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Master of Science Thesis

KPI-Oriented Process Control for Public Infrastructure: a Data-Governance Case Study at SCR Piemonte

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Abstract

This thesis explores the application of Business Intelligence (BI) tools and performance measurement systems to the management of public infrastructure processes, with a specific focus on the Expropriation Office of Società di Committenza Regionale Piemonte S.p.A. (SCR Piemonte). The research originates from the growing need for public organizations to improve transparency, efficiency, and accountability through data-driven decision-making.

The study begins by reviewing the theoretical foundations of performance measurement and Key Performance Indicators (KPI), highlighting their role in monitoring, controlling, and improving organizational processes. A particular emphasis is placed on the relationship between KPI, data governance, and Business Intelligence, and on how these elements collectively support the strategic and operational management of public sector organizations. The Balanced Scorecard (BSC) framework is also introduced as a structured approach to aligning operational metrics with strategic objectives.

From a methodological perspective, the thesis details the construction of a relational database designed to consolidate heterogeneous sources of information, followed by the implementation of a data pipeline to ensure integration, cleaning, and transformation of data. On this basis, a Power BI dashboard was developed to monitor the activity of the Expropriation Office. The dashboard highlights key performance areas through a set of carefully selected KPI, offering transparency, traceability, and improved internal communication.

The results show how the use of BI tools and KPI-driven governance provides tangible benefits, including faster access to information, enhanced process monitoring, and greater alignment between operational activities and strategic objectives. Furthermore, the research identifies limitations of the current model and proposes possible improvements, such as the integration of advanced analytics, automated alerts, and AI-driven predictive functionalities.

The contribution of this work lies in demonstrating how an engineering-based approach to performance management can bring added value to the public sector, traditionally less advanced in adopting digitalization practices. By providing both a technical and methodological framework, the thesis offers practical insights for SCR Piemonte and potential applications for other public entities facing similar challenges.

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1. Introduction

1.1. General Context

SCR Piemonte S.p.A. (Società di Committenza della Regione Piemonte) is a joint-stock company entirely owned by the Piedmont Region. It was established in 2007 under Regional Law No. 19 of August 6, 2007, with the aim of increasing the efficiency of public spending and optimizing procurement procedures in key sectors such as infrastructure, transport, telecommunications, and healthcare.

Figure 1: SCR Piemonte Logo

As a strategic partner of the regional administration, SCR contributes to the economic, financial, and social development of the Piedmont system. It promotes innovation to improve processes and services across its areas of responsibility, while ensuring high quality standards and operational excellence.

The company also supports sustainable development by adhering to regulations concerning environmental protection, energy efficiency, and workplace safety.
SCR Piemonte operates in close collaboration with a wide network of local stakeholders, including:

- Municipalities, public companies, educational and university institutions, and local housing agencies;
- Public law bodies established or participated in by the Region of Piedmont, as well as their consortia and associations;
- Regional health authorities and healthcare organizations.

In its institutional role, SCR Piemonte S.p.A. performs multiple functions:

- Central Purchasing Body: it assists regional entities in managing public tenders for goods, services, and works, by conducting both centralized and individual tenders. The company promotes aggregation strategies and the use of efficient, transparent procedures. It also provides consultancy, technical support, and digital infrastructure to facilitate the awarding of contracts.
- Aggregating Entity: since 2015, SCR has been listed in the National Anti-Corruption Authority (ANAC) register of Aggregating Entities. It carries out aggregated procurement procedures for specific product categories and financial thresholds, as defined by the Prime Ministerial Decree of July 11, 2018, thereby contributing to cost optimization and procedural streamlining.
- Contracting Authority: it develops and manages integrated projects in the fields of infrastructure, transportation, road systems, and healthcare construction.

- Single Contracting Authority: in accordance with the Prime Ministerial Decree of June 30, 2011, SCR manages tender procedures on behalf of individual entities for activities and financial thresholds not falling under its Aggregating Entity function.
- In-House Providing Company: SCR also manages projects and activities directly entrusted to it by the Piedmont Region. These tasks fall outside the scope of its role as a central purchasing body but remain consistent with its corporate purpose.

Based on the organizational chart of SCR Piemonte S.p.A. dated 25/07/2023, the company's structure is designed to ensure effective governance, operational efficiency, and strategic alignment with regional objectives. Below is a detailed overview:

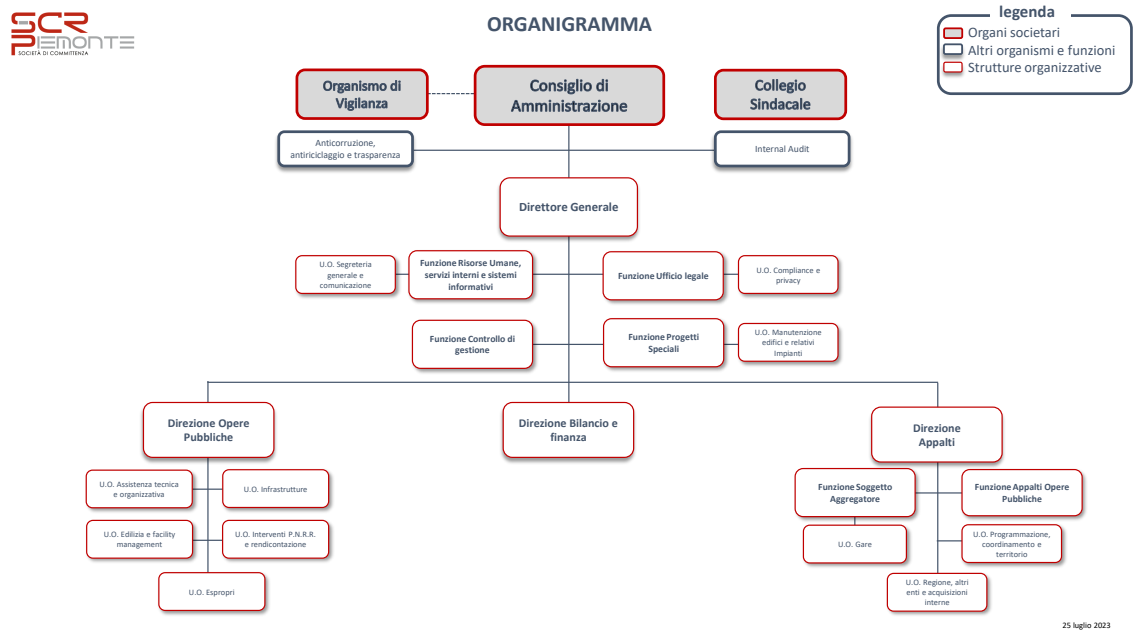


Figure 2: SCR Piemonte Organizational Chart

Corporate Governance Bodies:

- Board of Directors (Consiglio di Amministrazione): responsible for strategic decisions and overall management.
- Board of Statutory Auditors (Collegio Sindacale): oversees financial reporting and compliance.
- Supervisory Body (Organismo di Vigilanza): ensures adherence to the organizational, management, and control model as per Legislative Decree 231/2001.
- Internal Audit and Compliance Functions: focus on anti-corruption, anti-money laundering, and transparency.

Executive Management:

- General Manager (Direttore Generale): oversees daily operations and coordinates various departments.

Main Departments and Functions:

- Public Works Department (Direzione Opere Pubbliche): manages infrastructure projects, including:
  - Infrastructure Unit (U.O. Infrastrutture): handles large-scale infrastructure initiatives.
  - Building and Facility Management Unit (U.O. Edilizia e Facility Management): oversees building projects and facility operations.
  - PNRR Interventions and Reporting Unit (U.O. Interventi P.N.R.R. e Rendicontazione): coordinates projects funded by the National Recovery and Resilience Plan.
  - Expropriation Unit (U.O. Espropri): manages expropriation procedures necessary for public projects.
  - Technical and Organizational Assistance Unit (U.O. Assistenza Tecnica e Organizzativa): provides technical and organizational support across departments.
- Procurement Department (Direzione Appalti): handles procurement processes, including:
  - Public Works Procurement Function (Funzione Appalti Opere Pubbliche): manages procurement for public works.
  - Aggregator Function (Funzione Soggetto Aggregatore): coordinates aggregated procurement initiatives.
  - Programming, Coordination, and Territory Unit (U.O. Programmazione, Coordinamento e Territorio): plans and coordinates procurement activities across territories.
  - Tenders Unit (U.O. Gare): manages tendering processes.
  - Region, Other Entities, and Internal Acquisitions Unit (U.O. Regione, Altri Enti e Acquisizioni Interne): handles procurement for regional entities and internal needs.
- Finance and Budget Department (Direzione Bilancio e Finanza): oversees financial planning and budgeting.
- Management Control Function (Funzione Controllo di Gestione): monitors performance metrics and supports decision-making.
- Special Projects Function (Funzione Progetti Speciali): manages unique or strategic projects.
  - Building Maintenance and Systems Unit (U.O. Manutenzione Edifici e Relativi Impianti): ensures maintenance of buildings and related systems.
  - Compliance and Privacy Unit (U.O. Compliance e Privacy): ensures adherence to compliance and privacy regulations.

- Human Resources, Internal Services, and IT Systems Function (Funzione Risorse Umane, Servizi Interni e Sistemi Informativi): manages HR, internal services, and IT infrastructure.
  - General Secretariat and Communication Unit (U.O. Segreteria Generale e Comunicazione): handles administrative support and communication strategies.
- Legal Office Function (Funzione Ufficio Legale): provides legal support and ensures compliance.
  - Compliance and Privacy Unit (U.O. Compliance e Privacy): ensures adherence to compliance and privacy regulations.

This organizational structure enables SCR Piemonte S.p.A. to effectively manage complex public procurement and infrastructure projects, ensuring alignment with regional development goals and compliance with regulatory standards.

The Management Control Office (Ufficio Controllo di Gestione) collaborates with all departments to define objectives, monitor indicators, and assess project execution in relation to cost, time, and quality constraints. It plays a crucial role in promoting a culture of performance measurement and decision-making based on Data within the company.

Given the legal, administrative, and technical complexity of each procedure, and their social impact, the need for accurate, timely, and transparent data management increased. Until a few years ago, the operational management of procedures was primarily based on Excel spreadsheets maintained independently by individual operators. While this approach offered some degree of flexibility and immediacy, it lacked the structural robustness, traceability, and integration necessary to support institutional transparency, workload management, and strategic evaluation.

In response to these limitations, SCR has initiated a process of digital transformation, introducing relational databases developed in SQL and integrated through Microsoft Access, which has become the centralized system for collecting, organizing, and querying all data. This system allows for the creation of standardized reports, dynamic queries, and user-specific views based on the needs of different stakeholders, from field technicians to managers and institutional auditors.

Building on this data infrastructure, SCR has also launched a progressive integration of Business Intelligence (BI) tools, particularly Microsoft Power BI, which allows for the transformation of raw procedural data into interactive dashboards and visual performance reports.

These BI solutions are not limited to static reporting, they enable dynamic, multi-dimensional analysis of key indicators, such as the number of procedures managed per project or per operator, average lead times for each procedural phase, frequency of disputes, and workloads distributed across the team. The dashboards can be filtered by time period, geographic location, project type, or procedural status, thus supporting multi-level analysis by both operational and executive users.

This digital evolution acts as a fundamental change in the company's approach to performance management. Whereas previously decisions were often reactive and based on manually compiled summaries, the availability of real-time, accurate, and granular data now enables a proactive and evidence-based management style.

In this context, the introduction of Quality Engineering (QE) principles plays a strategic role. Unlike traditional quality control methods that focus on final outcomes, Quality Engineering emphasizes the design and continuous improvement of processes through the use of data, statistics, and systematic feedback mechanisms.

In SCR Piemonte, QE methodologies are being applied through the definition and monitoring of Key Performance Indicators (KPIs); these metrics are continuously monitored through Power BI dashboards and used in periodic performance reviews, both at the team, organizational and corporate levels.

The goal is to create a virtuous cycle of continuous improvement, in which data influence decision-making, decisions lead to targeted actions, and actions are evaluated through measurable outcomes. This feedback loop is the essence of the synergy between relational database systems, Business Intelligence platforms, and Quality Engineering principles. It not only supports the compliance with institutional objectives but also supports a corporate culture based on transparency, accountability, and innovation, essential values for a modern public company committed to executing strategic infrastructure projects in a manner that ensures long-term sustainability and public trust.

1.2. Research Motivation

Before the introduction of a structured information system, the Expropriation Office at SCR Piemonte managed its activities using large Excel files created internally. These spreadsheets contained important information about expropriation procedures, such as timelines, legal references, land registry data, involved personnel, technical and legal steps, and the amounts to be paid. Data was entered manually, row by row, by the office staff. Although the file looked organized on the surface, it lacked a proper relational structure, and there were no automated checks on the data being entered.

At first, Excel was useful because it was easy to use, even for people with limited IT skills. However, as the number of procedures increased and operations became more complex, several difficulties began to appear. The system became harder to manage, slower to update, and more vulnerable to inconsistencies and mistakes.

One of the main problems was the high chance of making errors. There were no automated controls like required fields, drop-down menus, or alerts, so it was easy to type-in incorrect names, forget important dates, or duplicate entries. Even small errors could lead to larger issues, such as delays, communication errors, or mistakes in reports. Over time, this reduced the reliability of the entire dataset. Moreover, since the information was not connected, the same data had to be re-entered in multiple sheets, which made everything more time-consuming and increased the chance of inconsistencies.

Another critical issue was scalability and adaptability. Every time the office faced new regulatory requirements or needed to introduce a new process, the Excel file had to be manually updated, often by adding new columns or creating additional sheets. This not only made the file more complicated but also harder to maintain and understand over time. Each operator had their own method of entering and interpreting data, without a shared standard or structure. As a result, collaboration became inefficient, especially when new staff joined the team and had to learn everything from scratch.

The limitations of Excel also affected Data Analysis, Performance Indicators, Project Tracking, and Reporting. All had to be done manually: copying and pasting data into new files, setting up formulas, building pivot tables, and generating charts. These activities were repetitive, required time and technical skills, and were prone to human error. The graphs and statistics were static and did not allow for interactive exploration of the data, limiting the ability to gain meaningful insights or quickly spot trends and issues.

A very serious problem was the lack of traceability. Files were saved locally on personal computers or shared via e-mail or shared drives, without any version control or record of changes. If data was modified or deleted, there was no way to know who made the change, when it happened, or why. This created a major risk for a public organization like SCR Piemonte, which must always be able to retrace every step of its procedures, especially in case of audits, complaints, or legal investigations. Without a reliable history of the work done, the entire process was exposed to operational and reputational risks.

In addition to these technical and operational problems, there were also strategic motivations behind the research. The Expropriation Office needed a system that would support:

- the clear tracking of each procedure from start to finish, ensuring that every step, decision, and document is properly recorded, accessible, and auditable;
- the assignment of responsibilities to specific staff members or external collaborators, making it easier to identify roles, monitor tasks, and promote accountability;
- the integration of all relevant data into one shared platform, which could be used by the entire organization for coordination, oversight, and continuous improvement.

All these difficulties clearly showed the need for a more solid, organized, and secure system. A system not only capable of automating data entry and management but also of improving the quality of work, the clarity of processes, and the transparency of actions. It was not just about managing more data, but about managing it better.

This research was born from that need: to analyze the limits of the previous system and propose an innovative solution based on modern tools like relational databases and interactive dashboards, capable of supporting both the daily operations and the strategic goals of the organization.

The goal is not just to move the work from Excel to a digital tool, but to rethink the daily operations of the Expropriation Office in a more structured and efficient way, that promotes transparency, efficiency, control, and quality. In the context of the public sector,

these elements are not just desirable, they are essential for building trust, ensuring compliance, and delivering value to the community.

1.3. Research Objectives

This thesis aims to design and implement a Data Management and Analysis system to improve the operational and strategic monitoring of Expropriation Procedures managed by Expropriation Office in SCR Piemonte. The work is developed with the intention of enhancing the quality of available information, supporting internal decision-making processes, enabling clearer and more effective communication both within the organization and toward external stakeholders, but even to give importance to the work of Expropriation Office.

To achieve these goals, the project is articulated around three main technical and methodological objectives:

- Development of a Relational SQL Database: the starting point of the project was the need to overcome the limitations of spreadsheet-based data management. For this reason, a structured relational database was designed using SQL Server. The database stores all the relevant information on expropriation procedures in a normalized format. This architecture enables consistent data entry, easier updates, and the ability to perform complex queries, which would be inefficient or impossible using traditional Excel files.
- Integration of Microsoft Access for Data Visualization and Reporting: to ensure accessibility and usability of the data for users who are less familiar with SQL tools, Microsoft Access was adopted as an intermediary layer between the database and the user. Through Access, customized queries and views have been created, allowing the team to analyze each procedure both in summary form and in detail. In addition, the use of predefined masks and reports simplifies the generation of standardized documents, thus supporting daily operations and improving internal efficiency.
- Creation of an Interactive Dashboard through Power BI: finally, Power BI was employed to design and implement dynamic dashboards aimed at monitoring key performance indicators (KPIs) related to expropriation activities. This dashboard could be useful first of all to give relevance to the work of Expropriation Office, emphasizing their positive aspects for different purposes depending on the stakeholder involved, they can be: Responsible of Procedure, Board of Directors, External Stakeholders, etc.

Through this integrated approach, the project not only improves the accuracy and accessibility of procedural data but also promotes a culture of transparency, accountability, and data-driven decision-making within SCR Piemonte. The tools and methods implemented give a base for the foundation of a method based on continuous improvement, and it could be further expanded to support other departments and strategic initiatives in the future.

2. State of the Art

2.1. The Importance of Data Management in Modern Organizations

In today's fast and competitive world, Data Governance plays a very important role. Thanks to digital technologies, organizations now have the ability to collect and manage huge amounts of data that come from many different sources, both inside and outside the organization. But having a lot of data also brings challenges. To really benefit from this data, avoiding risks and reducing costs, companies need to manage it in a structured and strategic way; this structured approach is called Data Governance.

Figure 3: Data Icons

Data governance is the set of rules, processes, roles, and tools that help an organization to manage its data in the best way. It consists in the following aspects:

- Data Cataloging: it is the process through which an organization creates and maintains a structured inventory of all its available data assets.
  The main goal is to make data easily discoverable and understandable by both technical and non-technical users. A data catalog includes descriptions, metadata, data owners, update frequencies, and business meanings associated with each dataset. This helps reduce data duplication, improves efficiency, and supports reusability of information across departments. It also plays a crucial role in establishing a shared understanding of data throughout the company, making it easier to trust and use the available information in a consistent way.

- Data Classification: it involves in the assigning of specific labels or categories to data, based on its sensitivity, value, and intended use.
  This process helps organizations protect sensitive or confidential data by defining how it should be accessed, handled, and stored. For instance, public data can be openly shared, while restricted or confidential data may require very precise and strict access controls. Classification is also important for regulatory compliance, as it ensures that data subject to legal constraints is properly managed. It allows the organization to prioritize resources and security efforts based on the criticality of different data categories.

- Auditing Data Entitlements and Access: it means continuously monitoring and reviewing who has access to what data, why they have it, and whether those permissions are still justified.
  This process helps ensure that access rights are granted based on actual business needs and are kept up to date. For example, when an employee changes roles or leaves the company, their access rights should be adjusted accordingly. Regular audits reduce the risk of data breaches or misuse by limiting access to only those who genuinely need it. They also support traceability and accountability, which are essential in governance and compliance scenarios.

- Data Discovery: it is the activity of identifying, exploring, and understanding the data that exists across the organization.
  It involves using tools and techniques that scan systems, databases, and applications to uncover data sources that may be underused or unknown. Through discovery, companies can gain full visibility of their data assets and understand relationships between datasets. This supports better data integration, facilitates informed decision-making, and prevents the creation of redundant data. Data discovery also helps in building a more complete and accurate data catalog, which is essential for strategic planning and operational excellence.

- Data Sharing and Collaboration: it refers to the structured way in which data is made available to different users, teams, or even external stakeholders.
  Good governance ensures that data sharing happens in a secure and controlled way, following predefined rules about who can access and distribute information. This enables departments to work together more effectively, using consistent and trustworthy data as a common foundation. Collaborative data environments encourage innovation, reduce silos, and improve organizational agility. At the same time, they require clear policies to prevent misuse or unauthorized access to sensitive data.

- Data Lineage: it is the detailed tracking of how data moves and transforms throughout its lifecycle, from its source to its final use.
  It shows where data originates, which systems or processes have modified it, and where it ends up, such as in dashboards, reports, or data warehouses. Understanding data lineage is critical for identifying the root causes of errors, validating the accuracy of analyses, and ensuring regulatory compliance. It also helps users build trust in the data by providing transparency into how information has been processed and whether it can be considered reliable for decision-making.

- Data Security: it refers to the set of measures, both technical and organizational, aimed at protecting data from unauthorized access, corruption, loss, or theft.
  This includes mechanisms such as authentication, access control, and intrusion detection systems. Strong data security practices ensure that information remains confidential, intact, and available to authorized users. In the context of governance, data security is essential not only for protecting business assets but also for complying with privacy laws and industry regulations. It helps build trust with customers, partners, and employees by demonstrating that data is handled responsibly and securely.

- Data Quality: it encompasses the accuracy, completeness, consistency, and timeliness of data.
  High-quality data is essential for reliable decision-making and efficient business operations. Poor data quality can lead to misunderstandings, flawed analyses, and ultimately, bad decisions that affect performance or compliance. Ensuring data quality involves continuous monitoring, validation, and correction processes to detect and fix errors. It also includes defining quality standards, responsibilities, and metrics so that all stakeholders are aligned on what "good data" means for the organization. In a governance context, data quality is a foundational element that supports trust, efficiency, and long-term value creation.

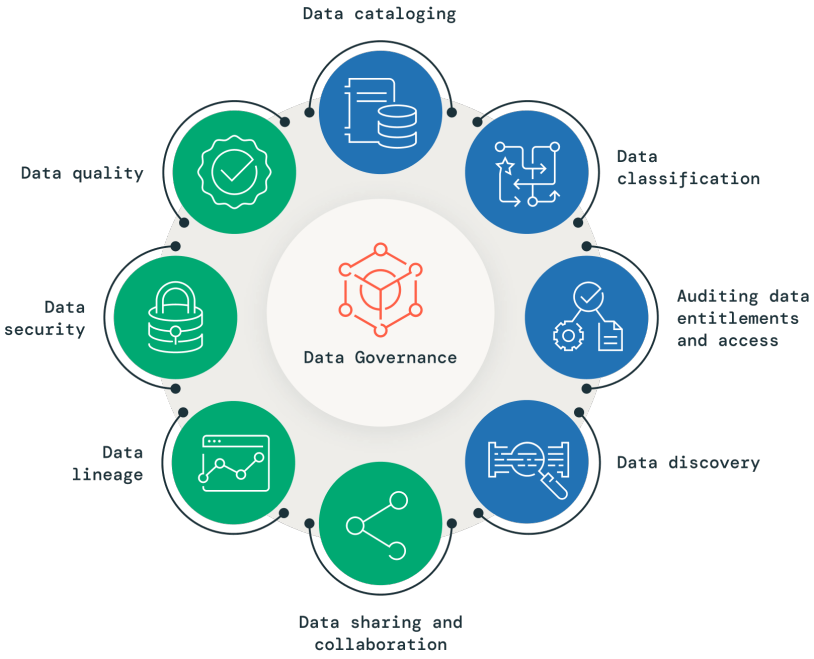


Figure 4: Data Governance

A good Data Governance strategy is a valuable asset for companies, especially when working with large and complex data. It helps to create a clear and shared system across the organization. In this way, the company can become more efficient, make better decisions, avoid mistakes, and follow laws and regulations. The goals of governance, depend on the business priorities, such as protecting privacy, meeting legal requirements, or combining information from different systems. These goals help the definition of the structure of the governance model in each organization.

Good governance requires that people at all levels of the company, Strategic, Operational, and Technical, know their roles and responsibilities. Everyone who works with data must understand what they can and cannot do, and these responsibilities must be written down and shared. Data governance is not just about technology, it also includes how the organization works, how laws apply, and how people interact with data.

It's also important to understand what Data Governance is not; sometimes people confuse it with other areas like Data Management or Master Data Management (MDM):

- Data Management includes all activities in the life of data, from its creation to its deletion. Data Governance is a part of this process, but its job is to set the rules and provide direction. It helps manage things like data quality, security, metadata, databases, and storage.

- Master Data Management (MDM) is a more specific activity. It focuses on organizing and keeping consistent the core business data that is shared across departments, like customers, products, suppliers, or employees. MDM depends on Data Governance. For example, governance defines what a "customer" or "product" means, sets the rules for how that data is changed or used, and assigns people who are responsible for it.

Table 1: Levels of detail in Data Management

Data Management	It includes all the activities incurred during the life of data, from its creation to its deletion.
Data Governance	It is a part of Data Management, since its goal is to set the rules and provide the direction for data quality, security, storage, etc.
Master Data Management	It is a more specific activity which strongly depends on Data Governance, the aim is the organization and consistency of data across different departments.

Another related concept is Data Stewardship: while governance focuses on making the rules and organizing responsibilities, stewardship is about applying those rules every day. Data Stewards are the people who take care of data quality, making sure it stays accurate and reliable according to the rules. In simple terms, stewardship is the practical side of governance.

