

# **Cleaning Management at Politecnico di Torino**

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## **Abstract**

Nowadays Cleaning Management represents one of the major costs for Real Estate at Politecnico di Torino, and a study on this item was conducted. The aim of this focus is to provide a unique operative and structured tool in order to improve efficiency and quality of service provided through use of better planning and controlling for the whole Politecnico. A CAFM (Computer Aided Facility Management) information platform was selected to manage activities like Space Inventory, Personnel and Occupancy, On Demand Work, Preventive Maintenance and Cleaning to optimize relationships with technical services suppliers, allowing having a better planning and increased awareness of internal needs. Different procedures based on the space category, frequency and intervention type were assigned to spaces in order to guarantee the expected Service Level Agreement (SLA) by tender technical specifications. By means of this system it has been proven that the users obtained a clear added value to define optimal maintenance strategies and to identify and to monitor budget allocations. Data provided by the cleaning management services are gathered in different levels of reporting which support decisions for daily operations, tactical and strategic planning. A further approach to cleaning service management, currently in development phase, concerns the use of BIM (Building Information Modelling) methodology that provides significant opportunities for the rationalization and optimization of processes and resource for management of integrated services in public and private companies.

**Keywords:** cleaning management, CAFM, BIM

## **1. Introduction**

Many studies in the recent year have focused on processes rationalization and resource optimization in public and private companies that have significant Real Estate like Politecnico di Torino campus. In this context, great relevance takes on digitalization and dematerialization activities that allow to save working time and to create value through a smarter management. A CAFM information platform was adopted by Technical and Logistics

Department of Politecnico di Torino for property and facility management, with the aim to streamline internal processes and to pursue more efficiently resource utilization. The main problem related to the management of Real Estate is represented by data availability and traceability, which is key for reporting both for tactical and strategic decision processes. Preventive Maintenance represents one of the major costs for Real Estate at Politecnico di Torino: for this reason a study on cleaning management was conducted. The goal of this focus is to provide a unique operative and structured tool of the service provided in order to improve efficiency and quality through better planning and controlling for whole University.

## **2. Methodology**

The Archibus FM software was selected to manage ordinary activities like Space Inventory, Personnel, Occupancy and also Service Desk, On Demand Work and Preventive Maintenance. These two latter processes were revised and streamlined to be managed in a digital way. The cleaning management is included in these activities, and two types of processes are presented in this paper: the first one, currently running, which follows a traditional approach, based on state of the art information systems; the second one, most innovative, but just experimental at the moment that is based on BIM usage.

The traditional approach project can be divided into three phases.

### *FIRST PHASE*

The first phase focused on the cleaning service re-engineering, carefully analyzing the tender specifications and options. At the beginning several agreements related to cleaning service were signed and were managed independently by the individual Departments, with different suppliers and different prices. Currently, instead, the tender with the supplier is designed in order to create a framework agreement for all the Politecnico di Torino Structures (11 Departments and several Structures that belong to the Central Administration) to make synergies and cost saving. Specific agreements on their spaces are signed by all of these Structures on the basis of the same general cleaning performance specifications. Two lots are defined in the framework agreement, allowing a variety of service levels (basic, medium, high), directly selectable by the Structures management. The service level for the Central Administration of the Politecnico (lot 1) is only one (high), while for the Departments (lot 2) there is a greater diversification depending on the local needs. For this reason it was necessary to provide to the Structures a unique operative tool to make more simple and efficient the definition of the individual contracts.

The study conducted showed that evaluation and the choice of service level made by both Departments and Central Administration was simplified by the good availability of rooms data, allowing easy planning, pricing simulation, expenditure budgeting and service control.

The implementation of the cleaning service activities was carried out through a customization of the Politecnico information system (Preventive Maintenance module), on the basis of the requirements that emerged during the analysis phase.

To achieve the objectives, planned activities include:

- the mapping of all spaces with the associated cleaning procedures;
- the creation of web views that highlight services levels for planimetric areas;
- the creation of reporting web views about services, service levels and costs.

