Breaking Tech Monopolies: The Role of Public Procurement in Fostering SME-Led Innovation in Europe

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Abstract. The growing dominance of large technology companies in Europe's digital markets raises concerns about innovation concentration, limited competition, and reduced technological sovereignty. Public procurement represents a powerful yet underutilized instrument to address these dynamics by enabling smaller firms to compete, innovate, and scale within critical sectors. This study examines how public procurement can strengthen innovation capacity and economic diversity in the European information and communication technology sector. Focusing on the participation of startups and small businesses, we provide large-scale empirical evidence on structural barriers and market concentration in cross-border procurement practices. Our study reveals that public procurement systems often reproduce existing power asymmetries, despite policy ambitions to foster inclusivity and competition. Our findings highlight the significance of procedural complexity, limited outreach, and insufficient institutional capacity as key obstacles to startup participation. Moreover, we show that small and medium sized companies are far from homogeneous, necessitating targeted policy responses rather than uniform support measures. By framing startup inclusion as a systemic condition for innovation and digital sovereignty, the study contributes to ongoing theoretical debates on demand-side innovation policy and strategic governance. It also offers actionable insights for policymakers and procuring agencies aiming to design inclusive, innovation-oriented procurement ecosystems. In doing so, the study advances the academic discourse on public procurement and provides practical insights to support a more competitive and resilient European ecosystem by leveraging public procurement volume.

1. Introduction

The rapid advancements in information and communication technologies (ICT) have spurred intense competition among major technology corporations. This race is characterized by the accumulation of intellectual monopolies through proprietary innovations, patents, and extensive data collection, resulting in the formation of highly concentrated tech oligopolies (Rikap and Lundvall, 2021). These powerful entities wield significant influence over the trajectory of technological development, innovation priorities, and market dynamics, often overshadowing smaller players in the industry.

Public procurement emerges as a crucial mechanism to drive innovation and foster a more balanced technological ecosystem in the European Union, accounting for an estimated 14% of its GDP. By strategically guiding

public procurement, governments can stimulate competition, promote technological diversity, and counteract the dominance of large tech firms. Public procurement programs that prioritize inclusivity and accessibility can provide startups and small and medium-sized enterprises (SMEs) with the resources, visibility, and opportunities needed to develop and deploy cutting-edge technologies (Commission, 2024). This approach, employed by the European Union among others, not only encourages innovation but also ensures that a broader range of stakeholders can contribute to and benefit from advancements in ICT (Commission, 2024).

In this paper, we focus on the role of public procurement in fostering competition and innovation within the European ICT ecosystem. While previous literature on e-procurement has emphasized digitalization and efficiency gains (Gunasekaran and Ngai, 2008; Vaidya et al., 2006), this technocratic lens often neglects the institutional and strategic complexity of public procurement. In the European context, it is deeply embedded in regulatory frameworks and political objectives, including innovation promotion, SME inclusion, and digital sovereignty (Edler and Georghiou, 2007; Edquist and Zabala-Iturriagagoitia, 2012; Uyarra et al., 2014). This paper adopts the latter perspective, situating public procurement as a policy instrument with transformative potential for the European digital ecosystem. Specifically, we analyze the market share of startups and small companies within the European public procurement landscape, examining their participation rates and success metrics (Niehaves et al., 2024).

Our research questions are as follows: What factors influence the access of startups and small to medium-sized enterprises (SMEs) in the ICT sector to public procurement opportunities at the European level? To what extent do the complexity and administrative burden of public procurement procedures impact the participation of startups and SMEs in European tenders?

This study contributes to the ongoing discourse on strategic public procurement by providing large-scale, empirical insights into how European market structures influence SME and startup participation (Lukkien et al., 2023; Niehaves et al., 2024). While prior research has examined general barriers to SME access, it often focuses on national case studies, lacks cross-sector comparability, or fails to differentiate between startups, micro-, small-, and medium-sized enterprises. By addressing these gaps, the study highlights how procurement design and administrative complexity shape competitive dynamics and outlines opportunities to foster a more dynamic and diversified procurement landscape—supporting the EU's broader goals of innovation, competitiveness, and digital autonomy.

The findings of our study underscore the importance of fostering transparency and accessibility in public procurement processes. Ensuring that smaller companies have equal opportunities to compete for contracts requires addressing structural barriers such as complex application procedures, lack of awareness, and limited organizational capacity. Our analysis reveals significant heterogeneity within the SME category, particularly between startups, microenterprises, and more established small and medium-sized firms, which has important implications for procurement design. One-size-fits-all approaches are insufficient; instead, differentiated and targeted measures are needed to address the specific constraints of distinct SME subgroups. Our research supports and extends the findings of Klassen et al. Klassen et al., 2024 by demonstrating that procurement systems can act as a counterweight to emerging tech oligopolies when designed to empower smaller actors. By conceptualizing SME inclusion as a structural feature of innovation systems, our work contributes to a more nuanced understanding of procurement as a policy instrument. Policymakers should consider targeted interventions, such as procedural simplification, tailored outreach, or quota-based incentives, to strengthen participation and promote inclusive innovation.