A well-done Data Governance plan brings many advantages, such as:

- Shared understanding of data: all departments in the company can use the same terms and definitions, which makes communication easier and avoids confusion.
- Better data quality: processes are in place to check, clean, and update the data so it stays accurate and useful.
- Easier to find and understand data: with proper governance, the organization knows where its data is, what it means, and how it should be used. This is like having a GPS that helps the company navigate its information.
- Respect for laws and rules: governance helps companies follow important regulations like the GDPR (for personal data), HIPAA (for healthcare), or PCI DSS (for payment systems), because it keeps the data under control and well documented.
- Bringing back the human element: in a world full of automation and digital systems, governance reminds us that people still matter. It helps define ethical principles, codes of conduct, and good practices, considering legal and cultural aspects too.

As technology evolves, many companies are moving their data systems to the cloud. This offers benefits like flexibility and scalability, but also creates new challenges, which include questions about who owns the data, where it is stored, and how safe it is when managed by external cloud providers.

In this situation, governance becomes even more important. A strong governance plan is needed from the start of the cloud migration. It must ensure that data remains protected, easy to understand, and well managed according to internal policies and international regulations. Security and access controls in the cloud must also be handled with special care, because they are different from traditional systems.

To put data governance into practice, companies need the right tools. These tools should be flexible, work well with current systems, and possibly be cloud-based or open source.

The tools must be able to:

- Automatically find and analyze data, including sensitive data;
- Improve data quality by cleaning and enriching it;
- Manage how data moves through the system using metadata and ETL (Extract, Transform, Load) processes;
- Monitor data usage to check for problems or risks;
- Add useful information (metadata) to make the data easier to find and use;
- Give tools to employees like data stewards so they can manage data by themselves when needed.

So, Data Governance is not something optional, it is a necessary part of a modern organization. It helps companies make better use of their data in a safe, consistent, and organized way. Only by applying a clear and structured governance strategy data can become a reliable and powerful resource, available to all parts of the business, while also respecting laws and supporting the organization's goals.

2.2. Relational Databases and Corporate Data Governance

In the modern digital era, where information constitutes one of the most strategic assets of any organization, relational databases emerge as a foundational technology for the effective management, structuring, and governance of data.

Born from the theoretical model developed by Edgar F. Codd in 1970, the relational database paradigm remained important during the time due to its logical elegance, robustness, and ability to represent real-world data relationships in a consistent, flexible, and scalable way.

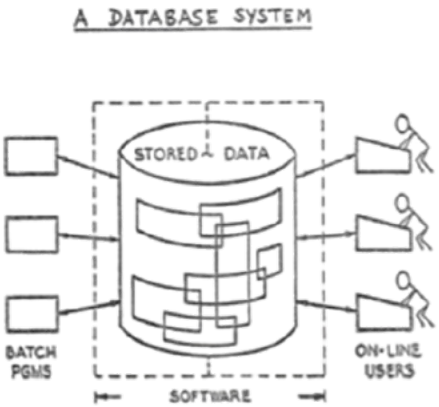


Figure 5: Edgar F. Codd's Relational Model introduced in 1970

A Relational Database is fundamentally a structured collection of data organized into tables, referred to as "relations", composed of rows (records or tuples) and columns (fields or attributes), in which each table is designed to represent an entity or concept from the domain of interest, such as customers, employees, invoices, or, in the context of public administration, procedures, parcels, and beneficiaries. The relational model is built upon a set of formal principles that enable the representation of complex interdependencies through a simple yet powerful structure.

One of the most distinctive features of relational databases is the ability to define relationships between tables using primary keys (unique identifiers for each record) and foreign keys (references to primary keys in other tables), enabling referential integrity and data cohesion across the entire system. This relational logic allows organizations to avoid redundancy, preserve data accuracy, and simplify updates, as a change in one record is automatically reflected in all contexts where it is referenced. Additionally, relational databases support data normalization, a formal process that decomposes large, complex tables into smaller, more manageable ones in order to eliminate redundancy, dependency anomalies, and update inconsistencies. Normalization progresses through a series of "normal forms," each of which ensures a higher degree of structural rigor and semantic clarity.

From a theoretical and practical perspective, relational databases offer a wide range of advantages that make them the preferred choice for structured data management.

First and foremost, they ensure data integrity, meaning that the stored information is accurate, complete, and consistent across time and operations. This is achieved through the enforcement of constraints such as: `NOT NULL`, `UNIQUE`, `CHECK`, and foreign key constraints, which prevent the insertion of invalid or duplicate data.

Secondly, relational databases support concurrent multi-user access while preserving transactional safety, thanks to the ACID properties (Atomicity, Consistency, Isolation, Durability), which ensure that database operations are performed reliably even in the

presence of errors, crashes, or simultaneous access. These features are particularly valuable in business-critical systems where dozens or hundreds of users may be reading and writing data in real time.

Another central aspect of relational databases is the use of Structured Query Language (SQL), the standard declarative language for defining, querying, updating, and managing data. SQL enables users to interact with the database through high-level commands that abstract away the complexity of data retrieval, allowing for the efficient execution of operations such as data filtering (`SELECT`), insertion (`INSERT`), modification (`UPDATE`), deletion (`DELETE`), and aggregation (`GROUP BY`, `COUNT`, `SUM`, etc.).

More advanced features of SQL include subqueries, joins, views, stored procedures, triggers, and indexing, which collectively enable automation, optimization, and customization of data workflows. The power of SQL lies in its ability to articulate highly complex data logic in relatively simple and human-readable statements, making it accessible to both technical and non-technical users.

The evolution of relational databases from Codd's foundational model reflects a trajectory of continuous innovation driven by the needs of scalability, performance, and integration. In the 1980s, the first commercial RDBMS products emerged, such as Oracle, IBM DB2, and Ingres, implementing Codd's ideas into production-ready software. During this period, the ANSI SQL standard was formalized, providing a common syntax that allowed developers to write portable queries across different platforms.

The 1990s marked the era of client-server architectures, in which relational databases were increasingly deployed on networked systems, enabling centralized data management with decentralized access. Products like Microsoft SQL Server and MySQL began to dominate the market by offering user-friendly interfaces and seamless integration with business applications. The emergence of graphical tools, procedural extensions (e.g., PL/SQL and T-SQL), and database administration features helped solidify relational databases as the backbone of enterprise information systems.

Figure 6: Microsoft SQL Server

The early 2000s introduced new challenges with the rise of the web, mobile devices, and big data. Although relational databases remained essential, their limitations in handling unstructured or semi-structured data, as well as horizontal scalability, led to the development of alternative models such as NoSQL and NewSQL.

NoSQL databases, like MongoDB and Cassandra, focused on flexibility, schema-less design, and high throughput, while NewSQL systems sought to retain the ACID guarantees of relational models while improving scalability and performance.

Despite the proliferation of alternative paradigms, relational databases adapted through advancements such as distributed architectures, in-memory processing (e.g., SAP HANA), and hybrid cloud deployments. Today's RDBMS platforms, such as PostgreSQL, Oracle 21c, and Azure SQL Database, offer features like JSON support, full-text search, columnar storage, AI integration, and real-time analytics, extending their applicability well beyond their original transactional scope.

In the broader context of Corporate Data Governance, relational databases serve as the technological foundation upon which organizations can build reliable, secure, and auditable data ecosystems. Data governance refers to the strategic framework that defines how data is collected, managed, protected, and used across an enterprise. It encompasses principles of data ownership, data quality, security, compliance, and accountability. Within this framework, relational databases contribute by offering centralized control, standardized structure, and traceable operations, all of which are essential for maintaining data trustworthiness and ensuring regulatory compliance (e.g., GDPR, SOX, HIPAA).

One of the greatest strengths of relational databases in data governance is their support for Role-Based Access Control (RBAC) and granular permissions, which allow organizations to restrict who can view or manipulate specific data elements. This ensures that sensitive information, such as financial records, personal identifiers, or strategic indicators, can only be accessed by authorized personnel. Furthermore, relational systems maintain detailed transaction logs and audit trails, which are indispensable in environments where transparency, traceability, and accountability are legal or organizational imperatives, such as in public institutions, financial services, and healthcare.

Relational databases also facilitate interoperability and data integration, enabling different departments or systems within an organization to share and reuse information without duplication or inconsistency. By adhering to shared schemas and data dictionaries, organizations can establish a single source of truth that supports decision-making, performance monitoring, and strategic planning. Moreover, the structured nature of relational data makes it highly compatible with Business Intelligence (BI) tools and reporting platforms, which can connect to relational databases to generate real-time dashboards, KPIs, and analytics that inform executives and operational teams.

These theoretical principles and capabilities find a concrete and valuable application within SCR Piemonte S.p.A., particularly through the efforts of the Management Control Office, which acts as a strategic intermediary between data sources and decision-making functions.

Within the current project context, a relational database has been designed and implemented to support the Expropriation Office, with the goal of organizing, tracking, and analyzing the vast set of activities associated with the expropriation procedures managed by SCR. The nature of these procedures, complex, heterogeneous, and spread across long timeframes, requires a system that can guarantee traceability, structural coherence, and data consistency.

The use of SQL has enabled the Management Control Office to Extract, Transform, and Load (ETL) data from the corporate systems, normalize and clean the datasets, and define logical relationships between entities such as expropriation procedures, cadastral parcels, administrative steps, project categories, and timelines.

Through the application of the relational model and the expressive power of SQL, the data have been organized into a robust, scalable structure that now feeds advanced Power BI dashboards, offering the Expropriation Office an unprecedented level of visibility into their own operations. Metrics are calculated and visualized in real time, enabling proactive monitoring and more informed strategic planning. This structured approach not only improves internal efficiency but also strengthens SCR's ability to respond to external stakeholders, regional governments, municipalities, and citizens with transparency and accountability.

Furthermore, the relational approach supports data governance objectives within SCR by making explicit the data lineage, validation rules, and user roles associated with each dataset. Data ownership and control mechanisms are embedded in the database architecture, ensuring that sensitive information is accessible only to designated roles, in line with internal policies and external regulatory frameworks. In this way, the relational database not only becomes an instrument of data organization but also a governance enabler, aligning technological infrastructure with organizational values such as efficiency, integrity, and public service.

So, relational databases represent not only a technical solution for storing and retrieving data but also a strategic enabler for effective data governance. Their logical rigor, structural clarity, and operational reliability make them ideally suited to support the institutional needs of organizations that aim to manage data as a critical asset. By aligning database design with governance principles, such as data quality, integrity, security, and compliance, organizations like SCR Piemonte S.p.A. can ensure that their information systems are not only functional but also, sustainable, and capable of supporting long-term digital transformation goals, especially in the service of complex and socially impactful functions like those carried out by the Ufficio Espropri.

2.3. Business Intelligence Tools for Performance Monitoring

Business Intelligence (BI) refers to the set of technologies, processes, and practices used to collect, integrate, analyze, and present business data. The purpose of BI is to support more informed decision-making at all organizational levels, turning raw data into actionable insights.

While the concept of using data to guide decisions is ancient, the formalization of BI as a discipline dates back to the 1950s and 1960s, when early computing systems were employed by corporations to generate reports from structured datasets. However, these systems were rigid, centralized, and reserved for specialized personnel.

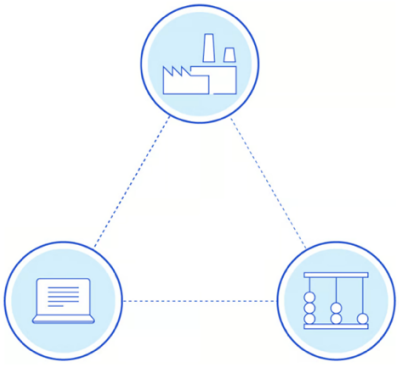


Figure 7: Business Intelligence gets a Boost from Computers

The term "Business Intelligence" was popularized by Howard Dresner in 1989, a Gartner analyst, who defined it as "a set of concepts and methods to improve business decision making by using fact-based support systems." During the 1990s and early 2000s, BI began to evolve rapidly due to the proliferation of Enterprise Resource Planning (ERP) systems and the exponential growth of data volumes.
Organizations realized that operational data could no longer be managed manually or through static spreadsheets, more agile, centralized, and interactive solutions were needed.

BI tools emerged as a response to the limitations of traditional reporting mechanisms. They allowed organizations to not only report on what had happened but also to analyze why it happened and predict what might happen next. Over time, BI shifted from being a tool solely for executives to a platform usable by managers, analysts, and even operational teams thanks to improvements in user interface design and the emergence of self-service BI platforms.

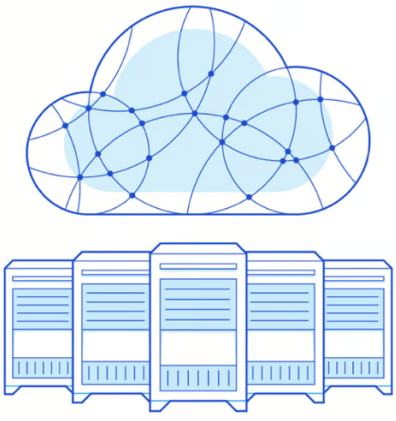


Figure 8: Data Explosion in the New Millenium

In today's landscape, Business Intelligence is a critical component of corporate governance, digital transformation, and continuous improvement initiatives. It enables

organizations to develop Key Performance Indicators (KPIs), measure progress toward strategic goals, monitor operational activities in real-time, and optimize resource allocation. Its role is particularly vital in public sector entities such as SCR Piemonte S.p.A., where transparency, accountability, and performance measurement are institutional priorities.

Among the wide array of BI tools available on the market, such as Tableau, Qlik Sense, SAS Visual Analytics, and IBM Cognos, Microsoft Power BI has emerged as a market leader due to its accessibility, integration with Microsoft's ecosystem, and powerful capabilities in data modeling, visualization, and collaboration.

Launched in 2015, Power BI is a cloud-based business analytics service that allows users to connect to multiple data sources, transform and model data, and generate interactive reports and dashboards. It is part of Microsoft's Platform and integrates with tools such as Excel, Azure, SQL Server, and SharePoint.

Power BI includes several components, including:

- Power BI Desktop: a free Windows application used to build complex data models, apply transformations, and create rich visualizations. This is the development environment where most of the report-building occurs.
- Power BI Service: a cloud-based platform that hosts published reports and dashboards. It facilitates collaboration among users, report sharing, and scheduled data refresh.
- Power BI Gateway: connects on-premises data sources to the cloud, enabling real-time or scheduled refresh without compromising security.
- Power BI Mobile: native applications for iOS and Android that provide mobile access to dashboards.
- Power BI Embedded: allows developers to integrate Power BI reports into other applications via APIs and SDKs.

The strength of Power BI lies in its ability to handle complex datasets through an intuitive, visual interface. It supports a wide range of data connectors, including SQL Server, Excel, Oracle, SAP, REST APIs, and cloud services such as Google Analytics or Azure Data Lake.
Its memory storage engine allows for high performance even with large volumes of data, while its scripting language (DAX - Data Analysis Expressions) enables the creation of custom metrics, calculated columns, and advanced aggregations.

At SCR Piemonte, Power BI has been implemented to provide visibility into the performance of key procedural activities. The dashboards developed allow users to track KPIs across various stages of each expropriation process, from the issuance of decrees to the disbursement of compensations. These dashboards, connected to a relational database created through SQL Server, allow the Management Control Office to support the entire organization in identifying trends, delays, workload distribution, and opportunities for process optimization.

Business Intelligence tools such as Power BI offer a wide spectrum of functionalities that contribute significantly to improving both operational efficiency and strategic alignment.

These functionalities include:

1. Data Connectivity and Integration: BI tools connect to disparate data sources, relational databases, APIs, Excel files, web services, and integrate them into a unified model. This enables the organization to overcome data silos and construct a consistent, comprehensive information system.
2. Data Cleaning and Transformation: tools like Power Query (embedded in Power BI) allow for data profiling, cleaning, and reshaping through a user-friendly interface. Users can remove duplicates, change data types, fill in missing values, and perform operations such as pivoting or merging tables.
3. Data Modeling and DAX: once the data is clean, it is modeled by defining relationships, hierarchies, and calculated measures. DAX functions, ranging from simple aggregations to time intelligence, allow users to create complex metrics that reflect business rules and KPIs.
4. Interactive Data Visualization: visualizations include bar charts, line graphs, matrices, treemaps, KPIs, and geospatial maps. Each visualization can be filtered, drilled down, or interacted with in real-time. Users can explore data independently, uncover patterns, and discover outliers.
5. Real-Time Dashboards and Alerts: BI tools allow for the creation of dashboards that update automatically with fresh data. Power BI also supports alert notifications when thresholds are exceeded, an essential function for monitoring risks or critical performance drops.
6. User Access Control and Collaboration: with role-based access control, different users see only the data relevant to their function. Collaboration features such as comments, annotations, and shared workspaces enhance team synergy.
7. Scheduled Reports and Automation: BI tools support report subscriptions, automatic e-mail delivery, and scheduled refresh, ensuring that decision-makers always have up-to-date information at their fingertips.
8. Export and Presentation Capabilities: dashboards can be exported to PDF, PowerPoint, Excel, or shared as web links. These features are crucial in institutional settings where standardized reporting is required for external stakeholders, auditors, or governance boards.

In the specific context of SCR Piemonte, these features have enabled the transformation of operational data from the Expropriation Office into strategic dashboards that support organizational learning and continuous improvement. Reports produced with Power BI are used not only to monitor compliance with internal procedures but also to document progress toward regional development goals, support the drafting of technical reports, and respond to audit requirements.

Moreover, the use of Power BI has fostered a data culture within SCR, encouraging departments to rely more heavily on quantitative analysis, share information across silos, and align operational activities with key indicators. This evolution enhances transparency,

improves the quality of decisions, and empowers staff at all levels to contribute to public value creation.

2.4. KPI: Measurement and Monitoring of Organizational Performance

Managers and department leaders commonly rely on performance indicators to assess how effectively objectives are being met. Key Performance Indicators (KPIs) are measurable indices that reflect how well an organization, team, or specific operational unit is achieving its predefined goals.

These indicators serve as vital tools in both strategic planning and operational control, allowing for objective evaluations and data-driven decisions.

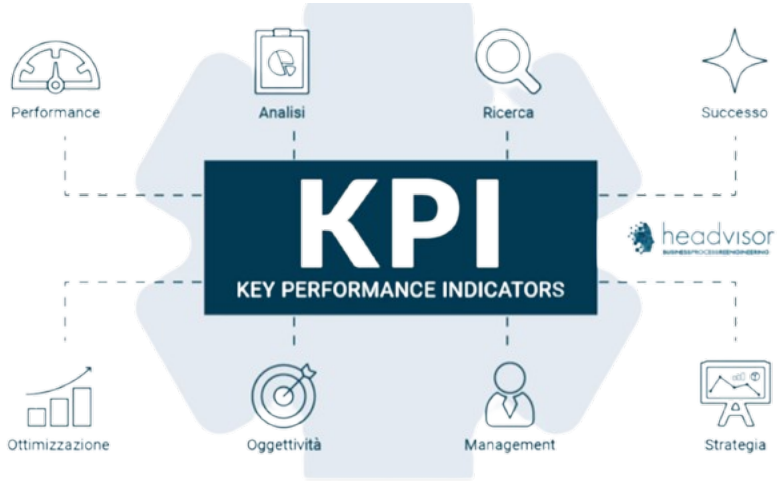


Figure 9: KPIs Functions

KPIs can be categorized into two main types: high-level and low-level indicators:

- High-level KPIs are used to monitor overall company performance and strategic alignment, such as profitability, market share, or return on investment.
- Low-level KPIs, on the other hand, focus on the performance of specific departments or processes, such as manufacturing efficiency, customer service responsiveness, marketing conversion rates, sales targets, or employee turnover.

The acronym KPI stands for Key Performance Indicator, and each element of the term is significant:

- "Key" refers to the fact that the indicator is strategically important, directly tied to the organization's core objectives.
- "Performance" refers to the measurable output or behavior of the process being monitored.

- "Indicator" implies that the metric reflects trends, success levels, or issues that require attention.

The primary function of KPIs is to quantify performance in a way that enables organizations to monitor progress over time. In a world increasingly driven by digital transformation and technological innovation, the need for clear, quantifiable, and real-time insights into business performance is more critical than ever. KPIs provide that insight.

KPIs are only useful if they are meaningful, interpretable, and actionable. For this reason, nine essential principles have been established to guide the design and implementation of KPIs:

1. Define Clear Objectives: KPIs must reflect clearly defined and measurable outcomes. Abstract or vague intentions must be replaced with tangible goals, such as the number of new leads, monthly revenue, product defect rate, or customer complaints.
2. Make KPIs Measurable: the indicators must be built on data that is easy to collect and consistently measurable using the same methodology. Direct and objective measurements are preferred.
3. Measure KPIs Consistently: the chosen metric must provide relevant and consistent information about whether performance is improving, declining, or stable. The goal is to support strategic decision-making by making performance visible and understandable.
4. Contextualize and Aggregate Where Needed: a single KPI in isolation may be misleading. Aggregating multiple indicators can provide a more accurate picture of a process or function. For example, in production departments, aggregated KPIs might combine machine efficiency, quality, and time performance.
5. Establish Performance Ranges and Thresholds: KPIs should include clearly defined performance levels, what constitutes excellent, acceptable, or poor performance. This can be visualized using traffic light systems (green, yellow, red) based on numerical ranges.
6. Agree on Update Frequency: depending on the nature of the process and cost of data collection, KPIs must be updated regularly (e.g., weekly, monthly, quarterly) to remain relevant and accurate.
7. Track KPI History: historical tracking of KPI values, including measurement dates, responsible individuals, and tools used, is essential. It allows trend analysis and highlights anomalies or improvements over time.
8. Evaluate the Cost of Measurement: every KPI has a cost. It is important to estimate the time and resources needed to collect the data. If the cost outweighs the value of the insight, the KPI should be re-evaluated.
9. Leverage Software for Data Collection**:** digitalization simplifies KPI tracking and ensures reliability. Consistent definitions and centralized software make implementation and reporting easier and more insightful.

Figure 10: examples of KPIs

A critical mistake organizations often make is adopting industry-standard KPIs without evaluating their applicability to their unique context. KPIs are, at their core, a communication tool. Like all communication, they must be clear, concise, and relevant to the intended audience. If a KPI fails to communicate meaningful insights, it risks becoming an empty formality.

To avoid this, KPI development should be a collaborative and iterative process involving managers, analysts, and front-line employees. It should begin with a shared understanding of strategic goals and proceed to the identification of which processes should be measured, how, and for whom the results are intended.

It is important to distinguish between KPIs and business metrics. While all KPIs are metrics, not all metrics are KPIs. A KPI must reflect a "key" result, something critical to organizational success. Therefore, the formulation of a KPI should involve specific guiding questions:

- What is the desired result?
- Who is responsible for that result?
- How can the outcome be influenced?
- How will progress be measured?
- How frequently will progress be reviewed?
- What indicates that the goal has been achieved?

Only when these questions are answered can a KPI be considered valid and effective.

In public infrastructure projects, where activities are long-term, complex, multidisciplinary, and subject to rigid regulatory frameworks, Key Performance Indicators (KPIs) serve as essential tools for steering operational execution, ensuring compliance, and fostering accountability.

Unlike private-sector KPIs, often oriented toward profitability, customer satisfaction, or market growth, KPIs in the public sector are strongly tied to transparency, efficiency in resource allocation, quality of service to citizens, and legal traceability.

The use of KPIs in public infrastructure allows for:

- Real-time monitoring of the progress of administrative and technical procedures.
- Control mechanisms that ensure alignment with budgetary, temporal, and legal constraints.
- Continuous improvement, through the identification of bottlenecks, delays, or inefficiencies.

For instance, in a typical expropriation procedure, a common component of public works, KPIs can track the number of procedural steps completed, average processing time per phase, adherence to planned milestones, etc.

These indicators do not merely offer a snapshot of performance; they empower institutions to compare performance across projects, teams, and time periods, and to anticipate criticalities before they materialize. This proactive approach contrasts with reactive or retrospective evaluations and marks a cultural shift toward evidence-based governance.

The experience of SCR Piemonte S.p.A., and in particular the Expropriation Office, exemplifies how modern public organizations are leveraging KPI-based systems within structured frameworks of data governance and Business Intelligence.

In the past, the lack of a relational database and the use of fragmented Excel sheets made it difficult to define, collect, or aggregate indicators in a reliable and scalable manner. The shift toward a relational database architecture, integrated with Microsoft Access and Power BI, has allowed for the creation of a centralized and standardized data ecosystem, which is a prerequisite for implementing a sustainable and functional KPI system.

In this context:

- Data Governance ensures the quality, consistency, and security of the underlying data. It clarifies roles and responsibilities, enforces validation rules, and restricts unauthorized access. Without this foundation, KPI calculations would be unreliable or misleading.
- Business Intelligence platforms like Power BI allow for the transformation of raw procedural data into dynamic dashboards and visual reports. These tools help Ufficio Espropri and the Controllo di Gestione team to explore trends, compare performance across projects or operators, and make better-informed decisions.

The integration of KPI logic into dashboards enhances the transparency of processes toward external stakeholders (e.g., municipalities, citizens, the Region of Piedmont), supports internal coordination, and provides clear criteria for performance reviews and operational planning.

2.5. Balanced Scorecard: a Structured KPI-driven Governance

Balanced Scorecard or BSC, which can be translated as "Balanced Evaluation Scorecard," is a framework used in strategic management to measure an organization's outcomes.
The aim of this tool is to help organizations transform their strategies into concrete, measurable actions through specific metrics.
In contrast to analyses focused solely on a company's financial and managerial aspects, the Balanced Scorecard also considers other dimensions, such as clients' perspective, internal processes, and learning and innovation, as essential and indispensable elements of good corporate governance.