## *SECOND PHASE*

The second phase involved the system setup and data population for cleaning activities. Firstly a complete mapping of all Politecnico spaces was made, verifying and updating intended use and responsible structure for all rooms. Since cleaning cost drivers are based on service levels and on surface managed, the updated and detailed mapping of buildings and spaces is essential, in order to rationalize public spending and monitor costs. In complex organizations such as the Politecnico di Torino, that are spread on vast extent buildings, the actual knowledge of spaces intended use and their actual utilization rate allows to calibrate intervention levels depending on specific needs. In fact the Real Estate assets of Politecnico di Torino are considerable. The Politecnico campuses are inspired by the Anglo-Saxon organizations, with multipurpose facilities for teaching, basic and applied research and student services. The main campuses are in Turin, in C.so Duca degli Abruzzi (122.000 m<sup>2</sup>) with the recent expansion of the Cittadella Politecnica (170.000 m<sup>2</sup>) and in the historic seat of Castello del Valentino (23.000 m<sup>2</sup>). There are other metropolitan seats like Mirafiori and Lingotto, and technology centers in the Piedmont region (Alessandria, Biella, Mondovì, Vercelli, Verrés) dedicated to research, technology transfer, training and specialist services to the area. Globally there are more than 60 buildings, 8.600 rooms, for a total of 189 floor plans currently loaded on the information system.

The software was designed to provide several functionalities in order to manage all the steps related to cleaning service activities: assignment, consultation, final accounting and historical data. The software was configured to map the lots and the service levels defined in the

framework agreement. The rooms are associated to lots and divided according to the responsible structures in order to allow data smoother handling and introduce a greater control factor. The activities are extended to all the Politecnico campuses.

Each room, in the assignment step, is associated to a cleaning category and procedure that are related to the room intended use and to target service level. The cleaning categories allowed by the framework agreement are as follows: teaching area, outdoor areas, technical room, restrooms, connection areas, office. These are closely related with room category and type; therefore they are automatically assigned by the system on the basis of a defined correlation table (cleaning category/room type). Also when a new room is created or the category/type attributes of an existing room are changed, the cleaning category follows automatically the modification, updating the space/cleaning data association. For each cleaning category, several procedures were defined depending on the service level agreement. 22 SLAs are defined in the Politecnico framework agreement. The procedure is linked with the cleaning category, in order to assign to the rooms only the provided procedures and to ensure proper allocation of service levels. In this way it is not possible, for example, to associate an office to the cleaning procedure of an outdoor area. When the room intended use is modifying the cleaning procedure associated will be completed. The rooms with no assigned procedure are displayed in a separate section in order to quickly identify and assign them the proper procedure. This operation cannot be done automatically by the system because the choice of the cleanliness level is free for each structure. Each procedure is described by a clear detail of cleaning actions to be done, by the operations to be performed and frequencies, according to the cleaning performance specifications.

Procedura	Procedura MP	Passo MP	Importo Parametrico Euro/mq mese
AD MEDIO AREA DIDATTICA MEDIO	AD MEDIO	1	0,68

Istruzioni:

- TARIFFA E/m2 per mese: 0,68
- 2/7 OP 34 OP 35 Aspirazione tappeti, zerbini, passatoie
- 2/7 OP 09 OP 48 Detersione e disinfezione punti di contatto comune (apparecchi telefonici, tastiere PC, maniglie porte e interruttori, scrivanie, banchi, lavabi laboratori e locali tecnici)
- 1/7 OP 13 Lavaggio vetrate interne, sportelli, box di segreteria
- 3/7 OP 05 Spazzatura a umido dei pavimenti
- 5/7 OP 02 OP04 Raccolta differenziata (carta, vetro, plastica) e rifiuti evidenti dai pavimenti e vuotatura cestini
- 1/7 OP09 Sostituzione dei sacchi a perdere
- 1/7 OP37 OP38 Deragnatura
- 1/7 OP27 OP28 Lavaggio pavimenti
- 1/7 OP09 OP21 Spolveratura arredi ed apparecchiature
- 12/A Lavaggio cestini, sostituzione sacchi a perdere
- 12/A OP 18 Spolveratura davanzali
- 12/A OP14 Lavaggio porte
- OP39 Pulizia a fondo meccanica dei pavimenti trattati e non trattati
- 2/A OP14 OP48 Detersione e disinfezione pareti lavabili
- OP34 Aspirazione polvere dalle tastiere dei PC
- 1/A OP12 OP48 Detersione e disinfezione arredi
- OP13 Detersione infissi, vetri finestre e balconi
- 2/A OP25 Lavaggio caloriferi, apparecchi illuminanti
- OP39 OP42 Deceratura pavimenti e successiva inceratura (minimo 2 mani protezione)
- OP13 Lavaggio vetri interni ed esterni (con affaccio sui cortili)

