the case of SECOP 1 data, a significant inconsistency was discovered regarding the date of contract upload. It was noted that, in many cases, the date on which the contract was signed preceded the date of contract upload to the SECOP platform. Such a discrepancy is

puzzling since contracts should ideally be uploaded and offered to potential providers before being signed, allowing them time to prepare their tenders and compete for the contract.

Addressing these issues proved challenging when attempts were made to bring these concerns to the attention of the agency CCE. The agency's response indicated that the responsibility for the accuracy and quality of information lies with each individual agency, thereby requiring errors to be addressed on an agency-by-agency basis. This decentralized approach may be perceived as inefficient, as there appears to be no single accountable institution overseeing and ensuring the accuracy of the data.

Furthermore, the study's ability to consider the general economic conditions in Colombia was limited due to inconsistencies in the available information, which did not align with the data available for SECOP 1 and SECOP 2. The inclusion of external factors such as the country's GDP or the number of companies capable of supplying the products and services tendered by public agencies could have provided valuable insights into the real effectiveness of the e-procurement platform SECOP 2 in Colombia.

The data-related challenges faced during the research highlight the critical need for accurate and standardized data in order to draw reliable conclusions and make informed policy recommendations. It is crucial for the relevant authorities to address these data inconsistencies and implement measures to ensure the integrity of the information available on procurement platforms like SECOP 1 and SECOP 2. Additionally, a more coordinated approach to managing data quality and accountability among various agencies can significantly improve the reliability of the procurement process and foster greater transparency and efficiency in Colombia's procurement landscape.

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