In recent years, this tool has spread especially among large companies, because they have very complex structures as well as a large volume of data and information to monitor and evaluate during their analyses.

The Balanced Scorecard is a model for evaluating corporate performance, used to facilitate the translation of a given strategy into concrete actions.
The origins of this analytical model date back to the 1990s, when two scholars, Robert Kaplan, a professor at Harvard, and David Norton, president of Nolan Norton, developed it as part of a research project titled "Measuring Performance in the Organization of the Future".
The name Balanced Scorecard derives from the scoreboards used in basketball and baseball games to indicate scores. However, in this case, the result displayed derives from the combination of different variables, requiring a special analytical model to determine how to weigh and present those variables.

In their study, Kaplan and Norton examined twelve large companies, each encountering various problems measuring performance data using traditional methods and tools. For that reason, those companies were ready to adopt innovative approaches to find an effective solution that could offer a competitive advantage over rivals.

The two scholars highlighted that, in an increasingly competitive and innovative context, classic performance measurement tools could no longer provide the right information for complex and effective analyses. Indeed, traditional indicators were too static compared to the dynamic environment and new challenges organizations faced at the time.

It was precisely in this context that the Balanced Scorecard (BSC) was born, which, even in a still rather rudimentary form, allowed these companies to gain a dynamic, global, and truthful view of their own performance.

Thus, the BSC is a system used to measure organizational performance that, starting from the company's vision and strategy, enables analysts to identify the strategic dimensions of a particular business through a top-down approach. From this perspective, it becomes possible to manage the entire organizational strategy, translating it into concrete and measurable actions through specific performance indicators (KPI - Key Performance Indicators).

In this way, the Balanced Scorecard places itself at the center of management, connecting short- and medium-long-term goals and incorporating both purely economic performance measures (lagging indicators) and non-economic performance measures (leading indicators).

The system developed by its two authors thus marks the transition from traditional analytical models to a model characterized by a multidimensional and "balanced" vision. The results of the study demonstrated the model's effectiveness, prompting companies to abandon traditional measures based solely on economic and financial indicators, and instead favor measures capable of providing a deep and realistic view of the organization.

In the following years, more and more companies decided to adopt this model, achieving excellent results thanks to the tool's ability to integrate both economic-financial and production and opportunity-based indicators.

Four distinct but correlated perspectives that must be considered during the analysis process were identified:

- Economic: economic-financial area
- Customer: customer perspective
- Internal Process: internal process development
- Learning & Growth: research and development for innovation and growth

Figure 11: different areas of BSC

The Balanced Scorecard (BSC) is based on the idea that evaluating an organization's performance should go beyond simple financial analysis. For this reason, in addition to

traditional indicators, other measures, or perspectives, are included that reflect critical aspects of an organization in the medium to long term.

These four perspectives are as follows:

- Financial Perspective: answers the question: “How do shareholders perceive the company?”
  Through financial statement analysis and its most common financial ratios, profitability and financial strength are assessed. Some of the measures analyzed include cash flow, sales volume, ROE, ROI, EBITDA, income, etc. The information identified in this phase is used to guide research and definition in subsequent phases. The Balanced Scorecard allows the selection of indicators to evaluate long-term success and the fundamental variables needed to identify and achieve final goals.

- Customer Perspective: answers the question: “How do customers perceive the company?”
  This perspective reflects the viewpoint of customers. For consumers, different factors matter compared to investors. Information is gathered mainly through satisfaction surveys or questionnaires, product sales statistics, and scores given on online platforms. Examples of measures considered include failure rates, defectiveness, delivery times, customer service, customer satisfaction, and the prices of products offered. With the advent of the new economy, the customer has become central to corporate strategies for value creation. Customer satisfaction thus becomes essential, since customers “pull” demand rather than it being “pushed.” Today’s companies can no longer evaluate customer management processes merely by sales. On the contrary, customer management must help companies acquire and maintain profitable, long-term relationships, delivering value to end customers.

- Internal Process Perspective: answers the question: “In what must the organization excel?”
  This perspective examines internal business processes, especially production processes, evaluating them to identify improvement opportunities. Some of the analyzed measures include productivity, cycle times, quality metrics, cost metrics, quote turnaround time, and the conversion rate of quotes into sales.

- Learning & growth perspective: answers the question: “How can the company improve and innovate?”
  It starts from the assumption that a company that doesn’t evolve in research and development is destined to age and lose market relevance. The aim of this perspective is to provide the drivers needed to achieve goals identified in previous phases, making investments in R&D, infrastructure, and employee skills. Economically, these activities (such as R&D and employee training) are treated as costs. Therefore, it is important to identify parameters to evaluate the progress achieved through these activities. Some factors considered include staff development, key skills, level of innovation, and R&D activities.

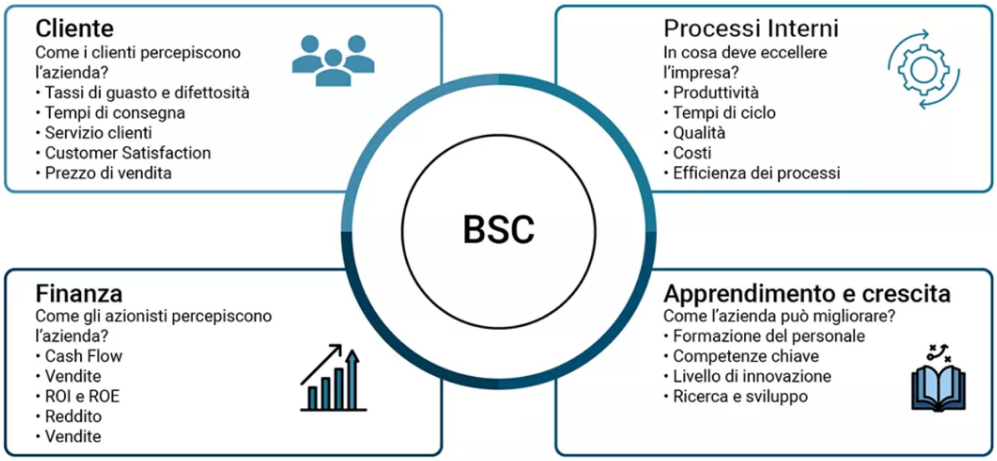


Figure 12: details of each BSC's area

The Balanced Scorecard brings several benefits to the organization where it is implemented.
First and foremost, the BSC provides a global view of organizational performance, identifying strengths and weaknesses and defining concrete strategies to improve performance.

Here are some advantages derived from its use:

- Integrated strategic vision: the BSC provides a balanced view of the organization, including both financial and non-financial components, enabling a comprehensive performance analysis.
- Strategic alignment: it helps link daily activities with medium- and long-term objectives, ensuring alignment across organizational goals.
- Improved communication: the Balanced Scorecard provides a clear framework of priorities and strategic objectives, improving internal communication and engaging employees in improvement processes.
- Measurement of non-financial performance: the BSC also considers aspects related to customer satisfaction, internal processes, and staff development, providing a comprehensive evaluation of performance.
- Adaptability: it can be adapted to the specific needs of the organization, customizing strategies and perspectives based on its characteristics and objectives.
- Continuous improvement: to function properly, the Balanced Scorecard requires coordinated and constant effort, in line with the Kaizen logic of continuous improvement.

Figure 13: BSC Advantages

However, the Balanced Scorecard also has limitations. It is a complex tool that requires time and resources to implement and to generate tangible results.
Moreover, this type of analysis was developed primarily for large companies, where mechanisms for controlling economic-financial metrics already exist and there is a wealth of available data to analyze.

In small or medium enterprises, the logic of financial statement analysis and performance evaluation is often lacking or non-existent. In such situations, using such a complex and potentially difficult-to-manage system may be counterproductive. For them, the recommendation is to proceed gradually, adopting a simplified Balanced Scorecard. It is advisable to start with the economic-financial perspective and include only the most important KPIs. If the company grows and expands its business volume, it can build on this foundation and include all four perspectives.

An important feature of the Balanced Scorecard is that it is based on a cause-and-effect principle. This means that actions and developments in one organizational area have important repercussions in other areas. Therefore, achieving an objective in one BSC perspective directly influences other perspectives. For example, the Learning & Growth perspective, related to employee skills and organizational development, influences the efficiency with which products or services are provided (Process perspective). That in turn affects the Customer perspective in terms of pricing and client satisfaction. Finally, clients influence the Financial perspective through their purchases, generating profit variations for the company.
The tool used to evaluate this flow is the Strategy Map, which highlights how achieving an objective in one perspective influences the others. The strategy map can be used by organizations to define their operational strategy to achieve preset goals. For instance, if the goal is to increase revenue, a possible solution is to find new leads to convert into clients. Therefore, it becomes necessary to understand how to acquire new customers, working through the Process perspective, and identify the prerequisites to achieve the goal by also working on the Learning & Growth perspective.

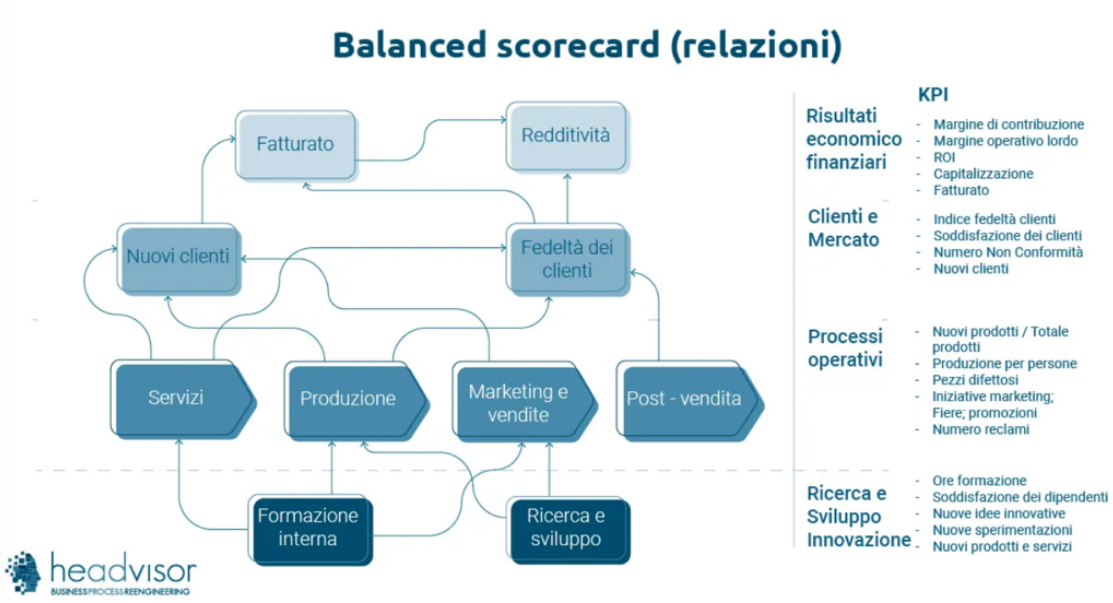


Figure 14: Strategy Map

The creation of a Balanced Scorecard involves several steps and requires strategic involvement from both organizational leaders and department heads. It also demands coordinated and constant effort, according to the Kaizen logic of continuous improvement.

Balanced Scorecard's steps can be adapted based on the type of organization and its objectives, and that these may iterate cyclically:

- Definition of strategy and critical success factors: understand the organization's strategy, long-term objectives, strengths and weaknesses, mission and vision. In this way, you identify the factors that will determine strategic success.
- Identify perspectives: determine which perspectives are relevant for your organization and the objectives you wish to achieve, which will be included in the BSC.
- Identify KPIs and metrics: for each perspective, identify KPIs to evaluate the achievement of strategic objectives, both at the end of activities and during them.
- Definition of goals: set specific goals and measurable targets, aligned with the organization's overall strategy, linked to the different perspectives.
- Planning resources and activities: identify strategic initiatives and projects to achieve Balanced Scorecard objectives. Assign responsibilities and resources as well.
- Implementation and monitoring: implement the BSC in the organization, communicating objectives clearly and providing training if needed. Create a monitoring system to evaluate progress and advancement.
- Evaluation and updating: periodically assess performance against established goals. If necessary, make adjustments to adapt to changing market conditions or organizational strategy.
- Continuous improvement: the BSC is a tool for continuous improvement. Therefore, results must be analyzed, lessons learned, and improvements applied.

So, the Balanced Scorecard is a support system for decision-making in corporate strategy. It must serve as a reference framework to dynamically highlight the status of actions undertaken in order to improve coordination or mitigate potential risk factors. The success of this tool demonstrates the great need to integrate financial control variables with the recognized urgency for better integration of operational activities.

The KPI strategy implemented at SCR Piemonte aligns closely with the logic of the Balanced Scorecard (BSC), which emphasizes the need to evaluate organizational performance from multiple, interconnected perspectives, focusing on compliance and budget control (financial and legal dimensions), and extending the approach to the evaluation of internal processes (e.g., procedural efficiency), stakeholder satisfaction (e.g., transparency toward citizens and local authorities), and organizational development (e.g., improved coordination and accountability across teams).

This conceptual integration enhances the strategic value of KPIs, turning them from mere control instruments into strategic levers for long-term improvement. The goal is not only to "measure" but to enable strategic alignment and cultural change across the organization.

3. Methodology and Adopted Approach

3.1. Design of the Relational Database

As part of the project developed by the Management Control Office of SCR Piemonte to support the Expropriation Office, a relational database system was designed and implemented to allow for the structured and integrated management of expropriation procedures. This system is built upon three key elements: tables (Appendice A), views (Appendice A), and forms (Appendice A), each serving a specific role in the representation, transformation, and visualization of data.

The tables form the foundation of the relational system, acting as containers for raw and normalized data. They have been divided into two major categories:

- Reference and support tables, including:
  - dbo_Dipendenti, which records staff involved in expropriation procedures.
  - dbo_L_StatoAttività, which defines the operational status of activities (active, completed, archived).
  - Classification tables (dbo_L_TipoDecretoEspr, dbo_L_AccontoSaldo) that support the coding of legal and financial acts.
- Transactional tables, which store the operational data of the procedures:
  - dbo_T_ProcEspropriativi, acting as the main table for each expropriation case.
  - Tables related to expropriation acts (dbo_T_Accatastamento, dbo_T_DecretoEspr, dbo_T_OrdinanzaOccupazTemp, etc.), each of which represents a distinct phase of the process.
  - Financial tables such as dbo_T_AccontoE_SaldiEspr, which track payments including advances and balances.
  - Relational tables (dbo_RelazioneCommesseDipendenti, dbo_T_Ruolo) linking procedures to involved employees with their respective roles (e.g., RUP, Expropriation Officer, Assistant).

Table 1: Database's Tables and Descriptions

Tables	Content Description
dbo_Dipendenti	The dbo_Dipendenti table stores detailed records of all employees who are part of, or collaborate with, the organization. Each row represents a unique individual, identified by a primary key, and includes personal and professional information relevant to their role within SCR Piemonte S.p.A.
dbo_L_AccontoSaldo	The dbo_L_AccontoSaldo table is a lookup table (also known as a domain or dictionary table) that defines and stores the possible categorical values for the status of financial disbursements within expropriation procedures,

	specifically distinguishing between advance payments (*acconti*) and final settlements (*saldi*).
dbo_L_StatoAttività	This lookup table defines the various possible statuses that an activity or procedure can assume within the expropriation process. Each record corresponds to a specific state (e.g., ongoing, archived, completed) and is used throughout the database to standardize status tracking and classification. It plays a key role in managing the procedural lifecycle and ensuring consistency in reporting and analysis.
dbo_L_TipoDecretoEspr	This lookup table categorizes the different types of expropriation decrees that can be issued within a procedure. It standardizes the classification of decrees (e.g., ordinary, urgent, partial) and ensures consistent use of decree types across records. This helps facilitate legal traceability, document generation, and analytical queries related to the nature of expropriation actions.
dbo_L_TipoDecretoTUE	It is used to classify and standardize the various decree forms issued for temporary or emergency occupation of land. The table ensures consistency in how these decree types are recorded, supporting accurate documentation and compliance with legal frameworks.
dbo_RelazioneCommesseDipendenti	This table manages the relationships between employees and the projects (commesse) they are assigned to. It includes information such as employee ID, project ID, role within the project, and the date of assignment. The table is fundamental for tracking the involvement of each staff member in specific projects and for identifying roles like Project Manager (RUP) or Expropriation Procedure Manager (RPE) within SCR Piemonte's operational structure.
dbo_T_Accatastamento	This table records the cadastral registration activities carried out within each expropriation procedure. It includes key details such as the unique cadastral registration ID, the associated expropriation procedure ID, and relevant timestamps or status information. The purpose of this table is to track and document the official updates to land records required during the expropriation process, ensuring legal and administrative compliance.
dbo_T_AccontoE_SaldiEspr (riparto da qua)	Tracks compensation payments, including both down payments and final balances. Links each financial transaction to the corresponding expropriation file and beneficiary.
dbo_T_AutSoprPrel	Contains authorizations for preliminary access to land (autorizzazioni a sopralluogo), often required before initiating the expropriation procedure.
dbo_T_CommProvEspr	Records the resolutions (delibere) or provisions by public entities that initiate or support the expropriation process, including motivations and legal references.
dbo_T_ConfUrb	Stores information on urban planning conformity (conformità urbanistica), ensuring that each procedure aligns with zoning and development regulations.
dbo_T_DecretoEspr	Main table for expropriation decrees. Includes legal details, dates, and links to parcels and procedures. Essential for tracking formal steps and compliance.
dbo_T_DecretoOccUrgenza	Contains emergency occupation decrees (decreti di occupazione d'urgenza), which allow temporary possession of land before the final expropriation.

dbo_T_DichiarazionePU	Stores declarations of public utility (dichiarazioni di pubblica utilità), a fundamental step required for initiating expropriation under Italian law.
dbo_T_Frazionamento	Manages technical data about parcel subdivisions (frazionamenti), necessary for identifying the exact portions of land subject to expropriation.
dbo_T_OrdinanzaOccupazTemp	Tracks temporary occupation ordinances (ordinanze di occupazione temporanea), including timing, justification, and affected parcels.
dbo_T_PercAvanzamentoAttEspr	Calculates and records the percentage of progress for each procedure or set of procedural activities, supporting the generation of KPI metrics.
dbo_T_ProcEspropriativi	Core table of the database, containing the master data of all expropriation procedures. Includes procedure ID, project details, dates, legal steps, and status.
dbo_T_Ruolo	Stores the list of organizational roles or job functions assigned to staff within the system, used to manage access levels and responsibility tracking.
dbo_T_VincoloPrordEspr	Manages the preordained constraint to expropriation (vincolo preordinato all'esproprio), documenting legal and urban planning links between land and public interest.
dbo_T_D_ArcaElencoCommesse	Stores the list of project codes and descriptions extracted from the ARCA system, SCR Piemonte's enterprise resource planning (ERP) tool. This table serves as a reference to link expropriation procedures to corresponding financial and operational projects, enabling budget alignment, reporting, and project traceability.

All data was organized following normalization principles to avoid redundancy, ensure referential integrity, and facilitate system scalability.

Views play a fundamental role in extracting, filtering, and summarizing data without altering the original tables. Two main categories of views have been designed:

- Operational views, each representing a specific activity in the expropriation workflow:
  - V_E_Accatastamento, V_E_Frazionamento, V_E_DecretoEspr, V_E_AutSoprPrel, etc., each of which calculates the number of acts performed for each case and the corresponding percentage of progress.
  - V_E_Acconti and V_E_Saldi for the financial component, distinguishing between advances and final settlements.
- Summary views, more complex and aggregated:
  - V_E_ElencoProcedimenti, which merges all key information on expropriation procedures for the Expropriation Office, including assigned staff and progress statuses.
  - V_E_VerificaAttComplete, which aggregates weighted percentages to calculate the overall progress status of each procedure.
  - V_E_AssistentiRPE, V_RelazioneCommesseRUP, and others, which define the relationships between projects and the personnel involved.

Table 2: Database's Views and Description

Views	Function Description
Dbo_V_E_Accatastamento	Function: this view returns the count of cadastral registrations (Accatastamento) associated with each expropriation procedure, along with the corresponding progress percentage. Purpose: it enables monitoring of the cadastral update activity, which is crucial to ensuring that properties targeted for expropriation are correctly documented in the cadastral system.
Dbo_V_E_Acconti	Function: this view calculates the number of down payments (Acconti) issued for each expropriation procedure and matches this data to its predefined percentage of procedural progress. Purpose: it helps verify the financial progress of compensations and ensure that the partial payment phase to property owners is properly recorded.
Dbo_V_E_AssistentiRPE	Function: this view extracts the list of employees assigned the role of Assistant to the Expropriation Process Manager (Ruolo = 10), with their corresponding assignment dates and project codes. Purpose: it provides a mapping of which staff members are operationally involved in each project and when, supporting team coordination and accountability tracking.
Dbo_V_E_AutSoprPrel	Function: returns the number of preliminary site inspection authorizations issued (Autorizzazioni Sopralluogo Preliminare) and the related progress percentage. Purpose: useful for tracing early field operations in the expropriation process, especially for scheduling and verifying on-site activities.
Dbo_V_E_CommProvEspr	Function: counts the instances of Provincial Expropriation Committee (Commissione Provinciale Espropri) involvement per procedure, displaying the respective progress contribution. Purpose: tracks phases requiring formal institutional intervention, often linked to property value assessment and decision formalization.
Dbo_V_E_ConfUrb	Function**:** counts the number of urban conformity verifications (Conformità Urbanistica) carried out for each procedure and displays their contribution to the process progress. Purpose**:** ensures compliance of expropriated properties with urban planning tools before issuing official decrees.
Dbo_V_E_DecretoEspr	Function: returns the count of expropriation decrees (Decreti d'Esproprio) and their percentage impact on procedural progress. Purpose: represents a milestone in the expropriation process, marking the official transfer of ownership to the public authority.
Dbo_V_E_DecretoOccUrgenza	Function: provides the count and progress percentage related to emergency occupation decrees (Decreti di Occupazione d'Urgenza). Purpose: Tracks extraordinary measures allowing urgent possession of assets before the full expropriation process is complete.
Dbo_V_E_DPU	Function**:** counts the declarations of public utility (Dichiarazioni di Pubblica Utilità) and calculates their contribution to the overall procedural progress. Purpose**:** validates the preliminary legal condition for any expropriation process to be lawfully initiated.

Dbo_V_E_Frazionamento	Function: calculates how many parcel subdivisions (Frazionamenti) have been registered per procedure and displays the associated progress percentage. Purpose: confirms that each parcel has been properly delineated and legally identified before subsequent procedural steps.
Dbo_V_E_OrdinanzaOccupazTemp	Function: returns the count and percentage of temporary occupation ordinances (Ordinanze di Occupazione Temporanea) issued. Purpose: tracks temporary asset occupation required for urgent public works or investigative purposes.
Dbo_V_E_Saldi	Function: computes the count and progress contribution of final payments (Saldi) issued for each expropriation procedure. Purpose: helps confirm the closure of the financial compensation cycle and ensures payment compliance with legal requirements.
dbo_V_E_VerificaPreliminare	Function**:** returns the progress percentage of the preliminary document check phase (Verifica Preliminare Elaborati). Purpose**:** validates whether technical documentation has been reviewed and approved before moving forward with the operational process.
dbo_V_E_VincoloProcEspr	Function**:** returns the number of preordained constraints to expropriation (Vincoli Preordinati all'Esproprio) for each procedure and their corresponding progress percentage. Purpose**:** confirms the establishment of legal and regulatory foundations necessary to initiate an expropriation.
Dbo_V_E_ElencoProcedimenti	Function: comprehensive view that joins and aggregates all relevant information for each expropriation procedure: project codes, descriptions, managers, activity states, percentages, notes, archival status. Purpose: serves as the primary operational and analytical source to populate dashboards and forms. It supports the Ufficio Espropri in maintaining an integrated and up-to-date overview of all procedures.
Dbo_V_E_VerificaAttComplete	Function**:** complex analytical view that calculates both binary (activity completed or not) and weighted percentage contributions for each procedural activity. Purpose**:** enables total procedural progress calculation and allows the Management Control Office to evaluate performance based on actual advancement of critical milestones.
Dbo_V_RelazioneCommesseRespEspr	Function: maps each project to its assigned Expropriation Process Manager (Responsabile del Procedimento Espropriativo), based on the latest assignment date. Purpose: ensures correct responsibility attribution in reports, dashboards, and procedural records.
Dbo_V_RelazioneCommesseRUP	Function: maps each project to its designated Project Manager (RUP - Responsabile Unico del Procedimento), retrieving only the most recent assignment. Purpose: essential for verifying who is institutionally accountable for project execution and procedural alignment.

These views serve as the foundation for Power BI dashboards and Access forms, acting as a bridge between raw data and user-relevant information.

To facilitate user interaction with the system, several Microsoft Access forms have been developed. These are designed to simplify data navigation and make it more accessible even to non-technical users:

- Expropriation Procedures List Form (Expropriation Office): allows users to view and filter cases, displaying all key information such as description, percentage of progress, status, and presence of relevant acts.
- Procedure List Form (RUP): a simplified version tailored for the Unique Procedure Manager, automatically filtered to show only the procedures under their responsibility.
- Expropriation Procedure Detail Form: a complete record for each procedure, offering the ability to view (and potentially update) all phases: technical acts, constraints, declarations, decrees, payments, and internal notes.

All forms are dynamically linked to SQL views and allow for direct database queries.

