Case study 7: MEDIAAN

Lead Organisation: Cost Engineering Unit, Department of Mobility and Public Works

Location: Flanders, Belgium

Technologies: Big data and data analytics

Level of government: Regional

Problem Statement: The Department of Mobility and Public Works managed and tracked its procurement contracts using a digital system, however it lacked the tools to enable visibility of historical prices for goods and services. The Department was therefore not making full use of its data to guide its procurement decisions.

Description: The MEDIAAN platform provides a searchable database of historical prices together with a range of applications for cost engineering and analysis. The primary data source is the Department's eDelta contract management system, which contains price data on contracts going back to 2001. This data is supplemented from other sources, including information on rules and parameters that effect prices stemming from Belgian legislation. Tools and capabilities developed include a price revision applications, semi-automatic estimation of prices, and calculation of different unit and hourly rates. All tools and the underlying data is viewable via a user-friendly interface. MEDIAAN is currently only accessible for Department users, however there are plans to expand this to other users in the Flemish Government, as well as extending the range of tools available and the data on which these tools are based.

Lessons learnt: It is crucial for organisations to own their own (price) data; the database and applications should be kept separate to ensure flexibility and enable updates and changes to the interface and tools; a gradual approach is recommended to ensure the project is targeted at user needs.

Cost: €4.1 million (2014-2019). Expected annual costs of €300 000 – 400 000 going forward

Impact: High. 500 – 600 users of the platform across the Department; more accurate price estimates for projects; time saved on manual benchmarking.

Future expectations: Going forward, there are plans to expand and develop MEDIAAN across multiple dimensions – in terms of tools, data, and users

Human resources: 6 person FTE team: project coordinator, application manager; cost engineer; oracle database specialist; 2 x Oracle APEX Programmer.

Risks: Sensitive data that should only be accessed by authorised users; privacy concerns regarding data stored on individuals; use of proprietary technology implies some risk of lock-in

Other requirements: Ownership of historical pricing data (extracted from eDelta contract management system)

Project timeline: 2009 – present (the project was formalised in 2014)

Project status: Fully deployed solution

Email: mediaan@mow.vlaanderen.be

Website: https://mediaan.login.kanooh.be/mediaan

Context and problem statement

The Department of Mobility and Public Works within the Flemish Ministry of Mobility and Public Works is responsible for the creation and implementation of policies related to mobility and road safety, as well overseeing and managing investments in transport and port infrastructure in the region. Within the Department, the Cost Engineering team provides support and consultative services on cost engineering and price analysis services on investments. The team also performs cost audits on existing projects and programmes.

Since 2001, the Department **made use of the eDelta contract management system to manage and track their procurement contracts**. This meant that there was an existing pool of data related to the prices paid historically by the Department for a range of goods. The Cost Engineering Unit within the Department conducted cost audits and provided price analysis services on the basis of this data, however there was **no single platform on which historical pricing data could be reviewed and examined**. The Cost Engineering Unit drew on the data from the eDelta contract management system to extract reports in xls and pdf formats, providing some visibility into historical unit rates for standardised work elements of road construction and civil works. However, such reports are not easily searchable and analysable. As a result, in 2009, the Cost Engineering Unit began informal efforts to establish a searchable database of pricing data together with analytic tools.

Objectives and vision

Through the MEDIAAN project, the Cost Engineering Unit **aimed to promote the use of data in the preparation, negotiation and execution of public contracts**. Proper exploitation of the available historical price data was expected to enable users (department employees involved in contracting) to:

- better estimate the costs associated with new projects; and
- better negotiate with suppliers the prices of particular goods and services based on a fuller knowledge of historical prices agreed upon.