2. Theoretical Background and Relevant Work

Public procurement research gains relevance and traction, as scholars and policymakers recognize its potential to foster innovation and support the participation of small and medium-sized enterprises (SMEs)(Commission, 2024). It is important to distinguish between e-procurement and public procurement as two conceptually and practically distinct research strands. While e-procurement focuses on the digitization of procurement processes and the resulting administrative efficiencies (Gunasekaran and Ngai, 2008; Neupane et al., 2012), public procurement research is mainly concerned with the strategic governance of purchasing decisions to achieve broader societal goals (Edler and Georghiou, 2007; Edquist and Zabala-Iturriagagoitia, 2012). These include fostering innovation, addressing market failures, and enhancing digital sovereignty. In this regard, challenges specific to public procurement include complex stakeholder coordination, legal constraints, and multidimensional trade-offs between cost-efficiency, innovation, and inclusivity (Uyarra et al., 2014). A considerable body of work has emerged, focusing on understanding how recent procurement policies and practices can create opportunities for these firms, especially in local and regional markets (Grandia and Meehan, 2017). However, there remains a significant gap in the literature regarding the broader European public procurement landscape, where SMEs are still disadvantaged by aggregation of demand despite accounting for the

majority of European economy. Answering this gap we explore the market share of startups and SMEs in European procurement. In doing so, this paper considers the increasing reliance on big tech companies, a trend that poses potential risks to the EU's critical infrastructure and underscores the need for diversified and inclusive procurement practices to support a coherent and sovereign European innovation ecosystem (Bharosa, 2022; Roberts et al., 2021; Vardanyan and Kocharyan, 2023). Developing a robust understanding of public procurement market dynamics and the impact of procurement frameworks is essential for policymakers and practitioners to meet the strategic goals of public procurement.

2.1. Public Procurement Promoting Innovation

Research on public procurement as a driver of innovation dates back to the 1970s. Early empirical studies explored the relationship between procurement and innovation, concluding that public procurement has a more significant long-term impact on innovation than research and development (R&D) subsidies (Mowery and Rosenberg, 1979; Rothwell, 1984; Geroski, 1990). Their findings highlighted the potential of public procurement to stimulate demand-driven innovation. Despite these early insights, (Edquist and Hommen, 2000) argue that the promotion of innovation through public procurement has even declined in Europe during the 1990s due to the emergence of more stringent competition regulations. These regulations, while aimed at ensuring fairness and efficiency, have inadvertently limited the capacity of public procurement to serve as a catalyst for innovation (Edler and Georghiou, 2007).

More recently, however, the publication of numerous articles on public procurement promoting innovation (PPPI) reflects a renewed and heightened interest in the topic (Georghiou et al., 2014, Amann and Essig, 2015,Chicot and Matt, 2018, Wesseling and Edquist, 2018). Scholars have advocated for a more strategic use of public procurement as a tool to foster demand-driven innovation, emphasizing its potential to mobilize innovation on a large scale. Leveraging the extensive European public procurement landscape and its significant volume has been proposed as a way to stimulate innovation while simultaneously delivering improved services to citizens (Edler and Georghiou, 2007).

These arguments have influenced policy developments, culminating in the inclusion of strategic procurement goals in initiatives such as EU Directive 2014/24/EU or the Interoperable Europe Act (Commission, 2024). This directive explicitly articulates the strategic use of public procurement to promote innovation, marking a significant step toward embedding innovation objectives into procurement practices across Europe (Harland et al., 2021). Despite this progress, significant challenges remain. Amann and Essig, 2015 highlight time consumption and procedural complexity as major obstacles to the successful implementation of PPPI practices in the public sector. Additionally, their findings, aligned with those of Nyiri et al., 2007, reveal that modern public procurement often incorporates multiple objectives, such as cost savings, environmental sustainability, and social responsibility. These diverse goals are not always easily reconciled, as they frequently entail trade-offs. For example, prioritizing cost efficiency may conflict with the higher costs associated with procuring innovative products and services. Uyarra et al., 2014 conducted a supply-side survey identifying that lack of demand for innovation and lack of interaction with the procuring organisations are due to reduced contract sizes in pursuit of minimising transaction costs.

The type of procurement procedure employed plays a critical role in shaping innovative outcomes and SME access. According to Soliño and de Santos, 2010, the negotiated procedure is particularly conducive to innovation, as it facilitates a more detailed formulation and discussion of specifications and requirements. However, this approach entails higher time and resource expenditures compared to an open procurement process. The findings of Soliño and de Santos, 2010 are consistent with those of Uyarra et al., 2014, further supporting the notion that procurement design significantly influences innovation potential and multiple objectives may result in strategic dilemmas. This growing body of research underscores the need for a more strategic and nuanced approach to public procurement, one that balances competing objectives while leveraging its potential as a driver of innovation.

2.2. Roles of Startups in Innovation

Startups gain an increasing role as drivers of technological innovation (Bharosa, 2022; Niehaves et al., 2024). Innovation is understood here not only as technological novelty, but as the ability to generate, apply, and scale contextually relevant solutions that create systemic value across public and private sectors. This broad understanding aligns with Isenberg's concept of entrepreneurial ecosystems, where startups serve as dynamic agents of change embedded in interdependent networks of institutions, markets, and policy frameworks (Isenberg, 2010). In this view, fostering startup participation in public procurement contributes to innovation not merely by introducing new products, but by reshaping the structure of the innovation system itself.

This is particularly evident in the information technology field and public sector, where startups develop solutions that not only address specific market needs but also spur organizational digital transformation (Lukkien et al., 2023). By offering tools and platforms, startups empower public organizations to modernize their operations and enhance service delivery for their clients (Bauer, 2025). In the public sector, these innovations can lead to significant improvements in how public administrations interact with citizens and manage public resources (Bharosa and Janowski, 2024; Niehaves et al., 2024). However, the remaining and increasing dominance of BigTech companies (Jácome de Moura et al., 2024) introduces significant challenges for fostering innovation ecosystems, especially in Europe (Lukkien et al., 2023). In the context of this study, we define "Big Tech companies" as large multinational technology firms that exert disproportionate influence over digital infrastructure, data ecosystems, and innovation agendas, often through control of platforms, standards, and intellectual property rights. Their market power is reinforced by economies of scale, network effects, and high entry barriers for smaller actors (Rikap and Lundvall, 2021; Gleiss et al., 2023). This dependency exacerbates concerns regarding Europe's digital sovereignty, as reliance on non-European providers can expose vulnerabilities in terms of data control, security, and strategic autonomy (Rikap et al., 2024). Addressing such issues requires a response that aligns innovation policy with the principles of sovereignty and competitiveness, as becoming visible through the European Commissions endeavors like the AI and Interoperable Europe Act (Commission, 2024; Commission, 2022).