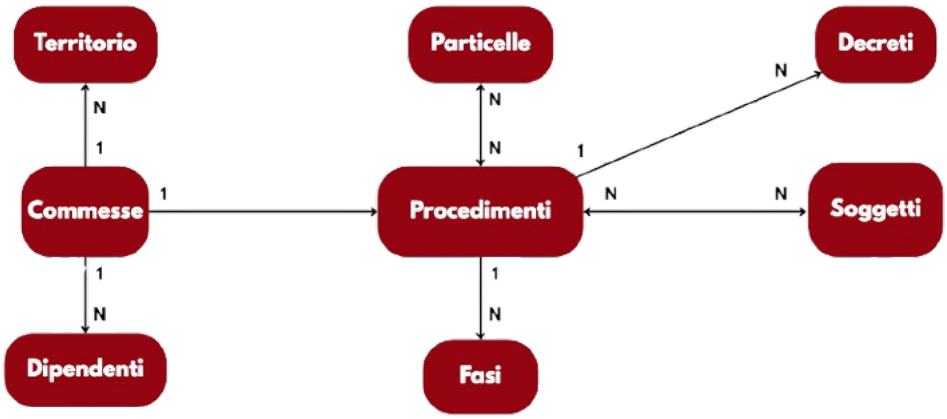


Figure 15: Entity-Relationship Diagram of the Expropriation Database, showing the main entities, attributes and relationships adopted for the design (Appendice A).

The modular and relational design of the database enables SCR Piemonte to manage expropriation procedures in an efficient, traceable, and scalable manner. The system not only improves the quality and security of data but also enables the Management Control Office to monitor activities with precision, providing structured and proactive support to the Expropriation Office. The information obtained through queries and forms is also prepared for use in Power BI interactive dashboards, which complete the information chain with advanced synthesis and visualization tools.

This approach is a concrete example of the integration between relational logic, data governance, and operational support, in line with the principles of digital modernization and continuous improvement that guide the mission of SCR Piemonte.

3.2. Data Structuring and Management

In any modern data-driven environment, especially within public institutions such as SCR Piemonte S.p.A., the effectiveness of decision-making processes depends heavily on the quality, consistency, and accessibility of the underlying data.

This requires a rigorous approach to data management that involves not only the creation of a relational database but also a structured Pipeline of Data Cleaning**,** Integration**,** Transformation, and Query Design for information retrieval. Within the context of the Expropriation Office project, these processes have been fundamental for enabling accurate monitoring, KPI-based evaluation, and timely reporting of ongoing procedures.

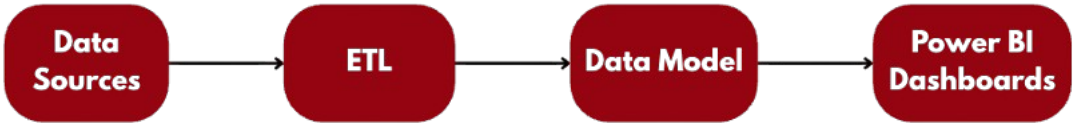


Figure 16: Data Pipeline from the Data Sources, to the Extraction of Data, to the Transformation (Cleaning, Integration, Validation, Normalization) and Loading, until the KPIs development

Data Cleaning, represents the first and most critical step in preparing datasets for analysis. In the SCR Piemonte project, raw data coming from heterogeneous sources (including legacy systems, spreadsheets, and manual input) often included inconsistencies such as duplicated records, missing values, incorrect references, or non-standard formats. These anomalies can lead to unreliable insights if not properly handled.

The cleaning process involved:

- Removing duplicates, particularly in datasets such as land parcels or administrative decrees.
- Standardizing data formats, for example, ensuring dates use the YYYY-MM-DD format and textual entries follow a consistent casing and syntax (e.g., all-caps for official decree titles).
- Validating foreign key relationships to guarantee referential integrity between tables like `T_ProcEsporpriativi` and `T_DecretoEspr`.
- Identifying null or incomplete records that required enrichment or correction from authoritative sources.

This stage was performed manually at first and then supported through SQL scripts designed to validate and flag discrepancies systematically, enabling reproducibility and auditability.

Once the data were cleaned and normalized, the next challenge was Data Integration: bringing together information from different domains into a cohesive and logically consistent database. Within the SCR system, this involved consolidating information from departments managing technical documents, legal decrees, GIS-based cadastral data, and financial transaction logs into a unified schema.

The integration process leveraged:

- Foreign key mapping, such as linking `ID_Commessa` across procedure tables and the `T_D_Arca_ElencoCommesse` table for project tracking.
- Lookup tables (e.g., `L_StatoAttivita`, `L_TipoDecretoEspr`) to ensure standard codification of qualitative information across multiple records.
- Cross-domain logic, for instance, calculating the financial advancement of a procedure by integrating data from both the legal decree progression and the payments issued (acconti and saldi).

By ensuring a high level of structural coherence, data integration created the foundational basis for complex queries and visualizations in Power BI.

The Data Transformation step was crucial to shape the integrated data into a structure suitable for performance monitoring and KPI tracking. Transformation refers to the process of deriving new variables, aggregating data, or reshaping datasets to meet analytical objectives.

Examples of transformation operations include:

- Aggregation of progress data using GROUP BY queries to compute per-procedure statistics, such as the number of activities completed per project.
- Calculation of procedural completion percentages, where weights were applied to different activity types based on strategic importance (as defined in `T_PercAvanzamentoAttEspr`).
- Creation of derived views, such as `V_E_ElencoProcedimenti`, which combined many fields and intermediate calculations into a single comprehensive dataset for visualization.

This step also involved mapping business logic (provided by the Ufficio Controllo di Gestione) into SQL-based expressions, ensuring that KPI definitions were both technically correct and operationally meaningful.

The ability to extract precise, actionable information from the relational database hinges on the careful design of SQL queries. In this context, queries had to satisfy not only functional requirements (e.g., retrieving status updates, counting occurrences) but also performance constraints, considering the growing volume of data.

Several types of queries were implemented:

- Descriptive queries, such as counting how many expropriation decrees were issued for a given project (SELECT COUNT(ID_DecretoEspr) ... WHERE ID_Commessa = X).
- Parameterized queries**,** enabling dashboard interactivity (e.g., filtering by responsible person, project code, or procedural state).
- Join-based queries, to consolidate information from multiple tables, such as combining decree data (`T_DecretoEspr`) with parcel information (`T_Frazionamento`) and payment records (`T_AccontoE_SaldiEspr`).

- Temporal queries**,** calculating lead time between key events, such as between the date of authorization and the date of notification.

Views such as `V_E_VerificaAttComplete` were developed as abstractions that encapsulate complex logic, integrating procedural activity completion rates into normalized percentages that directly feed into KPI dashboards.

These queries form the analytical backbone of the Power BI visualizations and are central to the operational monitoring system currently in use by the Ufficio Espropri.

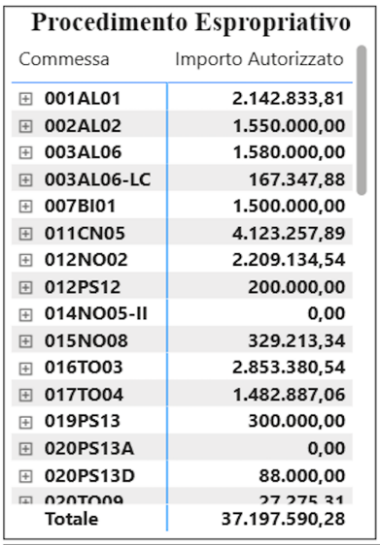
So, the structuring and management of data enabled the transition from fragmented and inconsistently recorded procedural information to a coherent digital infrastructure that supports both strategic oversight and day to day operations. The ability to trust, trace, and interact with structured data is a prerequisite for implementing KPI-driven governance and for ensuring compliance, transparency, and responsiveness in the public infrastructure domain.

3.3. Definitions and Monitoring of KPI: Power BI Dashboard

To support the Ufficio Espropri in managing and communicating the status of their operations, a comprehensive KPI monitoring dashboard has been developed using Microsoft Power BI. This dashboard has a dual objective: first, to provide an immediate and data-driven view of the office's performance; and second, to enhance the visibility and strategic relevance of the expropriation activities within the organizational structure of SCR Piemonte. The KPIs have been carefully selected to reflect both operational and managerial priorities, supporting transparency, traceability, and continuous improvement in line with corporate data governance principles.

Below is a detailed description of each KPI included in the dashboard:

1. List of Expropriation Procedures with Related Project Code, Assigned Personnel, and Authorized Amount: this indicator presents a consolidated table where each expropriation procedure is linked to its respective project code (commessa), with additional details such as the names of the RPE (Responsible for the Expropriation Procedure) and Assistants assigned to the project. It also displays the authorized budget for each commessa, enabling quick cross-checks between personnel, project scope, and financial dimension.



Procedimento Espropriativo

Commessa	Importo Autorizzato
001AL01	2.142.833,81
002AL02	1.550.000,00
003AL06	1.580.000,00
003AL06-LC	167.347,88
007BI01	1.500.000,00
011CN05	4.123.257,89
012NO02	2.209.134,54
012PS12	200.000,00
014NO05-II	0,00
015NO08	329.213,34
016TO03	2.853.380,54
017TO04	1.482.887,06
019PS13	300.000,00
020PS13A	0,00
020PS13D	88.000,00
020TO09	27.275,31
Totale	37.197.590,28

Figure 17: List of Expropriation Procedures with Related Project Code, Assigned Personnel, and Authorized Amount (Anonymized data. The image is provided for illustrative purposes only).

2. Number of Projects Assigned to Each RPE and Assistant: this KPI provides a count of how many commesse have been assigned to each RPE and assistant. It supports workload analysis and helps the management ensure balanced distribution of responsibilities among personnel.

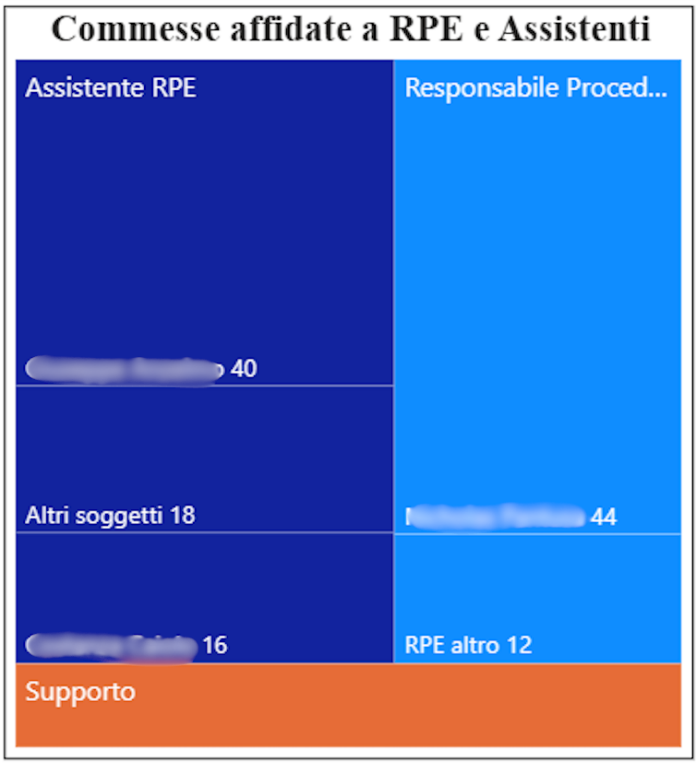


Figure 18: Number of Projects Assigned to Each RPE and Assistant (Anonymized data. The image is provided for illustrative purposes only).

3. Ratio Between Assigned and Authorized Amounts for Land/Property Acquisition: this financial KPI compares the actual amount entrusted to the Ufficio Espropri for acquisition purposes with the initially authorized amount. It serves as an indicator of budget adherence, financial planning accuracy, and project execution control.

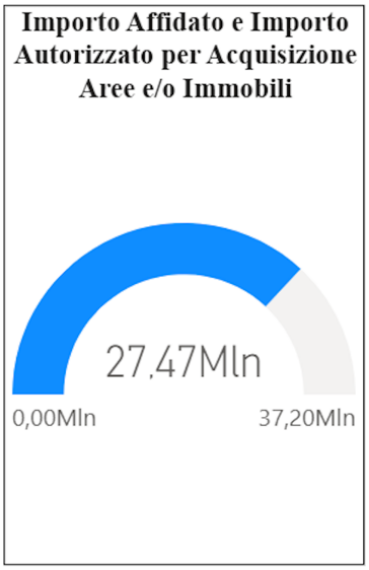


Figure 19: Ratio Between Assigned and Authorized Amounts for Land/Property Acquisition (Anonymized data. The image is provided for illustrative purposes only).

4. Total Number of RPEs: it displays the number of unique individuals holding the role of RPE across all active and closed projects. This metric supports human resource allocation analysis and the evaluation of internal capacity.

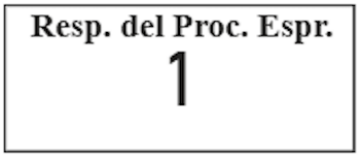


Figure 20: Total Number of RPEs (Anonymized data. The image is provided for illustrative purposes only).

5. Total Number of Beneficiaries (Soggetti): it shows the aggregate number of individuals or entities subject to expropriation across all projects. This KPI offers a perspective on the scale and social impact of ongoing procedures.

Figure 21: Total Number of Beneficiaries (Anonymized data. The image is provided for illustrative purposes only).

6. Total Number of Parcels (Particelle): it reflects the total count of cadastral parcels involved in expropriation activities. It helps quantify the land-related complexity of the procedures.

Figure 22: Total Number of Parcels (Anonymized data. The image is provided for illustrative purposes only).

7. Total Number of Projects (Commesse): it indicates the total number of unique projects handled by the Ufficio Espropri over time. This is a high-level indicator of operational volume.

Figure 23: Total Number of Projects (Anonymized data. The image is provided for illustrative purposes only).

8. Total Number of Ongoing Projects: it counts all commesse currently in progress. It is essential for resource planning and operational scheduling.

Figure 24: Total Number of Ongoing Projects (Anonymized data. The image is provided for illustrative purposes only).

9. Total Number of Projects in Finalization Phase: it tracks projects that have reached the final procedural stages. It allows for forecasting of near-term completions and closure timelines.

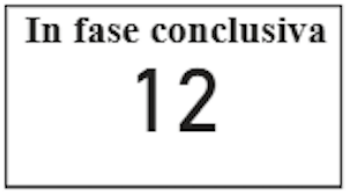


Figure 25: Total Number of Projects in Finalization Phase (Anonymized data. The image is provided for illustrative purposes only).

10. Total Number of Completed Projects: it reports the total number of commesse that have concluded all procedural and administrative phases. This serves as an indicator of output and delivery capacity.

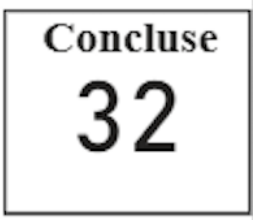


Figure 26: Total Number of Completed Projects (Anonymized data. The image is provided for illustrative purposes only).

11. Number of Expropriation Procedures per Project: it provides a breakdown of how many expropriation procedures are associated with each individual commessa. It supports project complexity analysis.

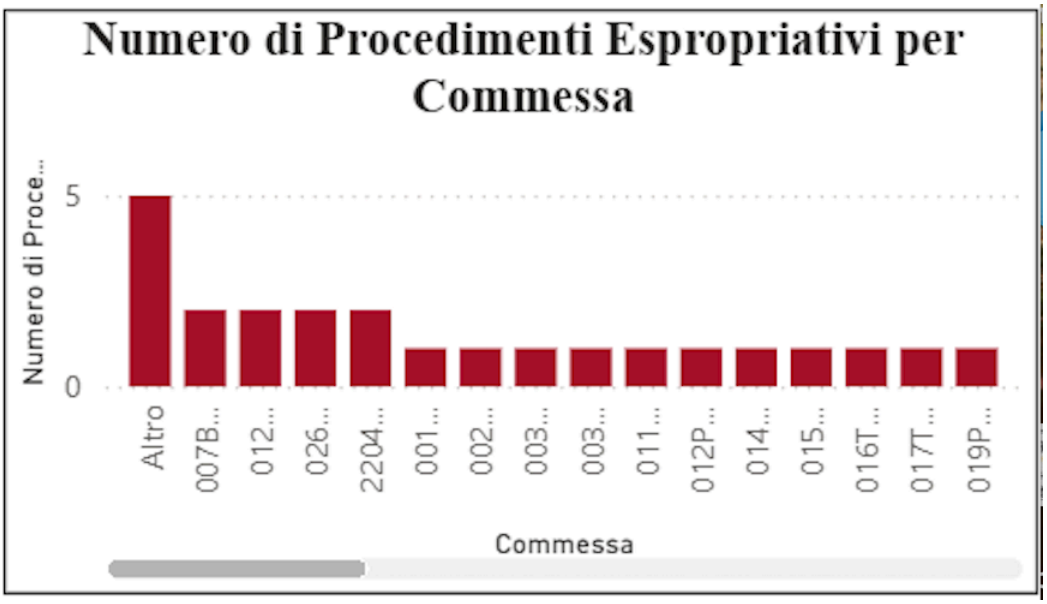


Figure 27: Number of Expropriation Procedures per Project (Anonymized data. The image is provided for illustrative purposes only).

12. List of Completed Phases and Percent Completion per Procedure: this KPI shows which phases of the expropriation process have been completed for each procedure and computes the overall completion percentage based on the number of pending versus executed steps. It enables detailed process tracking and early identification of delays.

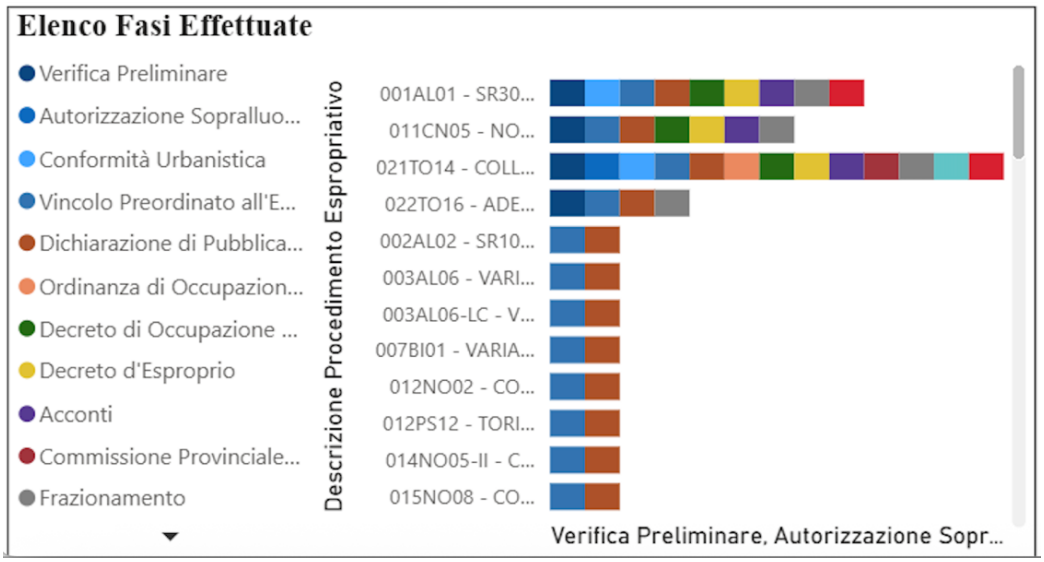


Figure 28: List of Completed Phases and Percent Completion per Procedure (Anonymized data. The image is provided for illustrative purposes only).

13. Operational Territory: it displays a geographical representation of the areas where expropriation activities are taking place. This spatial KPI is critical for understanding regional distribution and logistical considerations.

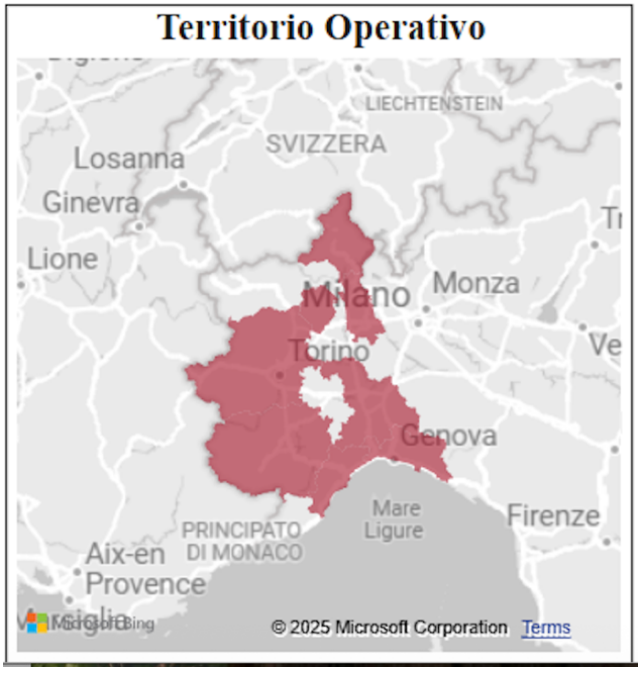


Figure 29: Operational Territory (Anonymized data. The image is provided for illustrative purposes only).

14. Number of Projects per Province: this indicator shows the concentration of projects across provinces, supporting analysis of territorial coverage and identifying any imbalance in regional workloads.

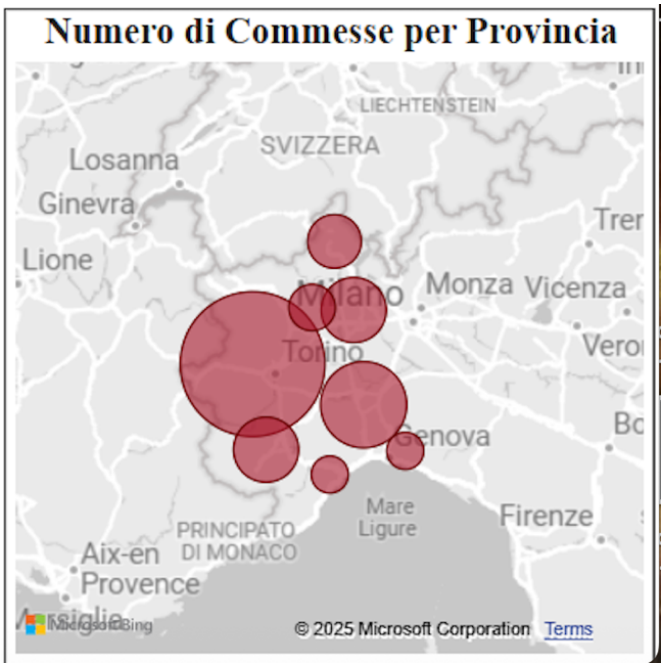


Figure 30: Number of Projects per Province (Anonymized data. The image is provided for illustrative purposes only).

The integration of these KPIs into the Power BI Dashboard offers a strategic advantage to SCR Piemonte's Ufficio Espropri, enabling the transformation of complex procedural data into a clear and actionable performance monitoring system. The dashboard not only ensures real-time visibility over project statuses, resource distribution, financial adherence, and territorial reach, but also fosters a culture of accountability, transparency, and continuous improvement.

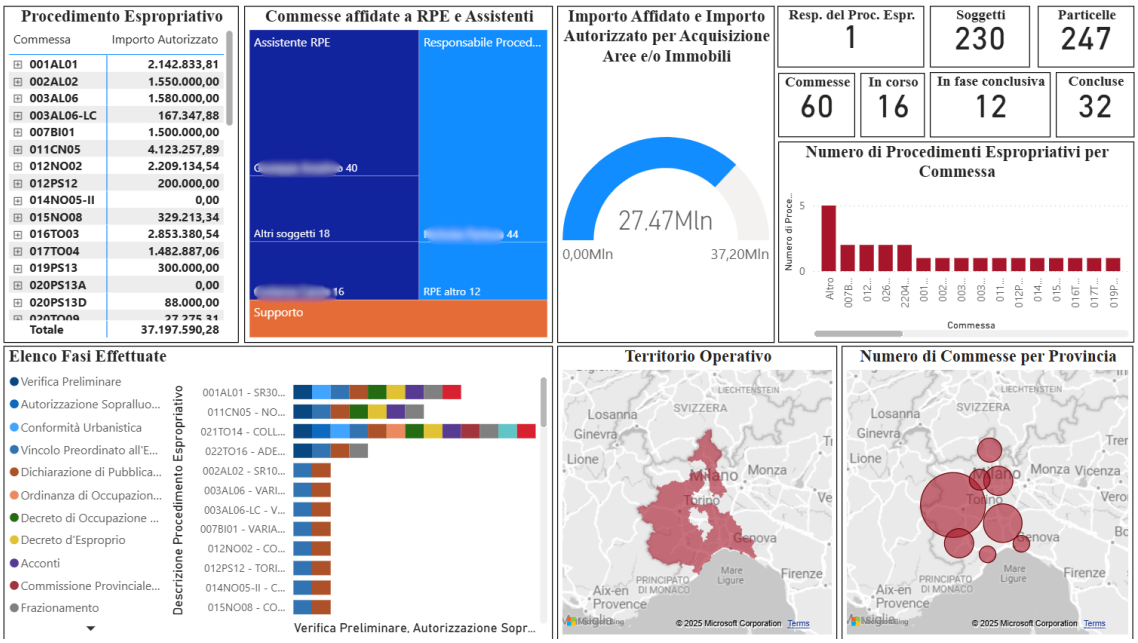


Figure 31: Global Power BI Dashboard about KPI (Anonymized data. The image is provided for illustrative purposes only).