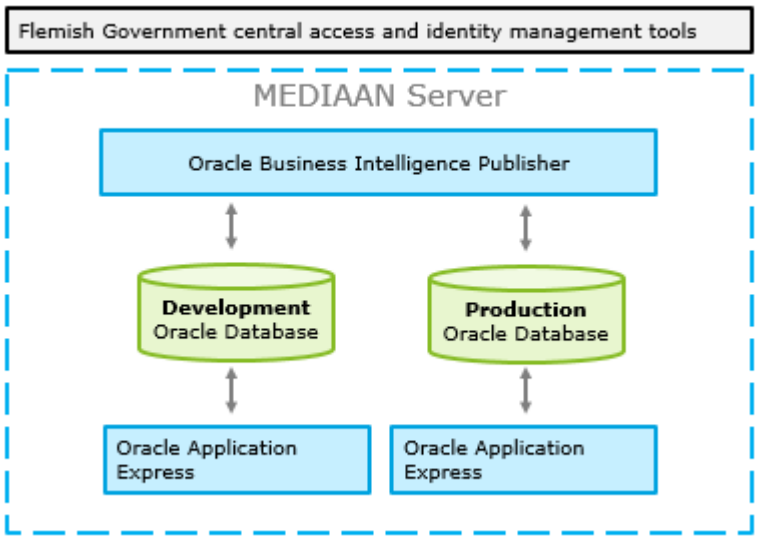
Ultimately, the objective was therefore to enable the Department to get better value for money in their outsourcing contracts. The vision for how to achieve this was the creation of a platform with a user friendly interface for the exploration and analysis of historical pricing data on infrastructure projects. On top of this platform, a series of tools related to cost engineering and other cost aspects of the construction, maintenance and reparation of public infrastructure, would be built.

Technological solution and implementation

The MEDIAAN project has been built out according to the vision described above. The implemented solution consists of:

- **An Oracle database** containing data on historical costs of infrastructure projects, as well as other supplementary data including on price revision parameters rules according to Belgian legislation;
- **Applications** (built in oracle Application Express) for the analysis of the data, providing a user-friendly interface for Department staff;
- **Software** (Oracle Business Intelligence Publisher) enabling the extraction of static reports on the data in the database

Figure 1: MEDIAAN server



A crucial feature of the implemented solution is that **the database and the applications built on top of it are kept separate**. This key advantage associated with this is that it limits the costs associated with changing the functionalities of the system. Large costs are associated with the development of the database, and direct changes to the structure of this database would be costly and difficult. Under the solution developed, however, applications on top of this database can be added and transformed relatively easily. A related advantage is also that it is easier to switch the provider of the application software (i.e. switching away from Oracle).

As is standard practice, the team maintains two separate identical databases for development and production. This allows for the development of new functionalities without risking shutting down the production database and inconveniencing users.

The applications and functionalities that have been created drawing on the core database are presented below.

Functionalities of the platform

The MEDIAAN project has steadily built out a range of applications and tools relevant to cost engineering and cost aspects of infrastructure projects, drawing on the department's historical pricing data and other sources. Access and use of these tools is controlled via the central access and identity management tools - Digital Access Management Flanders (ACM) - provided by the Flemish regional administration. The applications now include the following:

- **Interface to the unit rate database –** This searchable database provides information on the historical costs and prices on both standardised and non-standardised aspects of infrastructure projects. About 7.6 million unit rate prices coming from 105 000 bids on over 15 000 projects can analysed. Users are able to explore the data using a keyword search, and are also able to view and analyse the data across a number of different dimensions, for example producing charts illustrating how prices change for a particular product relative to the year or quantity ordered.
- **Price revision application –** this application complements the price database, and allows users to search for information related to price revision parameters, parameter values and

price revision formulas. According to Belgian legislation, contracts must include provisions on how prices in contracts will change if certain costs, such as labour costs, change. The application provides information on those variables and values that should be used in order to revise and index prices.

- **Semi-automatic estimation of prices –** Based on the data from the price database, this tool can be used to provide an estimate of the cost for a public work, based on a work breakdown structure that must be completed in another application – either the eDelta contract management system or Microsoft Excel.
- **Calculation of hourly rate of manual labour –** this tool enables a calculation of the hourly rates for different types of manual labour. It draws on the rules and rates laid out in Belgian legislation as well as in collective labour agreements.
- **Calculation of unit rates for construction equipment –** this tool enables the calculation of unit rates for the operation of different types of construction equipment. It draws on data from the European Structure of Construction Equipment (EUROLISTE) as well as the Register of Construction Equipment (BGL) – which provide standard rates for such equipment.
- **Cost engineering library –** The library contains information in a variety of different forms and formats – data, literature, manuals – on cost engineering and price analysis.