In the context of the European single market, public procurement holds the potential to bridge gaps for startups, enabling them to overcome barriers to entry and scale (Niehaves et al., 2024). However, these mechanisms are not without limitations. Market barriers, including cross-border challenges and preferential procurement practices, restrict the effective deployment of innovative solutions (Niehaves et al., 2024). By addressing market barriers and promoting a more inclusive approach to procurement, policymakers could significantly enhance the innovation landscape (Nose, 2023; Edquist and Zabala-Iturriagagoitia, 2012).

The participation of SMEs and startups in public procurement is not only a matter of economic inclusion but also of systemic innovation capacity. Building on the concept of National Innovation Systems (Lundvall, 1992), these firms act as vital carriers of knowledge diversity, experimentation, and adaptive innovation. Unlike large incumbents, startups often deliver context-specific, non-standardized solutions that challenge established technological trajectories and governance models. However, this lack of standardization introduces complexities for public buyers, who are often required to conform to strict procedural rules, risk-averse contracting standards, and interoperability constraints. As a result, the very heterogeneity that makes startups valuable for dynamic innovation ecosystems can conflict with procurement regimes optimized for stability and scale. Addressing this tension requires procurement frameworks that accommodate exploratory and learning-oriented interactions between public buyers and smaller, innovative suppliers (Uyarra et al., 2014).

2.3. SME Participation in Public Procurement

SME participation in the European procurement landscape has long been a focal point of interest. The European Commission has consistently addressed challenges and opportunities related to SMEs in public procurement, as reflected in numerous initiatives and policy documents (Commission, 1990; Commission, 2022; Commission, 2024). Recognizing the critical role of SMEs in driving innovation and economic growth, these efforts have sought to create a more inclusive and accessible procurement environment.

The barriers that impede SMEs from fully participating in the European procurement market were systematically examined by a recent study of the OECD, 2018. Their report on practices and strategies for shared benefits of SMEs in public procurement identified structural and procedural obstacles, such as complex administrative requirements, high tendering costs, and a preference for larger contracts, which collectively hinder SMEs' ability to compete effectively. These findings underline the persistent challenges that remain despite policy interventions aimed at enhancing SME access. To address these challenges, the European Commission introduced Directive 2014/24/EU, explicitly targeting SME inclusion in the procurement process. Among its key measures was the encouragement to divide contracts into smaller, more accessible lots, thereby reducing contract sizes to increase SME participation and improve their success rates. While this approach initially appeared promising, empirical studies have presented mixed results regarding its effectiveness (Glas and Eßig, 2018; Hoekman and Taş, 2022). Simply dividing tender contracts into smaller lots is insufficient to transform the European public procurement market into an innovative ecosystem Timmermans and Zabala-Iturriagagoitia, 2013. Successfully fostering startup and SME access while promoting innovation, requires a strategic and holistic approach (Timmermans and Zabala-Iturriagagoitia, 2013).

A related critique comes from Flynn et al., 2015, who examined disparities in tendering capabilities among SMEs, which are often mistakenly perceived as a homogeneous group. He highlighted that the current "one-size-fits-all" policy approaches fail to account for the vast differences between e.g. micro-enterprises and

medium-sized companies, all of which are collectively categorized under the term SMEs. By attempting to address the needs of such diverse entities simultaneously, these policies introduce additional complexity into procurement processes, frustrating public buyers and thereby further limiting the intended benefits for SMEs. Beyond the discussion on tender lot sizes, Directive 2014/24/EU also addressed procurement aggregation strategies in Articles 37 to 39. Aggregation techniques such as central purchasing bodies, framework agreements, and electronic catalogs were promoted as tools to enhance efficiency and achieve economic and administrative benefits. However, many researchers, including Sanchez Graells and Herrera Anchustegui, 2014 and Albano et al., 2010, have raised concerns about the potential negative consequences of these strategies. They caution that aggregated and centralized demand may lead to market concentration, suppressing SMEs and, over time, fostering oligopolistic competition that could undermine innovation and market diversity. Oligopolistic dependencies not only undermine the intended economic benefits of aggregation strategies but can also have adverse effects on digital sovereignty in areas such as critical infrastructure within Europe. Initial empirical evidence supporting these concerns has been found in the national Spanish procurement market (Arosa et al., 2025).

Building on these insights, this paper aims to investigate the factors influencing startup and SME access to public procurement at the European level, with a focus on the ICT sector. By addressing this gap, the study seeks to offer valuable insights into the challenges and opportunities for public authorities and decision-makers leveraging PPPI and promoting SME participation in the increasingly centralized and competitive procurement market. Additionally, the paper provides a robust methodology for utilizing the open government data platform, Tenders Electronic Daily (TED).

3. Data and Methodology

An exploratory quantitative methodology was adopted for this study to effectively answer the research question. The choice of this method aligns with the characteristics of the European procurement landscape, where a substantial volume of contract and award notices is published daily. The identification of data sources was grounded in a thorough review of the literature.

3.1. Data Sources

Building on the identified data sources from the literature review, the database for our analysis was compiled from three major sources: the procurement platform Tenders Electronic Daily (TED) 'European Union', n.d. firm-level data from the commercial database Orbis Moodyś, n.d. and the UN Treasury, which provided historical exchange rates 'United Nations', n.d.