By aligning these indicators with the organization's governance model, the Dashboard becomes a decision-support tool that bridges operational execution with strategic oversight.

Table 3: Technical Specification of KPIs

KPI	Formula	Data Source	Responsibility	Frequency (Assumption)	Thresholds
List of Expropriation Procedures	Direct extraction of all records with project code, RPE, Assistant, and authorized amount	V_E_ElencoProcedimenti + dbo_T_Commesse	Ufficio Espropri	Daily Refresh (Power BI)	Descriptive
Number of Projects Assigned to Each RPE and Assistant	Count of project codes per RPE/Assistant	dbo_T_Commesse + dbo_Dipendenti	RPE	Monthly	Higher is the number of Project for each RPE, higher are the risks
Ratio between Entrusted and Authorized amount	Sum (Importo Affidato)/ Sum(Importo Autorizzato)	dbo_T_Commesse + dbo_L_AccontoSaldo	Ufficio Espropri	Daily	Lower is the Ratio, higher is the risk
Total RPE	Count distinct RPE	dbo_Dipendenti	HR / Ufficio Espropri	Monthly	Descriptive
Total Subjects	Count distinct subjects	dbo_T_Soggetti	Ufficio Espropri	Monthly	Descriptive
Total Parcels	Count distinct parcels	dbo_T_Particelle	Ufficio Espropri	Monthly	Descriptive
Total Projects	Count distinct project codes	dbo_T_Commesse	Ufficio Espropri	Monthly	Descriptive
Ongoing Projects	Count projects with status = "in corso"	dbo_L_StatoAttività + dbo_T_Commesse	Ufficio Espropri	Monthly	Descriptive
Projects in final phase	Count projects with status = "conclusiva"	dbo_L_StatoAttività + dbo_T_Commesse	Ufficio Espropri	Monthly	Descriptive
Concluded Projects	Count projects with status = "conclusa"	dbo_L_StatoAttività + dbo_T_Commesse	Ufficio Espropri	Monthly	Descriptive
Expropriation Procedures per Project	Count procedures linked to each project code	dbo_T_ProcEspropriativi + dbo_T_Commesse	Ufficio Espropri	Daily	Descriptive
Phases Completion	% Completed = (Completed	dbo_T_FasiProc + dbo_L_StatoAttività	Ufficio Espropri	Weekly	Lower is the Completion Percentage,

	phases / Total phases)*100				higher is the risk
Operational Territory	Direct extraction of geographical coverage	dbo_T_Commesse + dbo_Territorio	Ufficio Espropri	Quaterly	Descriptive
Projects per Province	Count projects grouped by province	dbo_T_Commesse + dbo_Territorio	Ufficio Espropri	Quaterly	Descriptive

This structured approach to KPI-driven reporting lays the foundation for an advanced data governance framework and paves the way for deeper integration with methodologies such as the Balanced Scorecard, discussed in the following section.

3.4. Balanced Scorecard

The implementation of a Balanced Scorecard (BSC) approach within the KPI dashboard developed for SCR Piemonte's Ufficio Espropri represents a strategic enhancement of the overall data governance and performance control framework.

Unlike traditional financial-only models, the Balanced Scorecard incorporates both financial and non-financial indicators across four key perspectives: Financial, Customer, Internal Processes, and Learning & Growth. This multidimensional approach is particularly effective in complex public infrastructure contexts, where success depends not only on budgetary efficiency but also on stakeholder satisfaction, process reliability, and organizational capacity building.

In the context of the Ufficio Espropri, the BSC structure has been adapted to reflect the specific operational dynamics of expropriation procedures and their strategic relevance within SCR Piemonte's broader project management system. Each of the four Balanced Scorecard perspectives has been mapped into concrete dimensions of the expropriation workflow and associated KPIs, creating an integrated framework that aligns performance monitoring with strategic priorities.

- Financial Perspective: this dimension focuses on monitoring the Authorized and Entrusted Amounts for Land and Property Acquisition, ensuring that expenditures are aligned with contractual thresholds and legal mandates. This KPI provides immediate insights into the financial control and budgetary discipline of the Ufficio Espropri, contributing to ensuring the economic sustainability of projects and proper resource allocation within the company.

- Customer Perspective: although public administration operates in a non-commercial environment, stakeholder satisfaction remains a critical success factor. In this context, the "customers" include regional authorities, municipalities, and ultimately, citizens affected by the expropriation processes. Indicators related to the Number and Status of concluded expropriation procedures, completion rates of specific legal steps, and adherence to timelines help ensure that the service is delivered with transparency, consistency, and responsiveness to institutional needs. The presence of KPIs

measuring geographic concentration and procedural progressions offers a detailed overview of territorial performance and service coverage.

- Internal Process Perspective: this dimension evaluates the operational efficiency of the expropriation procedures. KPIs such as the number of active commesse, the count of associated parcels and beneficiaries, the status of each procedural phase, and the distribution of workloads among RPEs and assistants allow SCR Piemonte to identify bottlenecks, streamline internal processes, and improve task allocation. The process view provided by the dashboard serves as a real-time performance mirror, allowing both strategic supervisors and technical teams to act on concrete insights.

- Learning & Growth Perspective: although harder to quantify, this perspective addresses organizational development, knowledge retention, and capacity building. Within the Ufficio Espropri, this translates into indicators that support workforce planning and skill deployment, such as the total number of RPEs and assistants involved in each project, and may evolve in the future to include indicators on training, digital proficiency, and operational autonomy. The dashboard infrastructure itself, supported by Power BI, is a manifestation of organizational learning, demonstrating the office's shift toward digital maturity and data-driven culture.

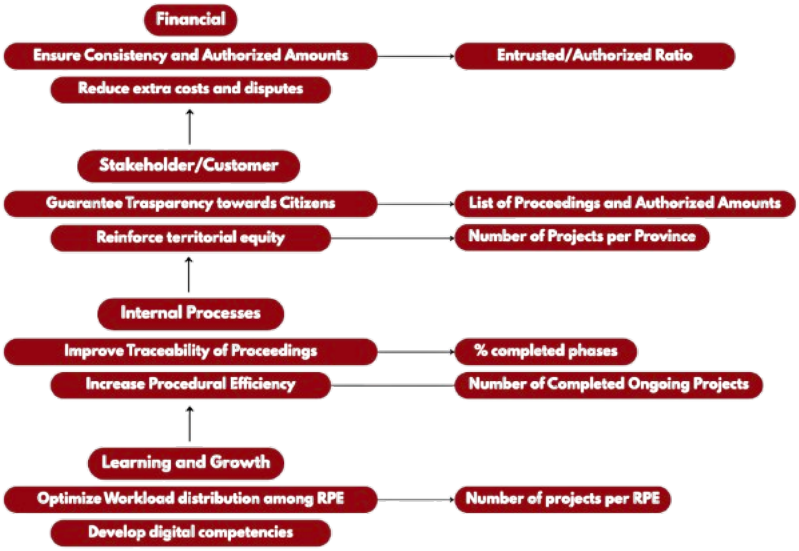


Figure 32: Strategy Map: Financial, Stakeholder/Customer, Internal and Learning Perspectives

The application of the Balanced Scorecard framework provides a structured and coherent lens through which the Ufficio Espropri can not only monitor but also strategically govern its activities. The alignment of KPIs with the BSC perspectives enables a deeper understanding of performance, not just as a set of discrete metrics, but as a dynamic system of interdependent drivers and outcomes. By visualizing the cause-effect relationships across perspectives, the BSC becomes a vital bridge between strategic intent and daily execution.

Through the definition of measurable goals, update frequencies, and threshold values, the system empowers the management to monitor progress, detect deviations, and deploy timely corrective actions. This contributes to reinforcing the principles of continuous improvement, accountability, and public value creation at the heart of SCR Piemonte's institutional mission.

Table 4: BSC Summary

Perspective	Strategic Objective	Key Performance Indicators (KPI)	Expected Outcomes
Financial	Ensure effective use of authorized financial resources for expropriations	Ratio between entrusted and authorized amounts	Cost control, financial efficiency, reduction of budget overruns
		Total authorized budget per commessa	
Customer	Improve transparency, accountability, and satisfaction of institutional stakeholders	Number of concluded procedures	Improved credibility, timely execution, increased trust from public authorities and citizens
		Completion percentage of procedural phases	
		Average duration per commessa	
Internal Processes	Streamline procedural execution and optimize task distribution	Number of active commesse	Process reliability, timely progress, early detection of delays or resource gaps
		Number of parcels, subjects, and expropriation steps	
		RPE/assistant load	

Learning & Growth	Streamline procedural execution and optimize task distribution	Number of RPEs and assistants per commessa	Enhanced decision-making, increased digital maturity, development of a data-driven organizational culture
		Number of monitored processes through dashboard	

All data used within the case study were handled in compliance with the EU General Data Protection Regulation (GDPR). Personal identifiers were anonymized or replaced with synthetic datasets, and all figures or screenshots presented in the thesis are for illustrative purposes only. This methodological choice ensured both the protection of individual privacy and the scientific reliability of the presented results.

4. Results and Discussion

4.1. Evaluation of Database Effectiveness

The effectiveness of a relational database is primarily assessed by examining the degree to which it supports data consistency, logical coherence, functional reliability, and its capacity to respond to real operational needs through efficient querying. In the context of the Expropriation Office of SCR Piemonte S.p.A., the creation of a relational database was conceived as a foundational tool for organizing, storing, and interrogating large volumes of heterogeneous data concerning procedures, commesse, roles, technical activities, and territorial information.

The data model implemented reflects the principles of referential integrity, normalization, and entity-relationship consistency. Each table was designed to represent a specific concept in the expropriation workflow, and relationships were carefully mapped using primary and foreign keys to ensure structural cohesion. Lookup tables (e.g., dbo_L_TipoDecretoEspr, dbo_L_StatoAttività, dbo_L_AccontoSaldo) were introduced to provide classification logic and ensure that enumeration values remain consistent across the dataset.

To verify the practical effectiveness of the database, a series of queries were executed to extract relevant insights, perform aggregations, and support the real-time monitoring of the office's activities. The following examples illustrate the power and reliability of the relational model through its SQL-based interrogability:

1. Querying Progress Status by Activity Phase: using views such as dbo_V_E_Accatastamento, dbo_V_E_DPU, and dbo_V_E_DecretoEspr, the database can compute the level of completion of each procedure based on the advancement of individual technical and administrative steps. The use of JOINs and GROUP BY clauses enables aggregation of data by procedure ID, allowing users to obtain synthetic and comparative progress metrics for dozens of cases at once.

2. Tracking Personnel Assignment Across Projects: through queries on dbo_RelazioneCommesseDipendenti and views like dbo_V_E_AssistentiRPE, it is possible to quickly determine which RPEs and Assistants have been assigned to which commesse, and how workloads are distributed across individuals. This is crucial for assessing personnel efficiency and optimizing task allocation.

3. Financial Monitoring and Gap Analysis: by comparing fields such as importo affidato vs. importo autorizzato stored in the main project-related tables and calculated through specific views, it becomes possible to measure spending progress, highlight underfunded projects, and support financial audits. This evaluation is further refined through calculated fields directly accessible in Power BI.

4. Temporal and Territorial Distribution Analysis: the relational structure makes it possible to filter and group procedures by province or by project year. By leveraging the data stored in dbo_T_ProcEspropriativi and related tables, users can analyze the

concentration of work in specific geographic areas and periods, thus identifying planning bottlenecks or regional overloads.

5. Extracting Key Operational Indicators: views like dbo_V_E_ElencoProcedimenti and dbo_V_E_VerificaAttComplete offer integrated overviews of procedural completeness, combining technical status updates with metadata on project ownership, progress levels, and archival states. These views represent essential building blocks for performance dashboards, as they consolidate information from over 15 operational tables into a single, coherent queryable structure.

The robustness of the data model is also demonstrated by its ability to scale as new types of data become relevant. For instance, new technical steps or decree types can be easily integrated by simply expanding the lookup tables and maintaining referential connections, without disrupting the existing structure. The use of surrogate keys and data type normalization further contributes to data integrity and low redundancy.

The presence of integrity constraints, such as foreign keys, NOT NULL values, and the correct use of bit, int, and datetime2 types, ensures the prevention of erroneous entries and enforces logical coherence throughout the system. In practice, this results in a database that resists corruption, remains stable across transactions, and supports traceability and accountability, especially in sensitive institutional processes like expropriations.

The relational database developed for the Expropriation Office of SCR Piemonte has proven to be both structurally solid and functionally versatile. It supports high-quality data collection, complex analytical reporting, and efficient information retrieval. Its design not only meets current needs but also lays a scalable foundation for future integrations, forming a strategic asset for digital transformation and public data governance.

4.2. Dashboard Analysis and its Impact on SCR Piemonte

The implementation of the dashboard developed through Power BI represents a pivotal advancement in the operational landscape of SCR Piemonte's Ufficio Espropri. By translating raw data into structured visualizations and performance metrics, the dashboard enhances process transparency, enables comprehensive traceability, and fosters more effective internal communication. This system is not only a technological innovation but also an organizational improvement, aligning information accessibility with the strategic and operational goals of the Expropriation Office.

One of the most relevant benefits introduced by the dashboard is Transparency; before its implementation, access to relevant data on the progress of expropriation procedures, the distribution of responsibilities, and financial allocation across projects was fragmented, often stored in different sources, and accessible only to specific personnel. The dashboard centralizes all this information in a unified and dynamic interface. By doing so, it enables stakeholders, RPEs (Responsabili del Procedimento Espropriativo), Assistants, Project

Managers, and Control Units, to gain immediate insights into the state of procedures, the allocation of work, and the completion level of each process phase.

Traceability is another key pillar of the dashboard's impact; thanks to the integration with the relational database and the use of unique identifiers for each commessa, subject, and procedural element, it is possible to track the history, progress, and interactions of each expropriation file over time. This is particularly important in public administration, where accountability and auditability are legal and ethical requirements. The dashboard allows any authorized user to consult detailed procedural records, visualize which phases have been completed or not, and analyze data consistency across records and time frames. The presence of calculated fields and status flags also enables instant recognition of bottlenecks or inconsistencies.

Even in terms of Internal Communication, the dashboard introduces a new level of information sharing between the Ufficio Espropri and other departments within SCR Piemonte; by providing a visual and intuitive representation of complex data structures, the dashboard facilitates interdepartmental collaboration, ensuring that all relevant parties have a shared understanding of current priorities, workloads, and criticalities. This has proven particularly useful in the weekly progress meetings held by the Control Unit, during which the dashboard is consulted in real time to discuss performance metrics, delays, and corrective actions. Furthermore, having an automatically updated system avoids the inefficiencies previously associated with manual reporting or inconsistent spreadsheets.

From a managerial perspective, the decision-making process has also benefited significantly. With the ability to filter KPIs by project, province, phase, or assigned personnel, it becomes easier to perform comparative analyses, identify underperforming areas, and plan strategic reallocations of resources. This is especially important given the highly different nature of expropriation activities, which often vary in complexity, geographical distribution, and legal implications.
The dashboard provides the necessary data granularity to support both operational decisions and strategic decisions, such as how to optimize the workload distribution among RPEs and improve time-to-completion across project categories.

The interaction with the Ufficio Espropri during the development and testing of the dashboard also contributed to its practical value. Several feedback cycles were conducted to refine the visualization logic, the terminology used in the filters, and the format of data presentation. The team expressed appreciation for the clarity and reliability of the dashboard, particularly highlighting how it enables them to communicate progress more effectively to external stakeholders (such as municipalities or regional authorities) and to respond to problems with greater speed and precision. The ability to export snapshots and summaries directly from the dashboard also enhances the efficiency of administrative reporting and documentation processes.

So, the introduction of the Power BI dashboard has not only improved the data literacy and operational visibility of the Ufficio Espropri but has also elevated the overall organizational capability of SCR Piemonte to monitor, evaluate, and optimize its infrastructure-related processes.

This solution exemplifies how Business Intelligence, when aligned with strong data governance principles and grounded in a well-structured relational model, can transform data into actionable knowledge, ensuring that public service processes are more transparent, efficient, and accountable.

4.3. Model Limitations and Possible Improvements

Despite the numerous strengths and tangible benefits offered by the relational database and Business Intelligence architecture developed for the Ufficio Espropri at SCR Piemonte, the project encountered some challenges and limitations that must be critically analyzed.
These constraints, both technical and organizational in nature, highlight opportunities for future improvement and provide a roadmap for enhancing the robustness, scalability, and adaptability of the model over time.

From a technical standpoint, one of the primary limitations concerns the static nature of the source data. Much of the information used in the dashboard originates from existing corporate systems or manually updated repositories.
In some cases, these data sources are not synchronized in real time, which introduces a lag between operational activities and their representation within the reporting system. This latency reduces the responsiveness of the model, especially in dynamic contexts where the state of a procedure can evolve rapidly: a possible improvement would be the development of automated data pipelines capable of integrating data in near-real time through API connections, ETL tools, or cloud-based synchronization platforms.

Another important limitation lies in the granularity of the data; while the model provides a comprehensive view of the expropriation processes, some datasets, such as those related to interactions with external stakeholders, communication timelines, or document-level metadata, remain external to the database and are not fully integrated. This reduces the system's capacity to perform multidimensional analyses or drill-down visualizations that could connect procedural progress to specific communication actions or legal documentation steps. To address this, future development could include the enrichment of the data model with new entities and relationships, enabling deeper process mining and legal traceability.

On the organizational side, one of the challenges faced during the implementation phase was the resistance to change among certain units less familiar with digital tools and data visualization systems. While training sessions and feedback loops were organized, the introduction of a Business Intelligence system inevitably requires a cultural shift, moving from static, document-based reporting to dynamic, data-driven decision-making. Promoting data literacy and developing a continuous training plan could ensure wider adoption and better exploitation of the dashboard's capabilities across all levels of the organization.

Another area for improvement relates to the feedback loop between users and system developers. During the project, improvements to filters, views, and terminology were based on manual consultations and iterative review sessions. In the future, establishing a

systematic feedback mechanism, such as embedded user surveys or interactive suggestions panels within the dashboard interface, could streamline the evolution of the tool in a more agile and user-centered way.

Lastly, considering the potential growth of SCR Piemonte's infrastructure projects, a significant extension of the model would be the implementation of predictive analytics and machine learning modules. By incorporating forecasting algorithms, it would be possible to anticipate procedural delays, resource overloads, or budget overruns before they occur. This proactive dimension of analysis would transform the dashboard from a monitoring tool into a strategic planning instrument, aligned with the long-term goals of public value generation and operational excellence.

So, while the current model constitutes a solid foundation for the digitization and governance of expropriation processes, its limitations trace the path on valuable directions for evolution. Enhancing real-time integration, expanding data scope, empowering user interactivity, and adopting predictive capabilities represent concrete steps toward a more intelligent, resilient, and future-ready system. These improvements would further consolidate the role of Business Intelligence not only as a reporting mechanism but as an integrated pillar of data-driven public management at SCR Piemonte.

Table 5: Limitations and Potential Improvement Summary

Limitation	Impact	Proposed Improvement
Static or delayed data sources	Limits real-time responsiveness and timeliness of reporting	Implement automated ETL pipelines or direct API synchronization for near-real-time updates
Limited data granularity	Inability to analyze communication events and document-level details	Expand the data model with entities tracking communications, document statuses, and timestamps
Fixed, non-customizable KPIs	Dashboard may not meet all stakeholder needs or adapt to evolving priorities	Enable user-driven filtering, scenario simulations, and custom KPI definitions in Power BI
Resistance to digital adoption	Underutilization of the tool by team members less familiar with BI systems	Establish ongoing data literacy training and support programs across all levels
Ad-hoc enhancement feedback process	Risk of slow convergence to optimal solutions	Introduce embedded mechanisms for systematic user feedback and real-time suggestions
Absence of predictive analytics	Lack of forward-looking insights for proactive decision-making	Integrate forecasting models or machine-learning modules to anticipate delays and resource needs

5. Conclusions and Future Developments

5.1. Summary of the Work

This thesis project was conceived and carried out within the strategic and operational framework of SCR Piemonte S.p.A., with the goal of designing and implementing a performance monitoring system to support the activities of the Expropriation Office (Ufficio Espropri). The work is part of a broader digital transformation and data governance initiative driven by the Controllo di Gestione Unit, with the objective of improving transparency, efficiency, and accountability in public infrastructure management.

The project began with an in-depth analysis of the organizational context and the operational functions of the Expropriation Office, identifying the need for a system capable of structuring, monitoring, and evaluating the vast amount of data generated by expropriation procedures across various regional projects. This need led to the foundation for the architectural and functional design of a relational database model specifically tailored to the requirements of the office.

The first major step involved the design and normalization of a relational database using Microsoft Access and SQL Server. The process began with the mapping of all relevant entities, such as expropriation procedures, land parcels, decrees, stakeholders, and internal actors (e.g., RPEs and assistants), and the definition of their interdependencies. Through the use of primary keys, foreign keys, and referential integrity constraints, a consistent and scalable data architecture was developed, allowing for the efficient storage and querying of complex procedural information.

The subsequent phase focused on the integration, cleaning, and transformation of raw data extracted from internal sources. Using structured query language (SQL), ETL operations were performed to import, filter, validate, and normalize datasets from existing corporate systems. This ensured high data quality, structural coherence, and semantic integrity, crucial prerequisites for meaningful performance analysis.

Once the database architecture was validated and populated, attention shifted to the development of a Business Intelligence (BI) environment using Microsoft Power BI. A comprehensive data model was constructed within Power BI, establishing dynamic connections to the relational tables and defining logic for real-time data refresh and dependency management. The aim was to build a system that would not only report performance metrics but also support decision-making and strategic planning.

The central deliverable of the BI implementation phase was the creation of an interactive, multi-page dashboard for monitoring key performance indicators (KPIs) related to expropriation processes. KPI selection was based on relevance, measurability, and strategic alignment with SCR's public service mandate. Indicators were chosen to capture both operational metrics (e.g., number of procedures, procedural phases completed, geographic distribution of projects) and financial metrics (e.g., ratios between authorized and committed budgets).

The dashboard structure was designed to be intuitive and user-friendly, enabling Expropriation Office personnel to explore data through interactive filters and visualizations.

To provide theoretical and strategic depth, the KPI framework was analyzed through the lens of Balanced Scorecard (BSC) methodology. The BSC model allowed for a multi-dimensional perspective that connects financial indicators, internal processes, learning and development, and stakeholder satisfaction. A strategy map was created to represent causal relationships between these perspectives, aligning the tactical activities of the Expropriation Office with broader organizational objectives.

The effectiveness of the solution was assessed in Chapter 4, through a discussion of SQL queries, dashboard usability, and organizational feedback from stakeholders. It was observed that the solution brought significant benefits in terms of data accessibility, process traceability, and internal communication, allowing the office to identify procedural bottlenecks, monitor progress more transparently, and report results to management and public stakeholders more efficiently.

The final section of the thesis focused on a critical reflection on the limitations of the current model and proposed several avenues for improvement. These included the integration of predictive analytics, extension to other departments, automation of data ingestion pipelines, and refinement of the KPI set through iterative feedback loops.

In conclusion, this thesis demonstrates how the structured use of relational databases, SQL, and Business Intelligence tools, combined with a robust governance framework, can contribute to enhancing the transparency, effectiveness, and accountability of public sector functions. The case of SCR Piemonte's Expropriation Office stands as a compelling example of how digital infrastructure can be leveraged to support data-driven decision-making in complex institutional settings.

5.2. Contribution of the Thesis to Quality Engineering

Quality Engineering (QE) is an engineering discipline focused on the design, control, and continuous improvement of quality across organizational processes through the use of analytical methods, digital tools, and structured measurement systems. Initially developed in the manufacturing sector, QE has progressively expanded to services and, more recently, to public administration, driven by the growing demand for transparency, traceability, and accountability in decision-making.
This thesis provides a concrete example of how Quality Engineering can be effectively applied to a complex and highly regulated public context, namely the Expropriation Office of SCR Piemonte S.p.A. It demonstrates how a rigorous, methodical, and engineering-driven approach can significantly enhance the effectiveness and efficiency of performance management.

The first major contribution of this work lies in the development of a coherent relational model for managing and monitoring expropriation procedures. Administrative and legal processes were translated into logical entities, well-defined relationships, and normalized

tables. This structured approach eliminated data fragmentation, minimized redundancy, and ensured referential integrity, core principles of quality-oriented database design.

Through the identification and tracking of Key Performance Indicators (KPIs), developed in collaboration with the Expropriation Office, the project introduced a continuous improvement logic grounded in objective and measurable data. Each KPI was designed based on criteria of relevance, clarity, traceability, and alignment with strategic goals. This system enables real-time feedback, allowing for prompt corrective actions and more proactive process control.

The Business Intelligence component, implemented through Power BI, transformed the information stored in the database into actionable insights. The dashboard developed not only displays the progress of expropriation procedures but also supports strategic planning, resource allocation, accountability tracking, and performance analysis by territory, project, or individual referents. This fosters a data-driven decision-making culture, in full alignment with the principles of Quality Engineering.

A further value of this thesis lies in the cultural impact it had on the organization. The engineering approach introduced concepts of standardization, measurability, procedural formalization, and transparent information sharing. It raised awareness about the importance of quality practices even in a public-sector setting, which is often perceived as bureaucratic and slow to adopt performance-driven logic.