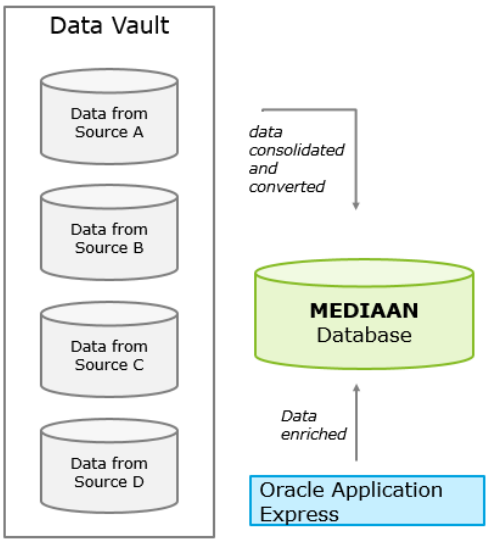
Data, software and infrastructure

The key **data underlying the MEDIAAN platform is extracted from the Department of Mobility and Public Work's eDelta contract management system** – with information on 7.6 million unit rate prices. However, as specified for a number of the applications described above, this departmental contract data has also been complemented and expanded upon with data stemming from other sources, including standardised lists and rules laid down in Belgian legislation.

Data from the different internal and external data sources and providers is first stored in a data vault, in their original structures. From here, the data is consolidated, converted into one uniform structure and uploaded to the Oracle database serving the MEDIAAN platform. The Cost Engineering Unit is also able to enrich the data from other sources, using Oracle Application Express. The entire process is shown in

Figure 2 below.

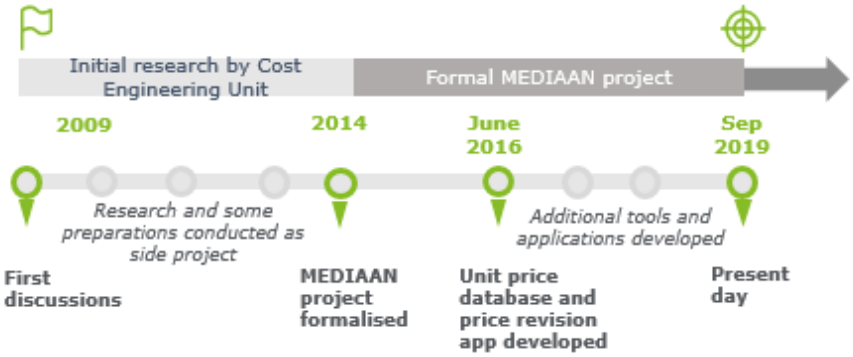
Figure 2: Provision and preparation of data for MEDIAAN



Implementation of the project

Work towards the development of tools now incorporated in the MEDIAAN platform began in 2009 as an individual initiative from the Cost Engineering team, drawing on its experience performing cost audits of projects. As a first step, they developed the unit rate database in order to demonstrate the value that this sort of data could have. Together with this the team developed the price revision application. These developments were successful, and **in 2013, the MEDIAAN program was formalised**, gaining official support and funding from the Department for its goals of providing cost engineering and price analysis tools. Since then the additional applications described have been developed.

Figure 3: Development of the MEDIAAN Programme



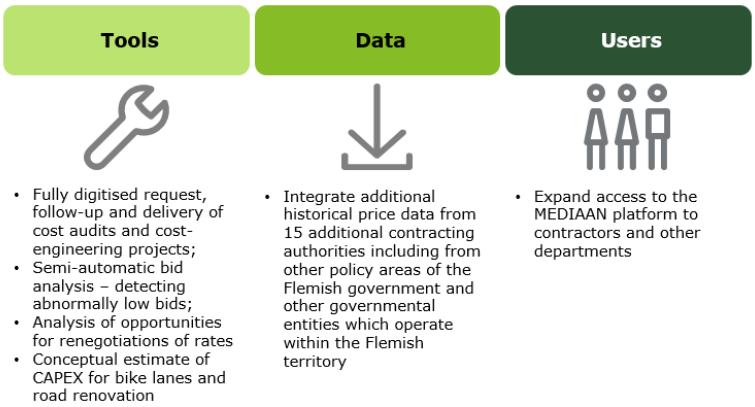
Results and future expectations

The **impact of the MEDIAAN platform is not directly measured**, making it difficult to estimate. One measure is provided by the uptake of the MEDIAAN applications within the Department, with **500 to 600 users now making use of these tools.** User satisfaction with MEDIAAN is high, as judged by user feedback during a more general annual evaluation exercise of the Department's work. The project team believes that the primary impact of the platform is in the accuracy of the price estimates it can generate, which is far higher than would otherwise be possible. Another benefit is also time saved for employees, who can use the available applications rather than conducting time-consuming manual benchmarking exercises. Overall, the project contributes to better planned and more successful public works programs and projects.

Going forward, there are plans to expand and develop MEDIAAN across multiple dimensions – in terms of tools, data, and users – as shown in

Figure 4 below.