TED is the official EU portal for high-value public procurement and mandated under Directives 2014/24/EU and 2014/25/EU. Its legal authority and accessibility make it highly suitable for analyzing procurement patterns relevant to EU innovation and digital sovereignty goals. In addition, TED offers rich metadata including procedure types, contract values, and buyer identities, enabling detailed structural analysis across sectors.

Firm-level data was sourced from Orbis due to its harmonized classification of SMEs and startups across countries, based on standardized financial and operational thresholds. Alternative sources such as national registers lack this consistency. Orbis also enables historical tracking and reliable firm identification via e.g. standardized company IDs, supporting clean integration with TED data.

This multi-source approach ensures policy relevance, analytical depth, and robust cross-country comparability for studying SME and startup participation in European ICT procurement.

3.2. Data acquisition

Building on the data sources introduced earlier, the process of data acquisition and preparation focused on collecting TED, Orbis, and UN Treasury data to construct a comprehensive and analyzable database. TED data served as the foundational source, providing detailed public procurement notices. Specific attention was given to extracting the winner field from the TED JSON documents, which included identifiers for successful bidders. These identifiers were mapped to individual countries using three-letter ISO country codes. However, a subset of entries with non-standard codes (e.g., "1A0") could not be mapped and was excluded from the analysis. To enable firm-level classification and enhance the granularity of the dataset, Orbis data played a pivotal role.
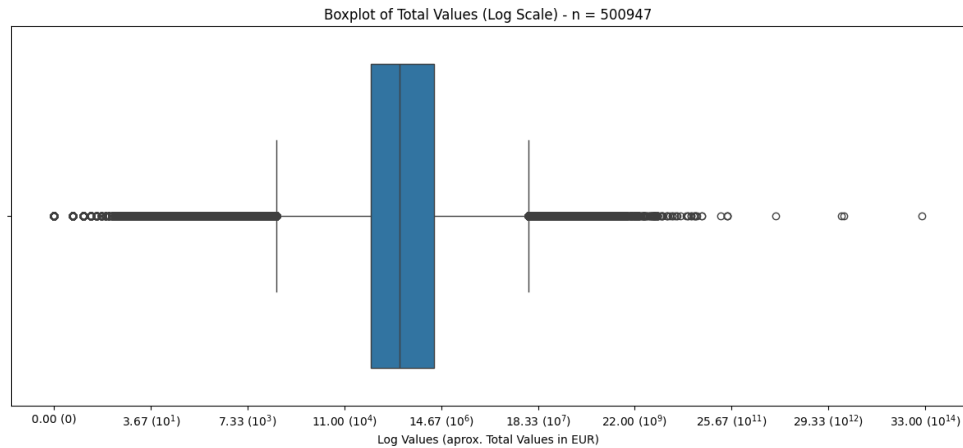
Fig. 1 – Boxplot of Total Values per Tender (Log Scale).

Orbis provided essential corporate information, which was crucial for categorizing entities, such as startups and SMEs, based on their size, operational scope and date of incorporation. Since country-specific identifier formats, such as VAT numbers, tax numbers, and commercial register entries, varied significantly, a systematic multi-step matching process was implemented. Identifiers were first queried within the most likely category for each country, and unmatched entries were subsequently searched in alternative categories. While this approach maximized the match rate, countries with insufficient Orbis coverage or unmappable identifiers were excluded from the final analysis.

The integration of TED and Orbis data required a robust storage and processing infrastructure. While TED data was initially stored in MongoDB for flexibility during processing, key fields were imported into a PostgreSQL relational database. PostgreSQL's capability to query JSON and array structures allowed for seamless integration of TED and Orbis data. Additionally, the database adhered to the first normal form by normalizing company identifiers into a separate table, ensuring efficient and atomic storage of values.

The fully integrated database enabled efficient querying and analysis through SQL operations, joins, and aggregations. By aligning tender data, company classifications derived from Orbis, and financial metrics, the study was equipped to investigate tender outcomes, market shares and influencing dynamics of public procurement across the European Union and various branches of industry.

3.3. Data Exploration and Preprocessing

After collecting the data, we conducted an initial analysis of the distribution across various variables. Our primary focus was on the tender value, as this variable is often strongly correlated with the size of the winning company, as discussed in Section 2.3. During this exploration, we identified significant anomalies in the total value variable, such as a large proportion of contract values equaling 0, as well as tender lots valued at 1 billion euros, published by, e.g. a local Austrian municipality. These anomalies suggested an extreme value distribution, prompting us to apply a log transformation to improve the data's interpretability and mitigate the influence of outliers. A boxplot was created to visualize the adjusted data and identify outliers (see Fig. 1). The interquartile range (IQR) was calculated to determine the boundaries for typical values, with the lower whisker extending to €4,544.04 and the upper whisker to €63,379,652 in the transformed dataset. Values falling below or exceeding these thresholds were classified as outliers.

3.4. Dataset

The initial dataset retrieved for this study comprised 1.7 million contract and award notices from the open government data platform TED, of which 939,165 unique contracts were identified. These unique records serve as the foundation for the subsequent analysis, providing a reliable and well-structured dataset for investigating public procurement dynamics across the European Union. Building on the data exploration and preprocessing steps outlined in the previous section, table 1 provides a detailed summary of the refined database. This overview highlights the key outcomes of the cleaning process and outlines the structure of the dataset as utilized in the following analyses.

TED Dataset	
Retrieved notices	1,642,250
Unique notices	939,165
Unique notices with CPV-Code classification	771,016
Unique notices with winner information	259,487
Retrieved winners	496,445
Unique winners	209,464
Unique notices with information on tender value (> 0)	491,073
Unique notices with information on tender value (> 4,544. < 63,379,652)	461,043
Unique notices with defined buyer country	858,822
Unique notices with defined winner country	259,487

Tab. 1 – Summary of the TED Dataset Used for Our Analysis

To address our research question, we employed a classification system to identify startups and SMEs within the dataset, leveraging the firm-level data provided by the Orbis database. Startups were defined as small companies with no branches and a founding date after January 1, 2015. This definition allowed us to identify 18,191 winner companies in our combined dataset that met these criteria.