Finally, this project has shown how KPIs can be linked to a strategic framework such as the Balanced Scorecard, extending the contribution of Quality Engineering to strategic planning and governance. By aligning KPIs with the four perspectives of the Balanced Scorecard, Financial, Customer, Internal Process, and Learning & Growth, it became possible to connect operational performance in the Expropriation Office with broader organizational objectives, promoting a holistic and long-term performance orientation.

So, this thesis highlights how Quality Engineering, when applied with methodological consistency and tailored to the public sector, can become a powerful driver of innovation, efficiency, and transparency. The integration of relational databases, Business Intelligence systems, KPI frameworks, and the Balanced Scorecard created a robust ecosystem for performance governance—demonstrating that even public institutions can embrace advanced and modern performance management models without compromising their public service mission.

5.3. Contribution of the Thesis to SCR Piemonte

The contribution of this thesis to SCR Piemonte lies primarily in the provision of a structured, data-driven framework for monitoring and managing the performance of the Expropriation Office. Through the development of a relational database, the design of a set of Key Performance Indicators, and the implementation of a Power BI dashboard, the work has enabled the organization to improve transparency, traceability, and accountability in its processes. The dashboard not only provides a real-time overview of the ongoing projects, but also highlights the workload distribution across RPEs and

assistants, the financial alignment between authorized and assigned amounts, and the progress of the procedural phases.

From an operational standpoint, SCR Piemonte now benefits from a more systematic method to evaluate the efficiency and timeliness of its activities, reducing the reliance on fragmented or manual reporting. The ability to aggregate data at different levels of detail, from individual procedures to the overall territorial distribution of projects, offers the management team a clearer view of resource allocation and project advancement. This represents a significant improvement in internal communication and coordination, facilitating informed decision-making at both tactical and strategic levels.

Moreover, the integration of the Balanced Scorecard logic has provided SCR Piemonte with a broader strategic perspective. By linking financial and procedural indicators with stakeholder satisfaction and organizational learning, the framework allows the company to align day-to-day operational monitoring with long-term strategic objectives. This ensures that the Expropriation Office is not only more efficient in its current processes, but also better positioned to sustain continuous improvement and to contribute to the overall mission of SCR Piemonte as a public infrastructure management entity.

Beyond the organizational benefits, the contribution of this thesis also extends to the public and institutional dimension of SCR Piemonte. By ensuring greater transparency in expropriation procedures and providing traceable, data-based evidence of progress and resource utilization, the developed model strengthens the trust of citizens, municipalities, and regional stakeholders in the fairness and effectiveness of the company's activities. The system supports accountability in the use of public funds, highlighting how resources are allocated and how projects evolve across the territory. In this sense, the thesis not only enhances the internal performance of the Expropriation Office, but also promotes the broader values of openness, reliability, and public service that underpin the role of SCR Piemonte in the regional infrastructure ecosystem.

5.4. Future Developments and Applications

The methodology and tools developed in this thesis, centered on the creation of a KPI-based monitoring system supported by relational databases and Business Intelligence, are not only applicable to the Expropriation Office of SCR Piemonte S.p.A., but can be extended, adapted, and scaled across other departments of the same organization and within other public entities facing similar challenges of performance measurement, data fragmentation, and governance transparency.

One of the most promising directions for future development is the Horizontal Replication of the model across different operational units within SCR Piemonte, such as the Technical Office, Procurement, Legal Affairs, or Project Management. These departments, much like the Expropriation Office, manage complex workflows involving multiple stakeholders, large data volumes, and compliance with regulatory requirements. Implementing similar KPI-oriented dashboards would allow each unit to monitor its activities, improve accountability, and support evidence-based decision-making at both operational and strategic levels.

At the inter-organizational level, the proposed model can be a blueprint for public agencies and regional institutions involved in infrastructure planning, urban development, land acquisition, or administrative services. By adopting a common relational model, standardized performance indicators, and user-friendly dashboards, these institutions could improve interoperability, benchmark their performance, and strengthen cross-institutional coordination. This would also foster policy alignment and regional equity, especially in projects co-funded by national or European programs where measurable impact and transparency are crucial.

In terms of functional enhancements, the system could evolve by integrating real-time alerts and notification systems. For example, the dashboard could be programmed to send automated alerts when KPIs fall below predefined thresholds, when deadlines approach, or when anomalies in the data are detected. Such functionalities would make the tool not just a passive reporting mechanism, but an active performance management system, capable of triggering timely interventions and increasing organizational responsiveness. Moreover, the incorporation of benchmarking capabilities, both internal (between departments) and external (against other public entities), could significantly enhance the strategic value of the dashboard. This would enable continuous comparison of performance, highlight best practices, and identify areas where corrective action is needed. Benchmarking could also support funding allocation, strategic prioritization, and performance-based incentives in public administration.

A particularly exciting frontier lies in the integration of Artificial Intelligence (AI) into the data governance architecture. AI-driven tools such as predictive analytics, anomaly detection, natural language processing, and machine learning-based decision support systems could dramatically extend the intelligence and automation of the current model. For instance:

- Predictive models could forecast delays in expropriation procedures or budget overruns based on historical data patterns.
- NLP could automatically classify and extract key information from unstructured documents, such as legal texts or citizen correspondence.
- AI-powered recommender systems could propose corrective actions or policy adjustments based on real-time data trends.
- Machine learning could continuously improve KPI thresholds and evaluation criteria by learning from outcomes and feedback loops.

This technological evolution would reinforce the alignment between KPI systems, Quality Engineering, and digital transformation agendas, especially in the context of smart public administration. In particular, AI could help shift the paradigm from descriptive analytics (what happened) and diagnostic analytics (why it happened) to predictive and even prescriptive analytics (what will happen and what should be done), offering a genuine leap in public sector performance management.

The model proposed and tested in this thesis not only addresses the current performance monitoring needs of SCR Piemonte's Expropriation Office but also lays the groundwork for a scalable, intelligent, and adaptive architecture capable of evolving in line with

technological advancements and governance demands. Its potential to be generalized, personalized, and enhanced ensures long-term relevance and value for a wide range of public and hybrid organizational contexts.

Table 6: Summary of Potential Future Development and Applications

Development Area	Expected Benefits	Considerations
Extension to other SCR departments	Improved performance monitoring, better coordination, uniform reporting	Adaptation of KPIs to department-specific processes; stakeholder engagement
Application to other public entities	Increased transparency, interoperability, policy harmonization	Institutional buy-in; alignment with existing regulatory and IT frameworks
Real-time alerts and notification systems	Prompt reaction to deviations or risks; proactive management	Definition of alert thresholds; automated data refresh; configuration of alert channels
Internal and external benchmarking	Performance comparison, best practice identification, strategic alignment	Availability of comparable KPI structures; data privacy and sharing agreements
AI-powered predictive analytics	Early detection of delays, budget issues, or bottlenecks	Historical data quality and volume; integration of AI models into the existing BI infrastructure
NLP for unstructured data processing	Automated extraction from legal texts, correspondence, or notes	Availability of training datasets; compliance with data protection standards
Decision-support recommender systems	Data-driven suggestions for corrective actions and prioritization	Advanced analytics modules; scenario modeling capabilities
KPI learning and dynamic thresholding (ML)	Adaptive KPIs based on outcomes and historical feedback	Continuous monitoring loop; capacity to validate AI model decisions
Integration with Smart Public Administration	Alignment with national and EU digital transformation agendas	Alignment with e-government frameworks and interoperability standards (e.g., eIDAS, INSPIRE)

6. Appendices

A. Database Schema: SQL and Access

SQL Data Type Legend

This section provides a technical explanation of the main SQL Server data types used in the relational database developed for managing expropriation procedures at SCR Piemonte S.p.A. The data types are essential for defining the nature, behavior, and validation rules of the stored information. Each type is selected based on the expected content, format, and functional requirements of the corresponding field.

- int
  Represents whole numbers. Commonly used for identifiers (such as primary keys and foreign keys), counters, and numeric codes.
- bigint
  Used for large whole numbers when higher numeric capacity is required. Suitable for fields that may contain very high numeric values.
- smallint
  Stores small whole numbers. Typically used for categorical variables or status codes with limited value sets.
- tinyint
  Designed for very small numeric values. Often used to represent small enumerations or Boolean-like flags.
- bit
  Represents binary values such as true/false or yes/no. Frequently used to indicate the presence or status of a condition or attribute.
- decimal(p,s)
  A precise numeric type that includes a fixed number of digits before and after the decimal point. Ideal for representing monetary values or quantities where precision is critical.
- money / smallmoney
  Specialized numeric types designed specifically for financial data. Useful for fields involving currency or accounting operations.
- datetime2(n)
  Used to store date and time values, including fractional seconds. Appropriate for fields that track timestamps or historical records.
- date
  Stores only calendar dates. Ideal for tracking deadlines, issuance dates, and other date-specific data without time information.

- time(n)
  Stores time of day values, including optional fractional seconds. Useful in contexts where only the time component is relevant.
- char(n)
  A fixed-length character type. Best suited for storing text values with consistent length, such as standard codes or abbreviations.
- varchar(n)
  A variable-length character type. Ideal for general-purpose textual data, especially when the length varies from record to record.
- nvarchar(n)
  A Unicode-compatible variable-length character type. Recommended when the data may include multilingual or accented characters.
- nvarchar(MAX)
  Used for long Unicode text values. Suitable for descriptive fields, detailed notes, and free-form user input.
- varbinary(MAX)
  Used to store large binary data such as files, attachments, images, or scanned documents.
- uniqueidentifier
  Stores globally unique identifiers (GUIDs). Useful for generating non-repeating IDs across systems and ensuring uniqueness.
- xml
  Used for structured data stored in XML format. Appropriate for storing hierarchical or semi-structured content.
- hierarchyid
  Designed to represent positions in a hierarchical structure, such as trees or nested relationships. Enables efficient hierarchical queries.
- geography / geometry
  Specialized data types for storing spatial and geospatial information, such as coordinates, areas, or boundaries. Commonly used in mapping and land management systems.

This classification helps interpret the logical structure of the database and understand how each field contributes to the data model.

SQL Tables

- *dbo_T_D_ArcaElencoCommesse*

Column Name	Data Type	Allow Nulls
ID_Commessa	int	Unchecked
Id_DOCommessa	float	Checked
Cd_DOCommessa	nvarchar(255)	Checked
Descrizione	nvarchar(255)	Checked
DescrizioneBreve	nvarchar(255)	Checked
Cd_CF	nvarchar(255)	Checked
Cd_DOCommessaStato	nvarchar(255)	Checked
DataInizio	datetime2(7)	Checked
DataFinePresunta	datetime2(7)	Checked
DataFineReale	datetime2(7)	Checked
NoteDoCommessa	nvarchar(255)	Checked
UserIns	nvarchar(255)	Checked
UserUpd	nvarchar(255)	Checked
TimeUpd	datetime2(7)	Checked
NoteXML	nvarchar(255)	Checked
Attributi	nvarchar(255)	Checked
xImporto	float	Checked
Sconto	nvarchar(255)	Checked
Provvigione	nvarchar(255)	Checked
CF_Descrizione	nvarchar(255)	Checked
Stato_Descrizione	nvarchar(255)	Checked
Valore_Gestito	money	Checked
[%AvanzamentoTotaleCommessaAl30_06_19]	int	Checked
[%AvanzamentoDellaCommessanel periodo01_01_19-30_06_19]	int	Checked
CentroDiCostoOLD00	int	Checked
CentroDiCostoOLD10	int	Checked
TimeIns	datetime2(7)	Checked
ProgDataAvvioProgettazione	datetime2(7)	Checked
ProgDataPubblicazioneBandoGara	datetime2(7)	Checked
ProgDataAggiudicazioneGara	datetime2(7)	Checked
ProgDataFineEsecuzioneContratto	datetime2(7)	Checked
ProgDataFineCollaudo	datetime2(7)	Checked
ProgDataChiusuraCommessa	datetime2(7)	Checked
DataAvvioProgettazione	datetime2(7)	Checked
DataPubblicazioneBandoGara	datetime2(7)	Checked
DataAggiudicazioneGara	datetime2(7)	Checked
DataFineEsecuzioneContratto	datetime2(7)	Checked
DataFineCollaudo	datetime2(7)	Checked
ChiudereAl31_12_2018	bit	Checked
NoteDirigenteCompetente	nvarchar(255)	Checked
ID_Aggregato	int	Checked
NQuadroEcon	int	Checked
Budget2020Completo	bit	Checked
Valore_Gestito_DaMonitoraggio	money	Checked

VDA_CodiceARCA_Ricavi	nvarchar(255)	Checked
N_Conto	nvarchar(255)	Checked
LavoriConclusi	bit	Checked
Data_SdF	datetime2(7)	Checked
Data_ProgPrel	datetime2(7)	Checked
Data_PDpostCDS	datetime2(7)	Checked
Data_ProgDef	datetime2(7)	Checked
Data_ProgEsec	datetime2(7)	Checked
Espropri	bit	Unchecked
Accatastamenti	bit	Unchecked
Frazionamenti	bit	Unchecked
FP_AttivitaPreviste	ntext	Checked
FP_Criticita	ntext	Checked
FE_Criticita	ntext	Checked
FE_AttivitaPreviste	ntext	Checked
DataInizioLavori	datetime2(7)	Checked
Data_ConsegnaOpera	datetime2(7)	Checked
IpotesiAvanz_dic2020	money	Checked
Data_PPpostCDS	datetime2(7)	Checked
Contenzioso	bit	Checked
Note_FontiFinanziamento	ntext	Checked
Data_InizioProcedimento	datetime2(7)	Checked
N_SAL	int	Checked
Data_SAL	datetime2(7)	Checked
Importo_SAL	money	Checked
Perc_SAL	float	Checked
Avanz_31_12_19	money	Checked
Avanz_31_12_20	money	Checked
Perc_AvanzLavori	float	Checked
Data_Programma_InizProg	datetime2(7)	Checked
Data_Programma_SdF	datetime2(7)	Checked
Data_Programma_ProgPrel	datetime2(7)	Checked
Data_Programma_PPpostCDS	datetime2(7)	Checked
Data_Programma_ProgDef	datetime2(7)	Checked
Data_Programma_PDpostCDS	datetime2(7)	Checked
Data_Programma_ProgEsec	datetime2(7)	Checked
Data_Programma_InizioLavori	datetime2(7)	Checked
EscludereDaPianoAttivita	bit	Checked
Data_ProgrammaBL_InizProg	datetime2(7)	Checked
Data_ProgrammaBL_SdF	datetime2(7)	Checked
Data_ProgrammaBL_ProgPrel	datetime2(7)	Checked
Data_ProgrammaBL_PPpostCDS	datetime2(7)	Checked
Data_ProgrammaBL_ProgDef	datetime2(7)	Checked
Data_ProgrammaBL_PDpostCDS	datetime2(7)	Checked
Data_ProgrammaBL_ProgEsec	datetime2(7)	Checked
Data_ProgrammaBL_InizioLavori	datetime2(7)	Checked
Data_ProgrammaBL_FineEsecuzioneContratto	datetime2(7)	Checked
Data_ProgrammaBL_FineCollaudo	datetime2(7)	Checked
CentroDiCostoOLD20	int	Checked
CodiceUnicoProgetto	nvarchar(50)	Checked
Longitudine	float	Checked
Latitudine	float	Checked
NAggregato_Bertora	int	Checked
ID_AggregatoPanelClienti	int	Checked
ID_TipoInfrastruttura	int	Checked
ID_TipoInterventoEdilizio	int	Checked
LavoriInCorso	bit	Unchecked
DirezioneLavori	bit	Unchecked

- *dbo_Dipendenti*

Column Name	Data Type	Allow Nulls
ID_Dipendenti	int	Unchecked
Societa	nvarchar(50)	Checked
Cognome	nvarchar(50)	Checked
Nome	nvarchar(50)	Checked
IndirizzoPostaElettronica	nvarchar(50)	Checked
Posizione	nvarchar(50)	Checked
TelefonoUff	nvarchar(25)	Checked
TelefonoAb	nvarchar(25)	Checked
TelCellulare	nvarchar(25)	Checked
Fax	nvarchar(25)	Checked
Indirizzo	ntext	Checked
Citta	nvarchar(50)	Checked
Provincia	nvarchar(50)	Checked
CAP	nvarchar(15)	Checked
Paese	nvarchar(50)	Checked
PaginaWeb	ntext	Checked
Note	ntext	Checked
Allegati	ntext	Checked
LivelloOLD	nvarchar(50)	Checked
CFdip	nvarchar(255)	Checked
Password	nvarchar(255)	Checked
UserLogin	nvarchar(255)	Checked
UserLevel	int	Checked
UserLevelGare	datetime2(7)	Checked
Genere	nvarchar(255)	Checked
UserLevelBudget	int	Checked
UserLevelRicaviTrim	int	Checked
UserLevelCostiTrim	int	Checked
RichiedereCosti	bit	Checked
RichiedereRicavi	bit	Checked
Password1	nvarchar(255)	Checked
Livello	int	Checked
AttivitaLavoro	int	Checked
CognomeNome		Checked
Titolo	nchar(10)	Checked
TipologiaLaurea	nchar(50)	Checked
DataConseguimentoTitolo	datetime2(7)	Checked
DataAbilitazione	datetime2(7)	Checked
Abilitazione	bit	Unchecked
IscrizioneOrdine	bit	Unchecked

- *dbo_L_AccontoSaldo*

Column Name	Data Type	Allow Nulls
ID_AccontoSaldo	int	Unchecked
Descr_AccontoSaldo	nchar(10)	Checked

- *dbo_L_StatoAttività*

Column Name	Data Type	Allow Nulls
ID_StatoAttivita	int	Unchecked
StatoAttivita	nvarchar(50)	Checked

- *dbo_L_TipoDecretoEspr*

Column Name	Data Type	Allow Nulls
ID_TipoDecretoEspr	int	Unchecked
DescrizioneTipoDecretoEspr	nvarchar(100)	Checked
DurataMesiTipoDecretoEspr	int	Checked

- *dbo_L_TipoDecretoTUE*

Column Name	Data Type	Allow Nulls
ID_TipoDecretoTUE	int	Unchecked
Descrizione_TipoDecretoTUE	nvarchar(100)	Checked

- *dbo_RelazioneCommesseDipendenti*

Column Name	Data Type	Allow Nulls
[ID Rel]	int	Unchecked
[ID Dipendente]	int	Checked
[ID Commessa]	int	Checked
RuoloOLD	nvarchar(50)	Checked
DataInserimento	datetime2(7)	Checked
Ruolo	int	Checked

- *dbo_T_Accatastamento*

Column Name	Data Type	Allow Nulls
ID_Accatastamento	int	Unchecked
DataAccatastamento	datetime2(7)	Checked
PercentualeAccatastamentoSuTot	float	Checked
ID_ProcEsporpriativi	int	Checked

- *dbo_T_AccontoE_SaldiEspr*

Column Name	Data Type	Allow Nulls
ID_AccontoESaldiEspr	int	Unchecked
N_AccontoESaldiEspr	int	Checked
DataAccontoESaldiEspr	datetime2(7)	Checked
ID_ProcEsporpriativi	int	Checked
DocAccontoESaldiEspr	varbinary(MAX)	Checked
ID_TipoAtto	int	Checked
Perc_AccontoESaldiEspr	tinyint	Checked
ID_AccontoSaldo	int	Checked

- *dbo_T_AutSoprPrel*

Column Name	Data Type	Allow Nulls
ID_AutSoprPrel	int	Unchecked
N_AutSoprPrel	int	Checked
DataAutSoprPrel	datetime2(7)	Checked
ID_ProcEsporpriativi	int	Checked
DocAutSoprPrel	varbinary(MAX)	Checked

- *dbo_T_CommProvEspr*

Column Name	Data Type	Allow Nulls
ID_CommProvEspr	int	Unchecked
N_CommProvEspr	int	Checked
DataRichCommProvEspr	datetime2(7)	Checked
DataRispCommProvEspr	datetime2(7)	Checked
ID_ProcEsporpriativi	int	Checked
DocRichCommProvEspr	varbinary(MAX)	Checked
DurataGiorniCommProvEspr	int	Checked
DocRispCommProvEspr	varbinary(MAX)	Checked

- *dbo_T_ConfUrb*

Column Name	Data Type	Allow Nulls
ID_ProtConfUrb	int	Unchecked
Prot	int	Checked
DataConfUrb	datetime2(7)	Checked
ComuneConfUrb	nvarchar(50)	Checked
ID_ProcEsporpriativi	int	Checked
DocConfUrb	varbinary(MAX)	Checked

- *dbo_T_DecretoEspr*

Column Name	Data Type	Allow Nulls
ID_DecretoEspr	int	Unchecked
N_DecretoEspr	int	Checked
DataDecretoEspr	datetime2(7)	Checked
ID_TipoDecretoEspr	int	Checked
ID_ProcEsporpriativi	int	Checked
DocDecretoEspr	varbinary(MAX)	Checked
ID_TipoDecretoTUE	int	Checked
Correzione_DecretoEspr	bit	Unchecked
ImmissionePossesso	bit	Unchecked
Registrazione	int	Unchecked
Voltura	int	Unchecked
Trascrizione	int	Unchecked
Notifica	int	Unchecked

- *dbo_T_DecretoOccUrgenza*

Column Name	Data Type	Allow Nulls
ID_DecretoOccUrgenza	int	Unchecked
N_DecretoOccUrgenza	int	Checked
DataDecretoOccUrgenza	datetime2(7)	Checked
DurataMesiDecretoOccUrgenza	int	Checked
ID_ProcEsporpriativi	int	Checked
DocDecretoOccUrgenza	varbinary(MAX)	Checked
ID_TipoDecretoTUE	int	Checked
ImmissionePossesso	bit	Unchecked

- *dbo_T_DichiarazionePU*

Column Name	Data Type	Allow Nulls
ID_DichiarazionePU	int	Unchecked
N_DichiarazionePU	int	Checked
DataDichiarazionePU	datetime2(7)	Checked
DurataAnniDichiarazionePU	int	Checked
ID_ProcEsporpriativi	int	Checked
DocDichiarazionePU	varbinary(MAX)	Checked

- *dbo_T_Frazionamento*

Column Name	Data Type	Allow Nulls
ID_Frazionamento	int	Unchecked
DataFrazionamento	datetime2(7)	Checked
PercentualeFrazionamentoSuTot	float	Checked
ID_ProcEsporpriativi	int	Checked

- *dbo_T_OrdinanzaOccupazTemp*

Column Name	Data Type	Allow Nulls
ID_OrdinanzaOccupazionaleTemp	int	Unchecked
N_OrdinanzaOccupazionaleTemp	int	Checked
DataOrdinanzaOccupazionaleTemp	datetime2(7)	Checked
ID_ProcEsporpriativi	int	Checked
DocOrdinanzaOccupazionaleTemp	varbinary(MAX)	Checked
ImmissionePossesso	bit	Unchecked

- *dbo_T_PercAvanzamentoAttEspr*

Column Name	Data Type	Allow Nulls
ID_PercAvanzamentoAttEspr	int	Unchecked
AttivitaAvanzamentoEspr	nvarchar(50)	Checked
PercentualeAvanzamentoEspr	float	Checked

- *dbo_T_ProcEspropriativi*

Column Name	Data Type	Allow Nulls
ID_ProcEsporpriativi	int	Unchecked
ImmissionePossesso	bit	Unchecked
AvanzamentoGenerale	decimal(5, 2)	Checked
Note	nvarchar(MAX)	Checked
ArchiviazioneProcedimento	int	Checked
ID_Commessa	int	Checked
DescrizioneProcEsporpriativi	nvarchar(150)	Checked
Soggetti	int	Checked
Particelle	int	Checked
PercM_VPE	float	Checked
PercM_DPU	float	Checked
PercM_ConformUrb	float	Checked
PercM_DecrOccUrg	float	Checked
PercM_DecrEspr	float	Checked
PercM_DecrCorr	float	Checked
PercM_OrdinOccTemp	float	Checked
PercM_CommProv	float	Checked
PercM_Acconto	float	Checked

- *dbo_T_Ruolo*

Column Name	Data Type	Allow Nulls
ID_Ruolo	int	Unchecked
Descrizione_Ruolo	nvarchar(255)	Checked

- *dbo_T_VincoloPrordEspr*

Column Name	Data Type	Allow Nulls
ID_VincoloPrordEspr	int	Unchecked
N_VincoloPrordEspr	int	Checked
DataVincoloPrordEspr	datetime2(7)	Checked
DurataAnniVincoloPrordEspr	int	Checked
ID_ProcEsporpriativi	int	Checked
DocVincoloPrordEspr	varbinary(MAX)	Checked

SQL Syntax Legend

This section provides a technical overview of the main SQL (Structured Query Language) commands and functions employed in the relational database designed for the Expropriation Office at SCR Piemonte S.p.A. Each keyword or expression plays a specific role in querying, manipulating, or aggregating data. Understanding these components is fundamental for interpreting the logic behind views, stored procedures, and reporting queries used within the system.

- SELECT
  Retrieves data from one or more tables. It defines the columns or expressions to be included in the query result set.

- FROM
  Indicates the source table(s) from which data is to be queried. It is essential for establishing the base of the query.

- WHERE
  Filters rows based on specific conditions. Only the records that meet the defined criteria will be returned.

- GROUP BY
  Aggregates data based on one or more columns. It is used in conjunction with aggregate functions (e.g., COUNT, SUM) to summarize data across groups.

- HAVING
  Applies filtering conditions to groups formed by the GROUP BY clause. It is used to restrict grouped results based on aggregate values.