Figure 4: Future plans for the development of MEDIAAN



Costs and requirements

Costs	Human resources	Other
≈ **€4.1 million** (2014-2019) • €0.7 million for hardware and licenses • €2 million on freelancers working on the project • €1.4 million on inhouse staff	• MEDIAAN team consists of 6 FTE workers with the following profiles: project coordinator, application manager; cost engineer; oracle database specialist; 2 x Oracle APEX Programmer.	**Data**: historical data in the eDelta contract management system

The total budget of MEDIAAN from 2014 to 2019 has been **€4.1 million**, split between hardware and licenses (€0.7 million), spending on freelancers (€2 million) and salaries for in-house staff (€1.4 million). Going forward beyond 2019, the yearly budget for the platform is expected to be €300 000 to 400 000.

This **spending on human resources** has been necessary to attract and retain the appropriate profiles (as listed above). In order to promote the use of MEDIAAN, the team has also conducted trainings and promotional activities. Going forward, in order to expand the project the **main additional requirements are for human resources to communicate and share the results and capabilities of the platform, and to perform additional data processing and content creation** (i.e. concepts for new applications).

Another key requirement for the success of the project was the **ownership of the historical price data contained within the eDelta contract management system**. This ownership of the data ensure that the project team has immediate and unconditional access to the data and was not tied down to any other third party. The importance of clear ownership of the data was brought home during recent efforts to expand the MEDIAAN programme to include data from local authorities. These authorities, however, used a private contract management system and the supplier of this system

did not want to cooperate with these efforts. As the contracts with this service provider did not define who owned the data saved and created with the software, it has not been possible to force the supplier to collaborate. The efforts to incorporate this local authority data into the MEDIAAN platform therefore eventually had to be abandoned. Clear and unambiguous ownership of price data is therefore a crucial enabler of projects such as MEDIAAN and should not be overlooked.

Risk and mitigation

Risks that were confronted during the project related predominantly to **privacy and security concerns**. Given the sensitive nature of some of the data (which could provide a competitive advantage to private sector suppliers) it was necessary to ensure that it is only made available to the appropriate public sector users within the Department of Mobility and Public Works.

In order to meet this challenge, the team was able to **draw upon user authentication tools - Digital Access Management Flanders – provided centrally by the Flemish Government**. The MEDIAAN team therefore only needed to implement this solution, rather than starting from scratch. Using these tools, the team is also able to determine exactly which tools and content specific users are able to access, depending on the type of user group they fall into. As an additional safeguard against misuse of the platform, a monitoring tool is used to scan user behaviour and identify risks. MEDIAAN also limits the type of data stored in their database so as to reduce privacy concerns. Only minimal information on individuals is stored in order to ensure GDPR compliance.

As the project makes use of proprietary technology, there is also **some risk of lock-in** should the department want to change providers at a later stage. This risk has however been minimised as far as possible through the use of commonly used open standard data formats, and designing the system so that it can operate on different kinds of hardware (with sufficient memory and storage capacity) and on different operating systems. The separation of the database and applications into separate layers, also reduces the chance of lock-in.

A formal risk analysis was conducted together with a Quality Manager responsible for the MEDIAAN project – identifying the risks mentioned above. Appropriate mitigation steps, as listed, have therefore been taken to limit them.

Challenges and lessons learnt

The MEDIAAN project has been a significant success for the Department and lessons can be learnt by considering the reasons for this success. One of the key lessons learnt is the **importance of an organisation owning its own data**. Their ownership of the historical pricing data within the eDelta contract management system allowed the team to develop the unit-rate database that underlies the MEDIAAN platform's functionalities. Where ownership of the historical data is not provided, it will be necessary to find a way to cooperate with and incentivise different types of private or public organisations to gain access to the necessary data.

Another lesson relates to the importance of ensuring that the **database and applications be kept separate**. The database lies at the core of the project, and any changes to it would be expensive and difficult. Keeping the application layer separate from the data allows flexibility in updating and changing the applications and their interfaces with limited costs. It would also facilitate a switch of technology provider (from Oracle Application Express) if deemed desirable.

The MEDIAAN project started as an individual initiative from the Cost Engineering team, and initially found it challenging to build up support for and awareness of the project. However, this also meant that the team took a **gradual approach**, developing the platform in an iterative manner, rather than aiming for the perfect solution straight away. The focus was on addressing practical issues the team faced and developing a solution that could improve and support their work. This iterative and practical approach can provide a model approach for other organisations.