The Orbis database categorizes companies by size based on financial and operational metrics. Very large companies (VL) are those that meet at least one of the following thresholds: operating revenue of ≥ 100 million EUR, total assets of ≥ 200 million EUR, a workforce of ≥ 1,000 employees, or listing on a stock exchange, provided their revenue or asset-per-employee ratios are not disproportionately low. Additionally, companies with unknown financial metrics but capital exceeding 5 million EUR are also classified as very large. Large companies (L), on the other hand, meet at least one of these criteria: operating revenue of ≥ 10 million EUR, total assets of ≥ 20 million EUR, or a workforce of ≥ 150 employees, while also maintaining reasonable revenue or asset-per-employee ratios. Companies with unknown revenue, assets, or employee counts but capital between 500,000 EUR and 5 million EUR fall into this category.

Medium-sized companies (M) are identified as those that meet at least one of the following conditions: operating revenue of ≥ 1 million EUR, total assets of ≥ 2 million EUR, or a workforce of ≥ 15 employees, but do not qualify as large or very large companies. All companies that fail to meet the criteria for these categories are classified as small companies (S).

This classification system was crucial in systematically identifying startups and SMEs within the dataset, ensuring alignment with the study's objectives.

4. Results

In order to address our research question, we conducted an extensive analysis of our database, focusing on variables that influence market dynamics, with particular emphasis on the access of SMEs and startups in the ICT sector. We aim to uncover key factors that shape the competitive landscape and provide insights into the challenges and opportunities faced by smaller firms within public procurement processes. Relevant variables considered in this analysis include sectoral distribution, measured through the European Common Procurement Vocabulary (CPV codes), and European procurement procedure types. Additionally, the procedure types provided valuable context regarding how procurement practices influence participation and success of SMEs. By analyzing these variables, we gain a deeper understanding of the barriers that startups and SMEs face in accessing the European public procurement market for ICT.

4.1. SME Access in European Public Procurement for ICT

We focused on CPV codes we assume to be relevant to ICT industries, selecting the following divisions: 48: 'Software packages and information systems'; 72: 'IT services: consulting, software development, Internet, and support'; 30: 'Office machinery, equipment, and supplies'; 32: 'Radio, television, and communication equipment'; 50: 'Repair and maintenance services'. Filtering tenders by these CPV-Divisions yielded 24,277 unique tenders and 34,287 tender lots. These lots were awarded to 15,346 distinct companies, categorized based on Orbis classifications. For a complete display of the distribution see Table 2. The sum of tenders is higher than 24,277 as multiple companies can participate in a tender.

	Unique Companies	Lots Won	Tenders Participated in
Small Companies	3,465	5,744	4,638
Medium Companies	5,954	11,695	9,246
Large Companies	3,331	10,461	8,647
Very Large Companies	1,497	6,387	5,529

Tab. 2 – Distribution of Companies in Public Procurement for ICT

Figure 2 illustrates the values presented in 2 and makes the comparison between the distribution of company sizes in the ICT procurement landscape and their success rates. Small companies are disproportionately disadvantaged, with their share of lots won (16.75%) being significantly below their respective presence (24.32%) in the ICT procurement market. In contrast, large and very large companies outperform expectations. Large companies, representing 23.38% of the landscape, secure 30.51% of the lots. Very large companies exhibit the most pronounced overperformance, winning 18.63% of the lots while constituting just 10.51% of companies engaging in ICT tenders.
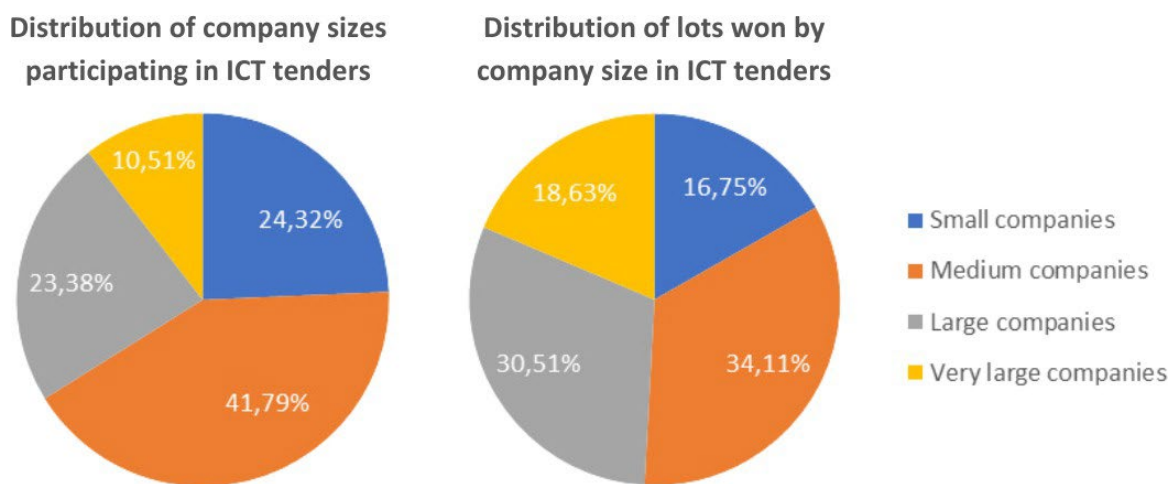
Fig. 2 – Distribution of Company Sizes in Public Procurement for ICT.