- JOIN / INNER JOIN / LEFT JOIN / RIGHT JOIN / FULL JOIN
  Combines rows from two or more tables based on a related column between them. The type of join determines which records are included based on matching or non-matching keys.

- ON
  Specifies the condition used to match rows between joined tables. Typically defines the foreign key and primary key relationship.

- COUNT()
  An aggregate function that returns the number of rows matching a condition. Often used to calculate the volume of records within a group.

- SUM()
  Calculates the total of a numeric column across the result set or group.

- AVG()
  Computes the average value of a numeric column.

- MAX() / MIN()
  Returns the highest or lowest value found in a column, respectively.

- AS
  Assigns an alias to a column or table, allowing for clearer or more user-friendly naming in the result set.

- ORDER BY
  Sorts the query results by one or more columns, either in ascending (default) or descending order.

- DISTINCT
  Eliminates duplicate rows from the result set, returning only unique combinations of selected columns.

- CASE WHEN THEN ELSE END
  Implements conditional logic directly within a SQL query. It allows the transformation of values based on logical conditions.

- ISNULL() / COALESCE()
  Returns a substitute value when a NULL is encountered. Useful for ensuring data completeness in outputs.

- IN / NOT IN
  Tests whether a column's value matches (or does not match) any value in a specified list.

- LIKE / NOT LIKE
  Enables pattern-based text matching, commonly used with wildcards to search for substrings within text fields.

- UNION / UNION ALL
  Combines the results of two or more SELECT statements into a single result set. UNION removes duplicates, while UNION ALL includes all records.

- TOP (n)
  Limits the number of rows returned by a query. Often used for previewing a dataset or returning the most recent entries.

- EXISTS / NOT EXISTS
  Checks for the existence of rows returned by a subquery. Frequently used to validate relationships between datasets.

- SUBQUERY (Nested SELECT)
  A query embedded within another SQL statement. Used to calculate intermediate values or dynamically filter data.

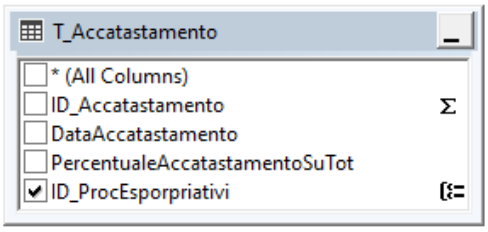
- VIEW
  A virtual table defined by a SQL query. Views simplify access to complex queries and serve as reusable components for reporting and dashboards.

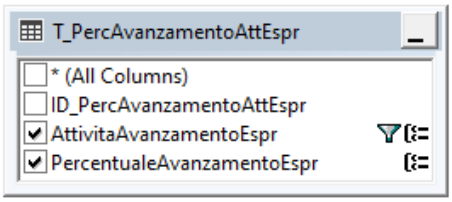
These SQL expressions form the backbone of the database's logic and reporting architecture.

SQL Views

- *dbo_V_E_Accatastamento*

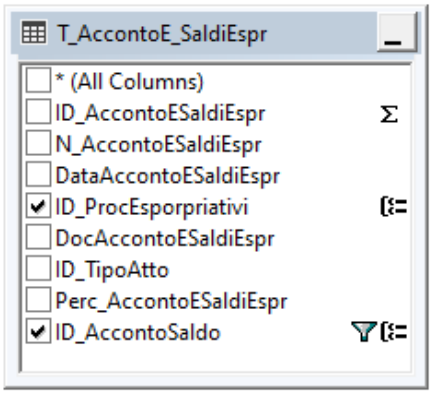
```
SELECT       COUNT(dbo.T_Accatastamento.ID_Accatastamento) AS
ConteggioDiID_Accatastamento, dbo.T_Accatastamento.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS
PercAccatastamento,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM         dbo.T_Accatastamento CROSS JOIN
dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_Accatastamento.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'Accatastamento')
```

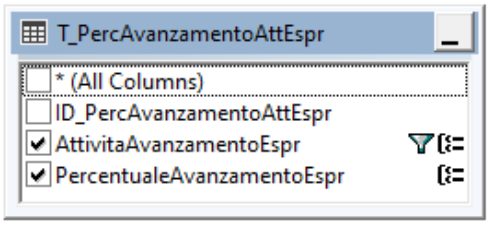




- *dbo_V_E_Acconti*

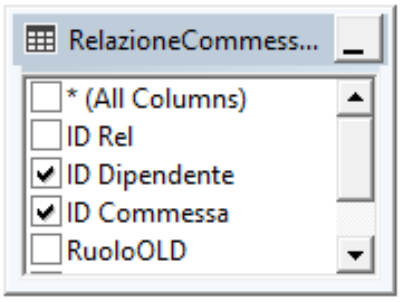
```
SELECT       COUNT(dbo.T_AccontoE_SaldiEspr.ID_AccontoESaldiEspr) AS
Conteggio_ID_Acconti, dbo.T_AccontoE_SaldiEspr.ID_ProcEsporpriativi,
dbo.T_AccontoE_SaldiEspr.ID_AccontoSaldo,
                  dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr
AS PercAcconto, dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM         dbo.T_AccontoE_SaldiEspr CROSS JOIN
                  dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_AccontoE_SaldiEspr.ID_ProcEsporpriativi,
dbo.T_AccontoE_SaldiEspr.ID_AccontoSaldo,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_AccontoE_SaldiEspr.ID_AccontoSaldo = 1) AND
(dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr = 'Acconto
Pagato')
```





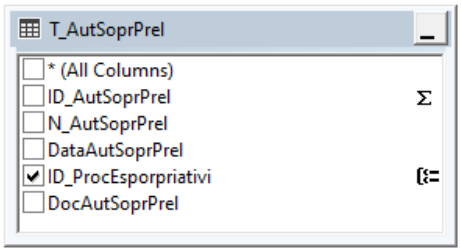
- *dbo_V_E_AssistentiRPE*

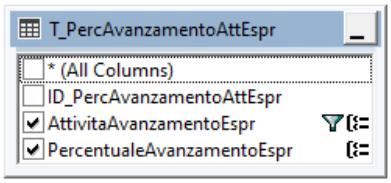
```
SELECT      [ID Dipendente], [ID Commessa], DataInserimento, Ruolo
FROM        dbo.RelazioneCommesseDipendenti
WHERE       (Ruolo = 10)
```



- *dbo_V_E_AutSoprPrel*

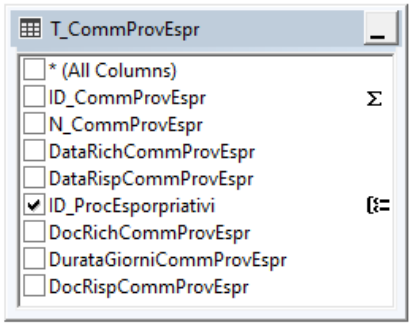
```
SELECT      COUNT(dbo.T_AutSoprPrel.ID_AutSoprPrel) AS
ConteggioDiID_AutSoprPrel, dbo.T_AutSoprPrel.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr,
                  dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr
AS PercAutSoprPrel
FROM        dbo.T_AutSoprPrel CROSS JOIN
                  dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_AutSoprPrel.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr
HAVING      (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
N'Autorizzazione sopralluogo preliminare')
```

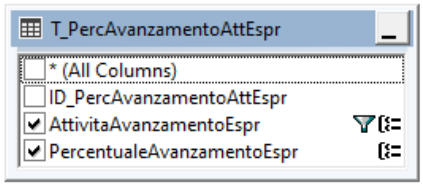




- *dbo_V_E_CommProvEspr*

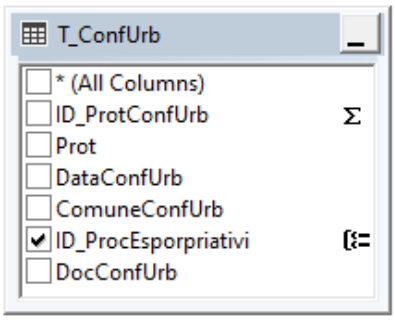
```
SELECT       COUNT(dbo.T_CommProvEspr.ID_CommProvEspr) AS
ConteggioDiID_CommProvEspr, dbo.T_CommProvEspr.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS
PercCommProvEspr,
                      dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM          dbo.T_CommProvEspr CROSS JOIN
                      dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_CommProvEspr.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'Commissione Prov. Espropri')
```

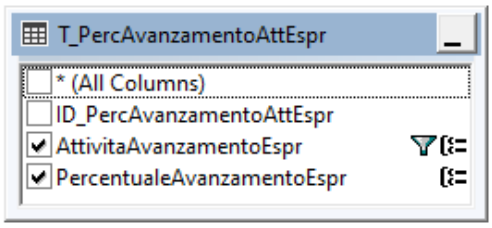




- *dbo_V_E_ConfUrb*

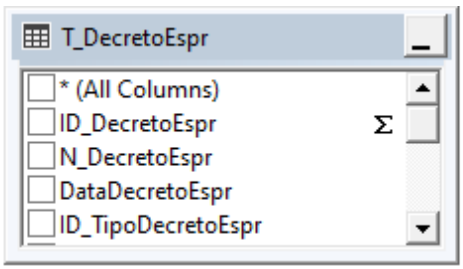
```
SELECT       COUNT(dbo.T_ConfUrb.ID_ProtConfUrb) AS
ConteggioDiID_ProtConfUrb, dbo.T_ConfUrb.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS
PercConfUrb,
                      dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM          dbo.T_ConfUrb CROSS JOIN
                      dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_ConfUrb.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'Conformità Urbanistica')
```

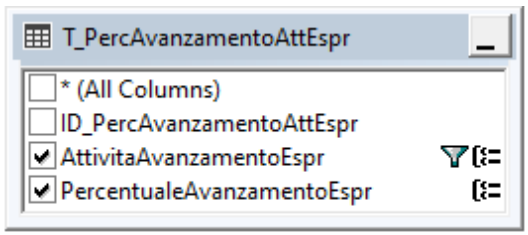




- *dbo_V_E_DecretoEspr*

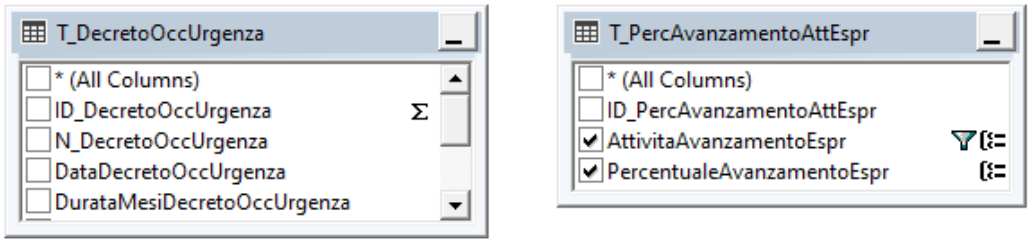
```
SELECT       COUNT(dbo.T_DecretoEspr.ID_DecretoEspr) AS
ConteggioDiID_DecretoEspr, dbo.T_DecretoEspr.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS
PercDecretoEspr,
                      dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM          dbo.T_DecretoEspr CROSS JOIN
                      dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_DecretoEspr.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'Decreto d''Esproprio')
```





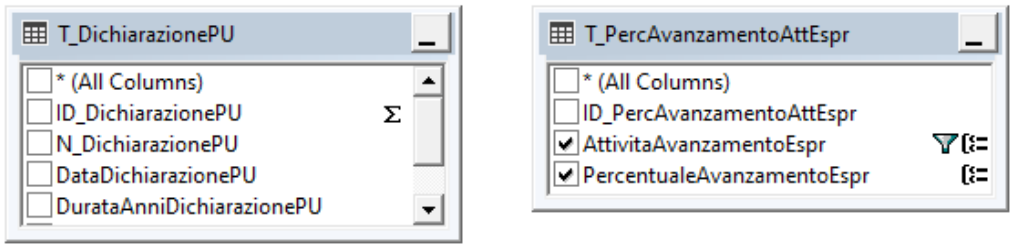
- *dbo_V_E_DecretoOccUrgenza*

```
SELECT       COUNT(dbo.T_DecretoOccUrgenza.ID_DecretoOccUrgenza) AS
ConteggioDiID_DecretoOccUrgenza,
dbo.T_DecretoOccUrgenza.ID_ProcEsporpriativi,
                      dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr
AS PercDecretoOccUrgenza,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM          dbo.T_DecretoOccUrgenza CROSS JOIN
                      dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_DecretoOccUrgenza.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'Decreto d''Occupazione Urgenza')
```



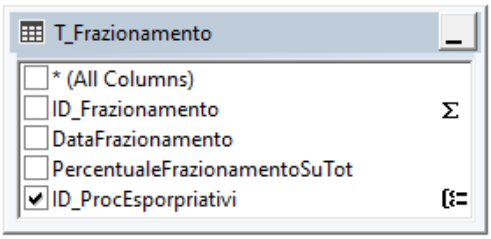
- *dbo_V_E_DPU*

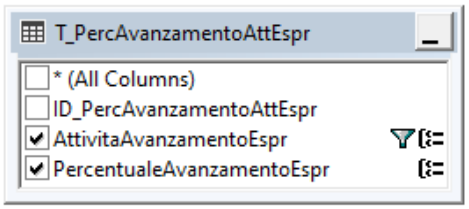
```
SELECT       COUNT(dbo.T_DichiarazionePU.ID_DichiarazionePU) AS
ConteggioDiID_DichiarazionePU,
dbo.T_DichiarazionePU.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS PercDPU,
                    dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM          dbo.T_DichiarazionePU CROSS JOIN
                    dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_DichiarazionePU.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'DPU')
```



- *dbo_V_E_Frazionamento*

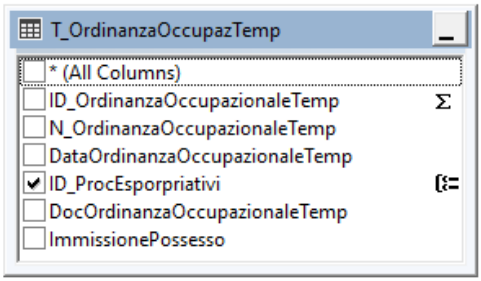
```
SELECT       COUNT(dbo.T_Frazionamento.ID_Frazionamento) AS
ConteggioDiID_Frazionamento, dbo.T_Frazionamento.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS
PercFrazionamento,
                    dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM          dbo.T_Frazionamento CROSS JOIN
                    dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_Frazionamento.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'Frazionamento')
```

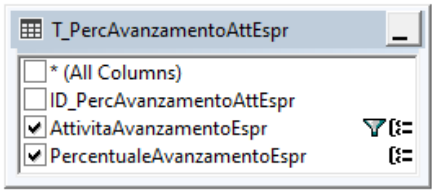




- *dbo_V_E_OrdinanzaOccupazTemp*

```
SELECT
COUNT(dbo.T_OrdinanzaOccupazTemp.ID_OrdinanzaOccupazionaleTemp)
AS ConteggioDiID_OrdinanzaOccupazionaleTemp,
dbo.T_OrdinanzaOccupazTemp.ID_ProcEsporpriativi,
                dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr
AS PercOrdinanzaOccTemp,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM        dbo.T_OrdinanzaOccupazTemp CROSS JOIN
                dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_OrdinanzaOccupazTemp.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING      (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'Ordinanza Occ. Temporanea')
```





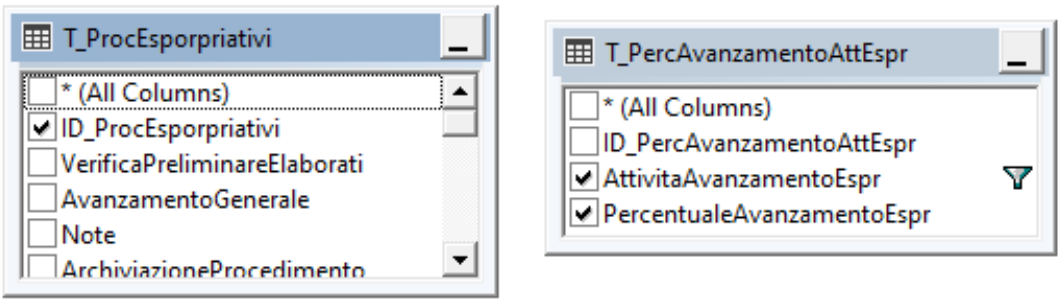
- *dbo_V_E_Saldi*

```
SELECT      COUNT(dbo.T_AccontoE_SaldiEspr.ID_AccontoESaldiEspr) AS
Conteggio_ID_Saldi, dbo.T_AccontoE_SaldiEspr.ID_ProcEsporpriativi,
dbo.T_AccontoE_SaldiEspr.ID_AccontoSaldo,
                dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr
AS PercSaldo, dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM        dbo.T_AccontoE_SaldiEspr CROSS JOIN
                dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_AccontoE_SaldiEspr.ID_ProcEsporpriativi,
dbo.T_AccontoE_SaldiEspr.ID_AccontoSaldo,
```

```
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING      (dbo.T_AccontoE_SaldiEspr.ID_AccontoSaldo = 2) AND
(dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr = 'Saldo Pagato')
```

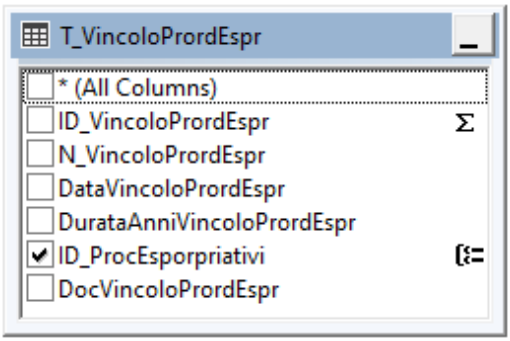
- *dbo_V_E_VerificaPreliminare*

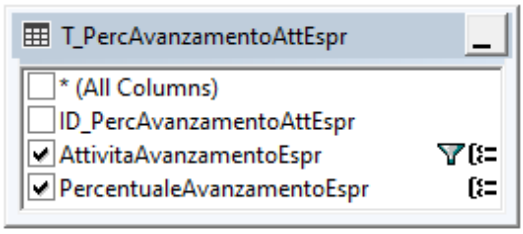
```
SELECT      dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS
PercVerificaPreliminare,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM        dbo.T_ProcEsporpriativi CROSS JOIN
                  dbo.T_PercAvanzamentoAttEspr
WHERE       (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
N'Verifica preliminare elaborati')
```



- *dbo_V_E_VincoloProcEspr*

```
SELECT      COUNT(dbo.T_VincoloPrordEspr.ID_VincoloPrordEspr) AS
ConteggioDiID_VincoloPrordEspr,
dbo.T_VincoloPrordEspr.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr AS PercVPE,
                  dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
FROM        dbo.T_VincoloPrordEspr CROSS JOIN
                  dbo.T_PercAvanzamentoAttEspr
GROUP BY dbo.T_VincoloPrordEspr.ID_ProcEsporpriativi,
dbo.T_PercAvanzamentoAttEspr.PercentualeAvanzamentoEspr,
dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr
HAVING      (dbo.T_PercAvanzamentoAttEspr.AttivitaAvanzamentoEspr =
'VPE')
```

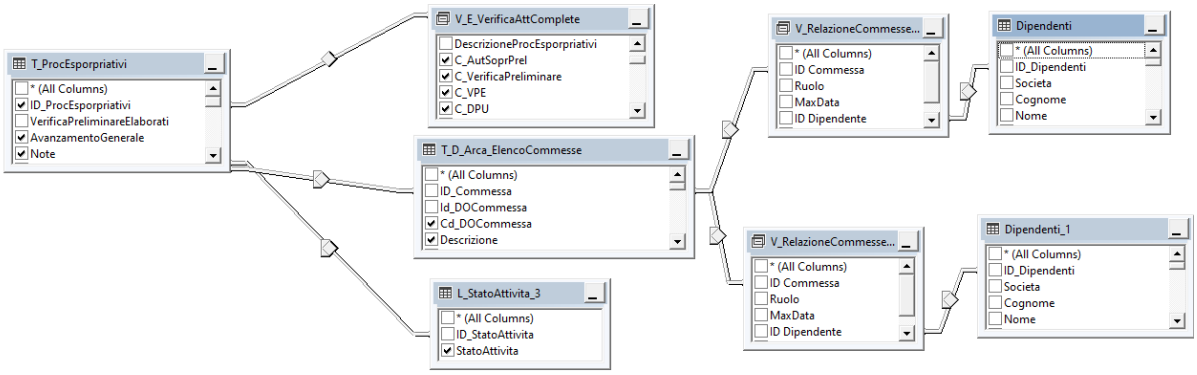




- *dbo_V_E_ElencoProcedimenti*

```
SELECT       dbo.T_D_Arca_ElencoCommesse.Cd_DOCommessa,
dbo.T_D_Arca_ElencoCommesse.Descrizione, dbo.Dipendenti.CognomeNome
AS [Responsabile del Procedimento],
                  Dipendenti_1.CognomeNome AS [Responsabile del
Procedimento Espropriativo], dbo.T_ProcEsporpriativi.AvanzamentoGenerale,
dbo.T_ProcEsporpriativi.Note,
dbo.T_ProcEsporpriativi.ArchiviazioneProcedimento,
                  dbo.T_ProcEsporpriativi.ID_Commessa,
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi,
dbo.T_ProcEsporpriativi.DescrizioneProcEsporpriativi,
dbo.V_E_VerificaAttComplete.C_VPE,
dbo.V_E_VerificaAttComplete.C_DPU,
                  dbo.V_E_VerificaAttComplete.C_ConfUrb,
dbo.V_E_VerificaAttComplete.C_DecretoOccUrgenza,
dbo.V_E_VerificaAttComplete.C_DecretoEspr,
dbo.V_E_VerificaAttComplete.C_OrdinanzaOccupazTemp,
                  dbo.V_E_VerificaAttComplete.C_CommProvEspr,
dbo.V_E_VerificaAttComplete.C_Frazionamento,
dbo.V_E_VerificaAttComplete.C_Accatastamento,
dbo.V_E_VerificaAttComplete.C_Acconti,
dbo.V_E_VerificaAttComplete.C_Saldi,
                  dbo.T_ProcEsporpriativi.PercM_DecrCorr, CASE WHEN
[AvanzamentoGenerale] IS NOT NULL THEN [AvanzamentoGenerale] ELSE
ISNULL([T_VPE], 0) + ISNULL([T_DPU], 0) + ISNULL([T_ConfUrb], 0)
                  + ISNULL([T_DecretoOccUrgenza], 0) +
ISNULL([T_DecretoEspr], 0) + ISNULL([T_OrdinanzaOccupazTemp], 0) +
ISNULL([T_CommProvEspr], 0) + ISNULL([T_Frazionamento], 0) +
ISNULL([T_Accatastamento], 0)
                  + ISNULL([T_Acconti], 0) + ISNULL([T_Saldi], 0) +
ISNULL([T_VerificaPreliminare], 0) + ISNULL([T_AutSoprPrel], 0) END AS
PercTOT, L_StatoAttivita_3.StatoAttivita AS StatoArchiv,
                  dbo.V_E_VerificaAttComplete.C_VerificaPreliminare,
dbo.V_E_VerificaAttComplete.C_AutSoprPrel
FROM         dbo.L_StatoAttivita AS L_StatoAttivita_3 RIGHT OUTER JOIN
                  dbo.Dipendenti AS Dipendenti_1 RIGHT OUTER JOIN
                  dbo.V_RelazioneCommesseRespEspr RIGHT OUTER JOIN
```

dbo.Dipendenti RIGHT OUTER JOIN
dbo.V_RelazioneCommesseRUP RIGHT OUTER JOIN
dbo.T_D_Arca_ElencoCommesse ON
dbo.V_RelazioneCommesseRUP.[ID Commessa] =
dbo.T_D_Arca_ElencoCommesse.ID_Commessa ON
dbo.Dipendenti.ID_Dipendenti =
dbo.V_RelazioneCommesseRUP.[ID Dipendente] RIGHT OUTER JOIN
dbo.T_ProcEsporpriativi ON
dbo.T_D_Arca_ElencoCommesse.ID_Commessa =
dbo.T_ProcEsporpriativi.ID_Commessa ON
dbo.V_RelazioneCommesseRespEspr.[ID Commessa] =
dbo.T_D_Arca_ElencoCommesse.ID_Commessa ON
Dipendenti_1.ID_Dipendenti = dbo.V_RelazioneCommesseRespEspr.[ID
Dipendente] INNER JOIN
dbo.V_E_VerificaAttComplete ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_VerificaAttComplete.ID_ProcEsporpriativi ON
L_StatoAttivita_3.ID_StatoAttivita =
dbo.T_ProcEsporpriativi.ArchiviazioneProcedimento