Based on our initial observations, we analyzed the values per tender lot to gain deeper insights into the patterns and the accessibility of of the ICT procurement landscape in respect to company sizes. A descriptive summary of all results can be found in Table 3. We analyzed all tenders in our database, as well as ICT-specific tenders, to gain insights into the unique characteristics of the ICT sector. We conducted our analysis both unfiltered (contract value > 0) and filtered, using the predefined value range introduced in Section 3.4 to exclude abnormal outliers. It is important to note that contract values may appear multiple times in this analysis. When multiple companies are listed as winners, the corresponding contract value is attributed to each company, as the quality of the data extracted from TED did not allow for proportional allocation.

Small companies win only 16.2% of ICT tender lots and 17.2% of the total procurement value, far lower than their share in overall public procurement, where they account for 37.5% of lots and 38.9% of value. On the other hand, medium-sized companies perform relatively well in ICT procurement, capturing 32.6% of ICT tender lots and 31.1% of the total value, much higher than their share in the general public procurement sector, where they only account for 5.9% of lots and 5.8% of contract value. The contrast between small and medium companies in ICT is striking — medium-sized companies have nearly double the share of ICT procurement in both lots and value, which is the opposite of the general public procurement sector, where small companies have a higher share. This suggests that procurement practices and market characteristics of the ICT sector, with its demand for specialized skills and larger project scopes, tend to favor medium-sized companies over small ones.

Additionally, filtering the data reveals that outliers significantly distort the unfiltered data, particularly in the general procurement sector, where the presence of large, extreme values inflates the overall figures. Filtering

Company classification	Avg value	Total value	Tender count
Small	5,382,428.71	504,660,807,387.35	93,751
Medium	6,303,362.00	921,866,693,037.66	146,250
Large	8,408,545.19	104,428,452,369.87	124,193
Very large	11,067,923.32	988,343,416,295.43	89,298
Small (filtered)	2,472,323.29	213,505,671,951.45	86,358
Medium (filtered)	2,365,978.21	32,060,049,531.27	13,540
Large (filtered)	2,775,745.37	321,475,725,687.79	115,816
Very large (filtered)	3,370,755.36	27,689,069,468.58	82,145
Small companies in ICT	5,432,224.01	54,313,175,671.39	9,998
Medium sized companies in ICT	3,208,348.39	63,775,549,325.60	19,878
Large companies in ICT	6,994,184.93	128,315,316,733.52	18,346
Very large companies in ICT	15,928,020.16	171,783,679,466.77	10,785
Small companies in ICT (filtered)	2,230,218.78	20,397,580,921.04	9,146
Medium sized companies in ICT (filtered)	1,996,922.82	36,879,170,666.26	18,468
Large companies in ICT (filtered)	2,493,002.64	43,190,001,643.78	17,292
Very large companies in ICT (filtered)	3,654,161.85	35,434,407,496.17	9,697

Tab. 3 – Count and Tender Value per Company classification

out extreme outliers significantly reduces the total procurement sums in both sectors. However, the effect is more pronounced in the general sector. Once these outliers are removed, the values in the ICT sector remain consistently higher, emphasizing the unique characteristics and importance of ICT procurement in Europe.

4.2. Procurement procedures

As highlighted in Section 2.1, procedure types are considered to exert a direct influence on SME access in public procurement (Soliño and de Santos, 2010) Procurement procedures not only determine the accessibility of tenders for different company sizes but also influence the alignment of procurement goals, ranging from cost efficiency to fostering innovation. Drawn from our extensive literature review, we sought to examine the different types of procurement procedures within the subset of ICT procurement data (CPV Divisions 48, 72, 30, 32, and 50). Our analysis identified a total of 24,277 unique tenders within this subset, offering a comprehensive view of the distribution of procedure types and the participation of various company sizes. A summary of this distribution can be found in Table 4, highlighting the dominance of Open Procedures (71.91%), followed by negotiated procedures without call (10.49%) and restricted procurement tenders (8.25%).

Procedure Type	Count Tenders	Small Companies	Medium Companies	Large Companies	Very Large Companies
Open	1,745,8	3,554	6,821	6,124	3,925
Negotiated without Call	2,546	308	749	845	698
Restricted	2,004	396	868	743	378
Negotiated with Call	1,207	169	438	455	312
Other Single	900	184	311	409	164
Not Defined	54	13	28	28	18
Competitive Dialogue	48	7	17	15	16
Other Multiple	33	5	8	15	8
Competitive Tendering	27	2	6	13	10

Tab. 4 – Procurement Procedures and SME Access in Public Procurement for ICT

As anticipated, small companies are most frequently represented in Open Procedures. In contrast, small companies are notably underrepresented in more complex, resource-demanding processes such as Negotiated Procedures and Competitive Dialogue. Medium-sized companies, on the other hand, exhibit a more balanced distribution across various procedure types. They are particularly well-represented in Negotiated Procedures without call and Restricted Procedures. Large and very large companies, with their substantial resources, predominantly participate in Negotiated and Restricted Procedures. Very large companies, in particular, tend to dominate procedures like Competitive Dialogue and Negotiated Procedures with Call, which are typically used for high-value, resource-intensive projects. While their involvement in Open Procedures is relatively limited, both large and very large firms maintain a presence.

Building on the previous analysis of participation patterns across different procurement procedures, we now extend our focus to the contract values and earnings within these procedure types. This offers a more complete understanding of how market access and procedural complexity affect not only the number of tenders small, medium, large, and very large companies participate in, but also the financial returns they achieve. By analyzing the distribution of total contract values within these procedures and the average contract values won by each company classification, we provide insights into how different procurement procedures impact the financial performance of companies of varying sizes and can provide further insights on factors influencing SME access in ICT procurement.

For small companies, despite their significant participation in Open Procedures — comprising 93% of their engagement in tender lots — they win only a modest share of the total contract value. In fact, their total contract value in Open Procedures amounts to approximately €13.67 billion, with an average contract value of €4.18 million, as shown in Table 6. In procedures like Negotiated with Call for Tenders, small companies capture only a small proportion of the total contract value, with an average contract value of approximately €5.93 million in this category. In contrast, medium-sized companies exhibit a more balanced participation profile across various procedures. They are notably active in Open, Negotiated without Call, and Restricted Procedures, with a significant share of their tenders being awarded through Restricted Procedures (25%) and Negotiated Procedures without Call (30%). As shown in Table 7, the average contract value for medium-sized companies in Open Procedures is approximately €1.62 million. However, their presence in more complex tenders, such as Restricted and Negotiated Procedures, allows them to secure larger contracts, with average values reaching €2.64 million in Restricted Procedures and €3.78 million in Negotiated Procedures with Call. As a result, medium-sized companies capture a more substantial share of the total value. In fact, medium-sized companies account for approximately 42.1% (Restricted) and 20.4% (Negotiated with Call), overperforming in respect to their market presence.

Large companies dominate the Negotiated and Restricted Procedures, where high-value contracts are often awarded. As illustrated in Table 8, in Restricted Procedures, the average contract value for large companies is approximately €3.85 million, while in Negotiated Procedures with Call, it rises to over €6.91 million. These firms are particularly well-suited to handle large-scale and complex IT projects, and as a result, they consistently capture a significant share of the total contract value.Large companies win 50.6% of the total value procured via Restriced procedure and 56.3% of competitive tender procedures.

Very large companies are the primary participants in the most complex and high-value tenders, such as Competitive Dialogue and Negotiated Procedures with Call. As seen in Table 9, the average contract value for very large companies in Negotiated Procedures with Call exceeds €17.48 million, while in Competitive Dialogue, the average contract value is even higher, at €34.57 million. As a result, very large companies capture the lion's share of total contract values, accounting for approximately €62,520 billion and 48.7% of the total procurement value in the overall ICT sector.

5. Discussion

Our analysis of European public procurement in the ICT sector highlights a distinct advantage for large and very large firms in securing tenders. While medium-sized companies form the majority of participants, their share of lots won is lower than expected. Small companies, in particular, are disproportionately disadvantaged, capturing significantly fewer tender lots and lower total contract values relative to their overall presence.

These findings align with prior literature emphasizing the barriers SMEs face in public procurement, including resource limitations, stringent procedural requirements, and economies of scale favoring larger firms (Soliño and de Santos, 2010). The procurement landscape for ICT reflects these structural challenges, with larger firms leveraging their financial and technical capacity to secure high-value contracts. Small firms, by contrast, are more reliant on Open Procedures, which offer lower entry barriers but tend to result in smaller contract values.

The contrast between small and medium-sized enterprises (SMEs) is particularly notable. While small companies struggle with access, medium-sized firms perform relatively well in ICT procurement compared to general public procurement. This suggests that ICT procurement favors firms with a moderate level of specialization and resources, a finding that supports the argument that a "one-size-fits-all" SME policy approach may not be suitable (Soliño and de Santos, 2010). Instead, differentiated policies are needed to support smaller firms without undermining the competitiveness of medium enterprises.

The impact of procurement procedures on firm participation further reinforces these observations. Small companies are most active in Open Procedures, whereas larger firms dominate more complex processes such as Negotiated and Competitive Dialogue tenders. These procedures often involve resource-intensive require-

ments, making them less accessible to smaller firms. Medium-sized enterprises demonstrate a balanced distribution across procedure types, suggesting that they have the capacity to navigate moderately complex procurement processes. These results emphasize the need to differentiate procurement procedures not only by legal form but also by their de facto complexity and resource demands. Smaller firms often lack the legal expertise, internal capacity, or financial flexibility to engage with complex procedures such as restricted or negotiated tenders. This indicates that administrative burden acts as a structural barrier, reinforcing asymmetries in participation and limiting the intended strategic effect of public procurement; a central concern addressed in our second research question.

Moreover, filtering out extreme contract values (outliers) significantly alters the observed distribution in general procurement. However, in the ICT sector, even after applying our filter, large firms continue to hold a dominant share of awarded contracts. This indicates that ICT tenders, by nature, involve high-value contracts that favor companies with substantial financial and operational capacity. The limited impact of filtering on the ICT sector suggests strong data quality and highlights the sector's economic and societal relevance.

From a theoretical perspective, this study contributes to the growing literature on public procurement as an instrument of innovation policy by offering large-scale empirical evidence on structural asymmetries in startup and SME access. Building on and extending previous work by Edler and Georghiou (2007) and Uyarra et al. (2014), it highlights how procurement design, rather than being neutral, actively shapes competitive dynamics in digital markets. By conceptualizing startup participation as a systemic innovation function, our analysis aligns with the National Innovation Systems framework Lundvall, 1992, illustrating how the inclusion or exclusion of smaller actors affects the adaptive capacity of public sector innovation. Furthermore, the integration of procurement, firm-level, and financial data offers a replicable methodological approach for studying innovation ecosystems from a structural perspective. In sum, the study advances theoretical understanding of how procurement processes interact with broader institutional and market structures.

6. Limitations and Further Research

This study analyzed 14 months of European procurement data, providing valuable insights into the state of public procurement datasets as well as startup and SME participation in the European public procurement landsace. The relatively short timeframe covered may limit the ability to generalize the results. Longer-term studies will be necessary to confirm whether the observed trends and patterns in procurement practices and participation are stable over time. The use of exploratory data analysis (EDA) and descriptive statistics, while effective for uncovering patterns, also introduced certain limitations. These include the potential for subjectivity, scalability challenges when handling larger datasets, and the possibility of overfitting or selectively highlighting patterns. The study did not employ more advanced statistical techniques, such as regression analysis or machine learning, due to the poor quality of the underlying data. This restriction limited the ability to explore deeper correlations or causations. Future research should address these limitations by extending the analysis period and employing advanced methodologies to derive more nuanced and robust insights.