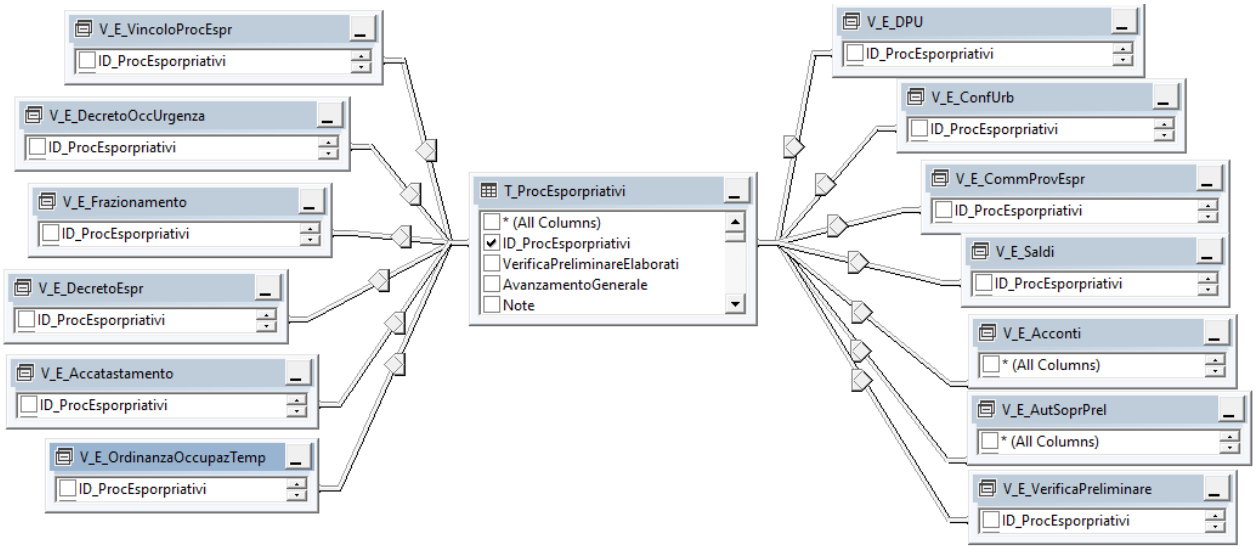
- *dbo_V_E_VerificaAttComplete*

SELECT dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi,
dbo.T_ProcEsporpriativi.DescrizioneProcEsporpriativi, CASE WHEN
[PercM_AutSoprPrel] IS NOT NULL THEN [PercM_AutSoprPrel] WHEN
[ConteggioDiID_AutSoprPrel] IS NOT NULL
THEN 100 ELSE 0 END AS C_AutSoprPrel, CASE WHEN
[PercM_VerificaPreliminare] IS NOT NULL THEN
[PercM_VerificaPreliminare] WHEN [VerificaPreliminareElaborati] = 1 THEN
100 ELSE 0 END AS C_VerificaPreliminare,
CASE WHEN [PercM_VPE] IS NOT NULL THEN
[PercM_VPE] WHEN [ConteggioDiID_VincoloPrordEspr] IS NOT NULL
THEN 100 ELSE 0 END AS C_VPE, CASE WHEN [PercM_DPU] IS NOT
NULL

```
                THEN [PercM_DPU] WHEN
[ConteggioDiID_DichiarazionePU] IS NOT NULL THEN 100 ELSE 0 END
AS C_DPU, CASE WHEN [PercM_ConformUrb] IS NOT NULL
                THEN [PercM_ConformUrb] WHEN
[ConteggioDiID_ProtConfUrb] IS NOT NULL THEN 100 ELSE 0 END AS
C_ConfUrb, CASE WHEN [PercM_DecrOccUrg] IS NOT NULL
                THEN [PercM_DecrOccUrg] WHEN
[ConteggioDiID_DecretoOccUrgenza] IS NOT NULL THEN 100 ELSE 0 END
AS C_DecretoOccUrgenza, CASE WHEN [PercM_DecrEspr] IS NOT NULL
                THEN [PercM_DecrEspr] WHEN
[ConteggioDiID_DecretoEspr] IS NOT NULL THEN 100 ELSE 0 END AS
C_DecretoEspr, CASE WHEN [PercM_OrdinOccTemp] IS NOT NULL
                THEN [PercM_OrdinOccTemp] WHEN
[ConteggioDiID_OrdinanzaOccupazionaleTemp] IS NOT NULL THEN 100
ELSE 0 END AS C_OrdinanzaOccupazTemp, CASE WHEN
[PercM_CommProv] IS NOT NULL
                THEN [PercM_CommProv] WHEN
[ConteggioDiID_CommProvEspr] IS NOT NULL THEN 100 ELSE 0 END AS
C_CommProvEspr, CASE WHEN [PercM_Frazionamento] IS NOT NULL
                THEN [PercM_Frazionamento] WHEN
[ConteggioDiID_Frazionamento] IS NOT NULL THEN 100 ELSE 0 END AS
C_Frazionamento, CASE WHEN [PercM_Accatastamento] IS NOT NULL
                THEN [PercM_Accatastamento] WHEN
[ConteggioDiID_Accatastamento] IS NOT NULL THEN 100 ELSE 0 END AS
C_Accatastamento, CASE WHEN [PercM_Acconto] IS NOT NULL
                THEN [PercM_Acconto] WHEN [Conteggio_ID_Acconti] IS
NOT NULL THEN 100 ELSE 0 END AS C_Acconti, CASE WHEN
[PercM_Saldo] IS NOT NULL THEN [PercM_Saldo] WHEN
[Conteggio_ID_Saldi] IS NOT NULL
                THEN 100 ELSE 0 END AS C_Saldi, CASE WHEN
[PercM_VPE] IS NOT NULL THEN [PercM_VPE] * [PercVPE] / 100 WHEN
[ConteggioDiID_VincoloPrordEspr] IS NOT NULL THEN [PercVPE] ELSE 0
END AS T_VPE,
                CASE WHEN [PercM_DPU] IS NOT NULL THEN
[PercM_DPU] * [PercDPU] / 100 WHEN [ConteggioDiID_DichiarazionePU]
IS NOT NULL THEN [PercDPU] ELSE 0 END AS T_DPU, CASE WHEN
[PercM_ConformUrb] IS NOT NULL
                THEN [PercM_ConformUrb] * [PercConfUrb] / 100 WHEN
[ConteggioDiID_ProtConfUrb] IS NOT NULL THEN [PercConfUrb] ELSE 0
END AS T_ConfUrb, CASE WHEN [PercM_DecrOccUrg] IS NOT NULL
                THEN [PercM_DecrOccUrg] * [PercDecretoOccUrgenza] / 100
WHEN [ConteggioDiID_DecretoOccUrgenza] IS NOT NULL THEN
[PercDecretoOccUrgenza] ELSE 0 END AS T_DecretoOccUrgenza,
                CASE WHEN [PercM_DecrEspr] IS NOT NULL THEN
[PercM_DecrEspr] * [PercDecretoEspr] / 100 WHEN
[ConteggioDiID_DecretoEspr] IS NOT NULL THEN [PercDecretoEspr] ELSE
0 END AS T_DecretoEspr,
```

```
                CASE WHEN [PercM_OrdinOccTemp] IS NOT NULL THEN
[PercM_OrdinOccTemp] * [PercOrdinanzaOccTemp] / 100 WHEN
[ConteggioDiID_OrdinanzaOccupazionaleTemp] IS NOT NULL
                THEN [PercOrdinanzaOccTemp] ELSE 0 END AS
T_OrdinanzaOccupazTemp, CASE WHEN [PercM_CommProv] IS NOT
NULL
                THEN [PercM_CommProv] * [PercCommProvEspr] / 100
WHEN [ConteggioDiID_CommProvEspr] IS NOT NULL THEN
[PercCommProvEspr] ELSE 0 END AS T_CommProvEspr, CASE WHEN
[PercM_Frazionamento] IS NOT NULL
                THEN [PercM_Frazionamento] * [PercFrazionamento] / 100
WHEN [ConteggioDiID_Frazionamento] IS NOT NULL THEN
[PercFrazionamento] ELSE 0 END AS T_Frazionamento, CASE WHEN
[PercM_Accatastamento] IS NOT NULL
                THEN [PercM_Accatastamento] * [PercAccatastamento] / 100
WHEN [ConteggioDiID_Accatastamento] IS NOT NULL THEN
[PercAccatastamento] ELSE 0 END AS T_Accatastamento, CASE WHEN
[PercM_Acconto] IS NOT NULL
                THEN [PercM_Acconto] * [PercAcconto] / 100 WHEN
[Conteggio_ID_Acconti] IS NOT NULL THEN [PercAcconto] ELSE 0 END
AS T_Acconti, CASE WHEN [PercM_Saldo] IS NOT NULL
                THEN [PercM_Saldo] * [PercSaldo] / 100 WHEN
[Conteggio_ID_Saldi] IS NOT NULL THEN [PercSaldo] ELSE 0 END AS
T_Saldi, CASE WHEN [PercM_VerificaPreliminare] IS NOT NULL
                THEN [PercM_VerificaPreliminare] * [PercVerificaPreliminare]
/ 100 WHEN [VerificaPreliminareElaborati] = 1 THEN
[PercVerificaPreliminare] ELSE 0 END AS T_VerificaPreliminare, CASE
WHEN [PercM_AutSoprPrel] IS NOT NULL
                THEN [PercM_AutSoprPrel] * [PercAutSoprPrel] / 100 WHEN
[ConteggioDiID_AutSoprPrel] IS NOT NULL THEN [PercAutSoprPrel] ELSE
0 END AS T_AutSoprPrel
FROM            dbo.T_ProcEsporpriativi LEFT OUTER JOIN
                dbo.V_E_AutSoprPrel ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_AutSoprPrel.ID_ProcEsporpriativi LEFT OUTER JOIN
                dbo.V_E_VerificaPreliminare ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_VerificaPreliminare.ID_ProcEsporpriativi LEFT OUTER JOIN
                dbo.V_E_VincoloProcEspr ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_VincoloProcEspr.ID_ProcEsporpriativi LEFT OUTER JOIN
                dbo.V_E_DPU ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_DPU.ID_ProcEsporpriativi LEFT OUTER JOIN
                dbo.V_E_ConfUrb ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_ConfUrb.ID_ProcEsporpriativi LEFT OUTER JOIN
```

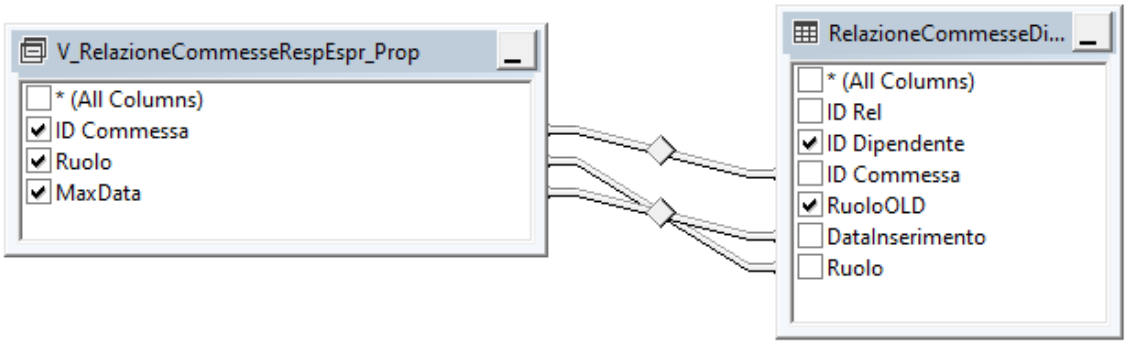
dbo.V_E_DecretoOccUrgenza ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_DecretoOccUrgenza.ID_ProcEsporpriativi LEFT OUTER JOIN
dbo.V_E_DecretoEspr ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_DecretoEspr.ID_ProcEsporpriativi LEFT OUTER JOIN
dbo.V_E_OrdinanzaOccupazTemp ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_OrdinanzaOccupazTemp.ID_ProcEsporpriativi LEFT OUTER JOIN
dbo.V_E_CommProvEspr ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_CommProvEspr.ID_ProcEsporpriativi LEFT OUTER JOIN
dbo.V_E_Frazionamento ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_Frazionamento.ID_ProcEsporpriativi LEFT OUTER JOIN
dbo.V_E_Accatastamento ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_Accatastamento.ID_ProcEsporpriativi LEFT OUTER JOIN
dbo.V_E_Acconti ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_Acconti.ID_ProcEsporpriativi LEFT OUTER JOIN
dbo.V_E_Saldi ON
dbo.T_ProcEsporpriativi.ID_ProcEsporpriativi =
dbo.V_E_Saldi.ID_ProcEsporpriativi



- *dbo_V_RelazioneCommesseRespEspr*

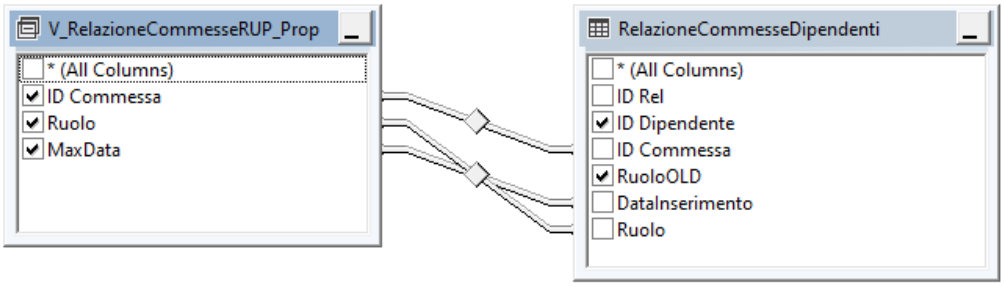
SELECT dbo.V_RelazioneCommesseRespEspr_Prop.[ID Commessa],
dbo.V_RelazioneCommesseRespEspr_Prop.Ruolo,
dbo.V_RelazioneCommesseRespEspr_Prop.MaxData,
dbo.RelazioneCommesseDipendenti.[ID Dipendente],

```
                dbo.RelazioneCommesseDipendenti.RuoloOLD
FROM          dbo.RelazioneCommesseDipendenti INNER JOIN
                dbo.V_RelazioneCommesseRespEspr_Prop ON
dbo.RelazioneCommesseDipendenti.[ID Commessa] =
dbo.V_RelazioneCommesseRespEspr_Prop.[ID Commessa] AND
                dbo.RelazioneCommesseDipendenti.Ruolo =
dbo.V_RelazioneCommesseRespEspr_Prop.Ruolo AND
dbo.RelazioneCommesseDipendenti.DataInserimento =
dbo.V_RelazioneCommesseRespEspr_Prop.MaxData
```



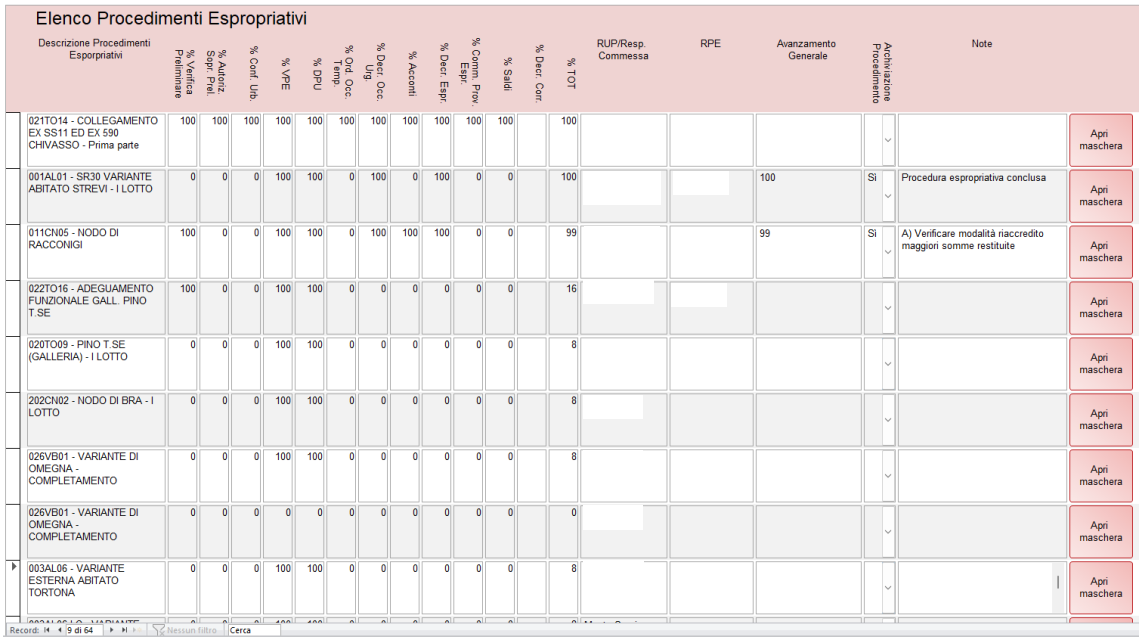
- *dbo_V_RelazioneCommesseRUP*

```
SELECT       dbo.V_RelazioneCommesseRUP_Prop.[ID Commessa],
dbo.V_RelazioneCommesseRUP_Prop.Ruolo,
dbo.V_RelazioneCommesseRUP_Prop.MaxData,
dbo.RelazioneCommesseDipendenti.[ID Dipendente],
                dbo.RelazioneCommesseDipendenti.RuoloOLD
FROM          dbo.V_RelazioneCommesseRUP_Prop INNER JOIN
                dbo.RelazioneCommesseDipendenti ON
dbo.V_RelazioneCommesseRUP_Prop.[ID Commessa] =
dbo.RelazioneCommesseDipendenti.[ID Commessa] AND
                dbo.V_RelazioneCommesseRUP_Prop.MaxData =
dbo.RelazioneCommesseDipendenti.DataInserimento AND
dbo.V_RelazioneCommesseRUP_Prop.Ruolo =
dbo.RelazioneCommesseDipendenti.Ruolo
```



Microsoft Access Forms

- Form 1: List of Expropriation Proceedings for Expropriation Office (Anonymized data. The image is provided for illustrative purposes only).

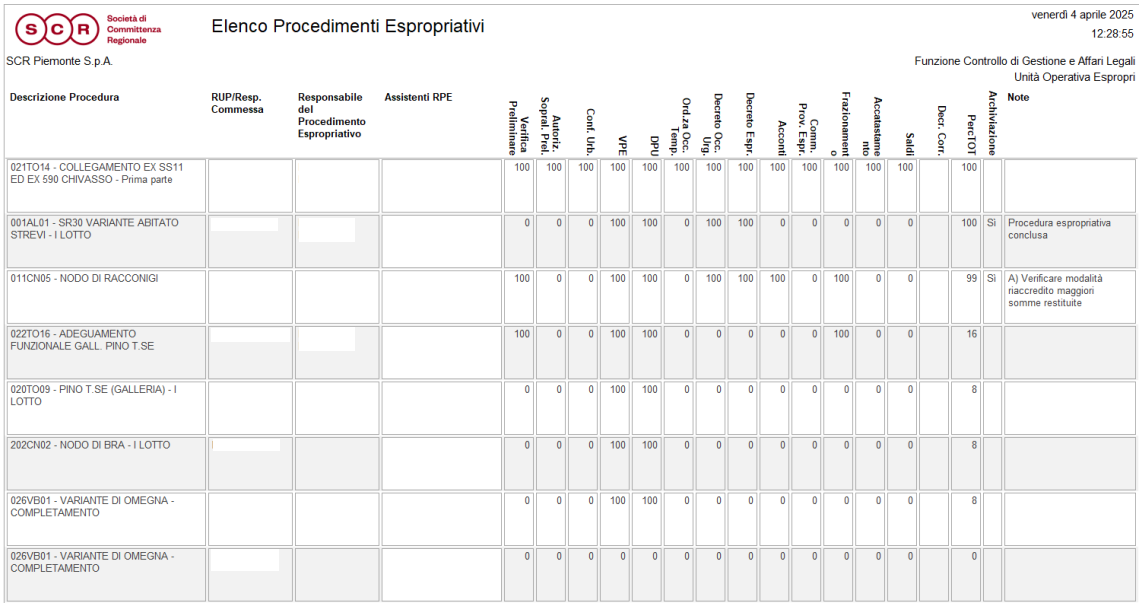


Elenco Procedimenti Espropriativi

Descrizione Procedimenti Esporpriativi	% Verifica Preliminare	% Autoriz. Sopr. Prel.	% Conf. Urb.	% VPE	% DPU	% Ord. Occ. Temp.	% Decr. Occ. Urg.	% Acconti	% Decr. Espr.	% Comm. Prov. Espr.	% Saldi	% Decr. Corr.	% TOT	RUP/Resp. Commessa	RPE	Avanzamento Generale	Archiviazione Procedimento	Note	
021TO14 - COLLEGAMENTO EX SS11 ED EX 590 CHIVASSO - Prima parte	100	100	100	100	100	100	100	100	100	100	100		100						Apri maschera
001AL01 - SR30 VARIANTE ABITATO STREVI - I LOTTO	0	0	0	100	100	0	100	0	100	0	0		100			100	Si	Procedura espropriativa conclusa	Apri maschera
011CN05 - NODO DI RACCONIGI	100	0	0	100	100	0	100	100	100	0	0		99			99	Si	A) Verificare modalità riaccredito maggiori somme restituite	Apri maschera
022TO16 - ADEGUAMENTO FUNZIONALE GALL. PINO T.SE	100	0	0	100	100	0	0	0	0	0	0		16						Apri maschera
020TO09 - PINO T.SE (GALLERIA) - I LOTTO	0	0	0	100	100	0	0	0	0	0	0		8						Apri maschera
202CN02 - NODO DI BRA - I LOTTO	0	0	0	100	100	0	0	0	0	0	0		8						Apri maschera
026VB01 - VARIANTE DI OMEGNA - COMPLETAMENTO	0	0	0	100	100	0	0	0	0	0	0		8						Apri maschera
026VB01 - VARIANTE DI OMEGNA - COMPLETAMENTO	0	0	0	0	0	0	0	0	0	0	0		0						Apri maschera
003AL06 - VARIANTE ESTERNA ABITATO TORTONA	0	0	0	100	100	0	0	0	0	0	0		8						Apri maschera

Record: 9 di 64 | Nessun filtro | Cerca

- Form 2: List of Expropriation Proceedings for RUP Office (Anonymized data. The image is provided for illustrative purposes only).



Società di Committenza Regionale

Elenco Procedimenti Espropriativi

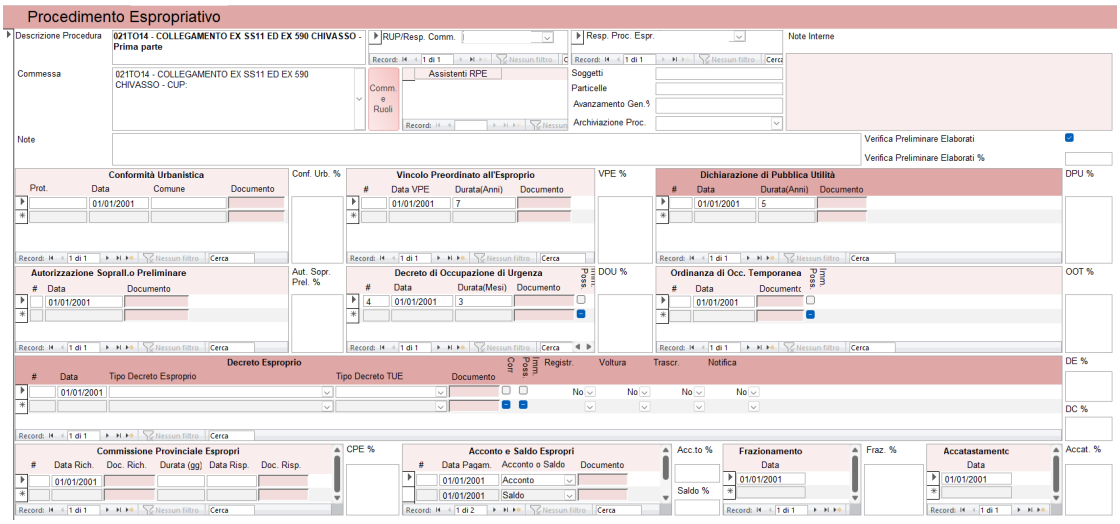
venerdì 4 aprile 2025
12:28:55

SCR Piemonte S.p.A.

Funzione Controllo di Gestione e Affari Legali
Unità Operativa Espropri

Descrizione Procedura	RUP/Resp. Commessa	Responsabile del Procedimento Espropriativo	Assistenti RPE	Verifica Preliminare	Autoriz. Sopral. Prel.	Conf. Urb.	VPE	DPU	Ord.za Occ. Temp.	Decreto Occ. Urg	Decreto Espr.	Acconti	Comm. Prov. Espr.	Frazionamento	Accatastamento	Saldi	Decr. Corr.	PercTOT	Archiviazione	Note
021TO14 - COLLEGAMENTO EX SS11 ED EX 590 CHIVASSO - Prima parte				100	100	100	100	100	100	100	100	100	100	100	100	100		100		
001AL01 - SR30 VARIANTE ABITATO STREVI - I LOTTO				0	0	0	100	100	0	100	100	0	0	0	0	0		100	Si	Procedura espropriativa conclusa
011CN05 - NODO DI RACCONIGI				100	0	0	100	100	0	100	100	100	0	100	0	0		99	Si	A) Verificare modalità riaccredito maggiori somme restituite
022TO16 - ADEGUAMENTO FUNZIONALE GALL. PINO T.SE				100	0	0	100	100	0	0	0	0	0	100	0	0		16		
020TO09 - PINO T.SE (GALLERIA) - I LOTTO				0	0	0	100	100	0	0	0	0	0	0	0	0		8		
202CN02 - NODO DI BRA - I LOTTO				0	0	0	100	100	0	0	0	0	0	0	0	0		8		
026VB01 - VARIANTE DI OMEGNA - COMPLETAMENTO				0	0	0	100	100	0	0	0	0	0	0	0	0		8		
026VB01 - VARIANTE DI OMEGNA - COMPLETAMENTO				0	0	0	0	0	0	0	0	0	0	0	0	0		0		

- Form 3: Single Expropriation Proceeding Office (Anonymized data. The image is provided for illustrative purposes only).



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