In Europe, initiatives such as GovTech Connect and GovTech Lab have been established to tackle the challenges addressed in this paper and explore potential solutions (PUBLIC. et al., n.d. 'Innovation Agency Lithuania', n.d.). However, no significant impact on improving access for startups and SMEs has been observed thus far. Further investigation is required to assess whether these initiatives can effectively enhance long-term participation and lower existing barriers in public procurement.

As data quality continues to improve, the application of advanced statistical techniques could uncover critical trends, inefficiencies, and causal relationships. This, in turn, would enhance the reliability of procurement data, supporting data-driven policymaking and enabling more targeted, evidence-based interventions. By leveraging these insights, policymakers can optimize the allocation of public procurement funds, ensuring that well-defined and informed strategies maximize the economic impact of European procurement initiatives.

7. Conclusions

Our study underscores the structural challenges small firms face in European ICT public procurement. While medium-sized firms perform relatively well, small companies remain underrepresented in awarded tenders and contract values. Larger firms, particularly very large ones, dominate high-value contracts and complex procedures, reinforcing existing market advantages and dependencies.

These findings suggest that policy interventions should be tailored to address the specific challenges of small firms while ensuring a competitive environment for medium-sized enterprises. Reforms in procurement processes, such as lowering barriers in complex procedures or providing targeted support mechanisms, could

enhance SME participation without compromising efficiency and competition and thereby leveraging procurement volume for strategic objectives like an innovative European ecosystem and digital autonomy.

Acknowledgement

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Appendix A

Procedure Type	Count	Total Contract Value (€)	Average Contract Value (€)
Competitive Dialogue	43	1,486,523,770.82	34,570,320.25
Competitive Tendering	25	62,927,801.36	2,517,112.05
Negotiated with Call for Tenders	832	5,625,854,590.79	6,761,844.46
Negotiated without Call for Tenders	2,161	5,499,865,404.65	2,545,055.72
Open Procedure	16,139	51,872,502,336.93	3,214,108.83
Other Multiple Criteria	23	324,529,932.18	14,109,997.05
Other Single Criteria	899	520,697,904.54	579,196.78
Restricted Procedure	1,797	4,868,040,008.73	2,708,981.64
Undefined	36	131,362,405.14	3,648,955.70

Tab. 5 – Contract Value Distribution for All Tenders in ICT CPV Divisions

Procedure Type	Count	Total Contract Value (€)	Average Contract Value (€)
Competitive Dialogue	7	1,168,918,730.88	166,988,390.13
Competitive Tendering	2	4,582,231.80	2,291,115.90
Negotiated with Call for Tenders	108	640,350,225.68	5,929,168.76
Negotiated without Call for Tenders	268	414,451,337.87	1,546,460.22
Open Procedure	3,269	13,669,217,379.58	4,181,467.54
Other Multiple Criteria	5	12,649,841.47	2,529,968.29
Other Single Criteria	183	136,316,550.96	744,899.19
Restricted Procedure	371	603,243,056.16	1,625,992.07
Undefined	2	10,293,805.78	5,146,902.89

Tab. 6 – Contract Value Distribution for Small Companies

Procedure Type	Count	Total Contract Value (€)	Average Contract Value (€)
Competitive Dialogue	13	61,724,884.48	4,748,068.04
Competitive Tendering	5	7,497,671.15	1,499,534.23
Negotiated with Call for Tenders	304	1,147,851,037.74	3,775,825.78
Negotiated without Call for Tenders	620	959,754,964.45	1,547,991.88
Open Procedure	6,266	10,140,826,689.81	1,618,389.19
Other Multiple Criteria	4	2,225,457.36	556,364.34
Other Single Criteria	311	101,872,882.65	327,565.54
Restricted Procedure	776	2,050,869,906.89	2,642,873.59
Undefined	12	64,171,698.08	5,347,641.51

Tab. 7 – Contract Value Distribution for Medium-Sized Companies

Procedure Type	Count	Total Contract Value (€)	Average Contract Value (€)
Competitive Dialogue	14	83,902,274.06	5,993,019.58
Competitive Tendering	12	35,378,754.01	2,948,229.50
Negotiated with Call for Tenders	350	2,420,550,563.86	6,915,858.75
Negotiated without Call for Tenders	761	1,831,238,233.93	2,406,357.73
Open Procedure	5,776	24,586,145,412.01	4,256,604.12
Other Multiple Criteria	9	172,993,397.94	19,221,488.66
Other Single Criteria	409	199,938,129.50	488,846.28
Restricted Procedure	640	2,462,100,278.66	3,847,031.69
Undefined	18	41,076,130.25	2,282,007.24

Tab. 8 – Contract Value Distribution for Large Companies

Procedure Type	Count	Total Contract Value (€)	Average Contract Value (€)
Competitive Dialogue	16	215,097,924.66	13,443,620.29
Competitive Tendering	9	21,137,015.36	2,348,557.26
Negotiated with Call for Tenders	208	3,635,625,184.17	17,478,967.23
Negotiated without Call for Tenders	564	2,323,112,631.88	4,118,994.03
Open Procedure	3,598	28,877,588,629.31	8,026,011.29
Other Multiple Criteria	8	288,661,235.40	36,082,654.43
Other Single Criteria	164	203,678,925.60	1,241,944.67
Restricted Procedure	347	2,218,329,180.21	6,392,879.48
Undefined	5	22,307,885.00	4,461,577.00

Tab. 9 – Contract Value Distribution for Very Large Companies