Fig. 1: Cleaning procedures operations and frequencies

A parametric unit cost is assigned to each procedure to automatically generate the final expenditure report. The calculations are set taking into account the SLA, the cleaning category, and room attributes like floor, campus and structure. A complete mapping of all areas was followed giving to each the correct cleaning procedure. This step was carried out by the Structures in order to update and manage data in a widespread manner. This has allowed a more structured and responsible management of the cleaning processes, stimulating the final users awareness.

The possibility of viewing the data in a graphical way represents an added value for the project. The associations of rooms with the cleaning categories and procedures are described using planimetric views. These are dynamically available in the system and are themed with different colours according to the cleaning categories corresponding with the indication of the procedure associated and the surface. Three types of visualizations are available: all rooms, filtered by Structure or filtered by “lot”.

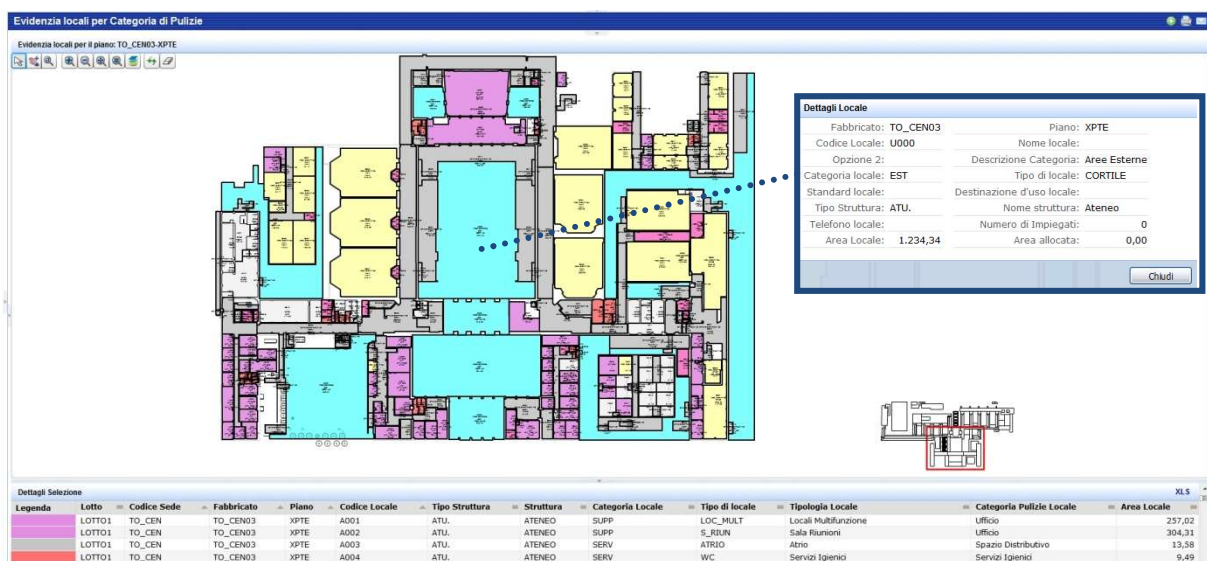


Fig. 2: All rooms thematization by cleaning category

The cleaning categories can be selectively highlighted using system functionalities, as shown in the pictures below.

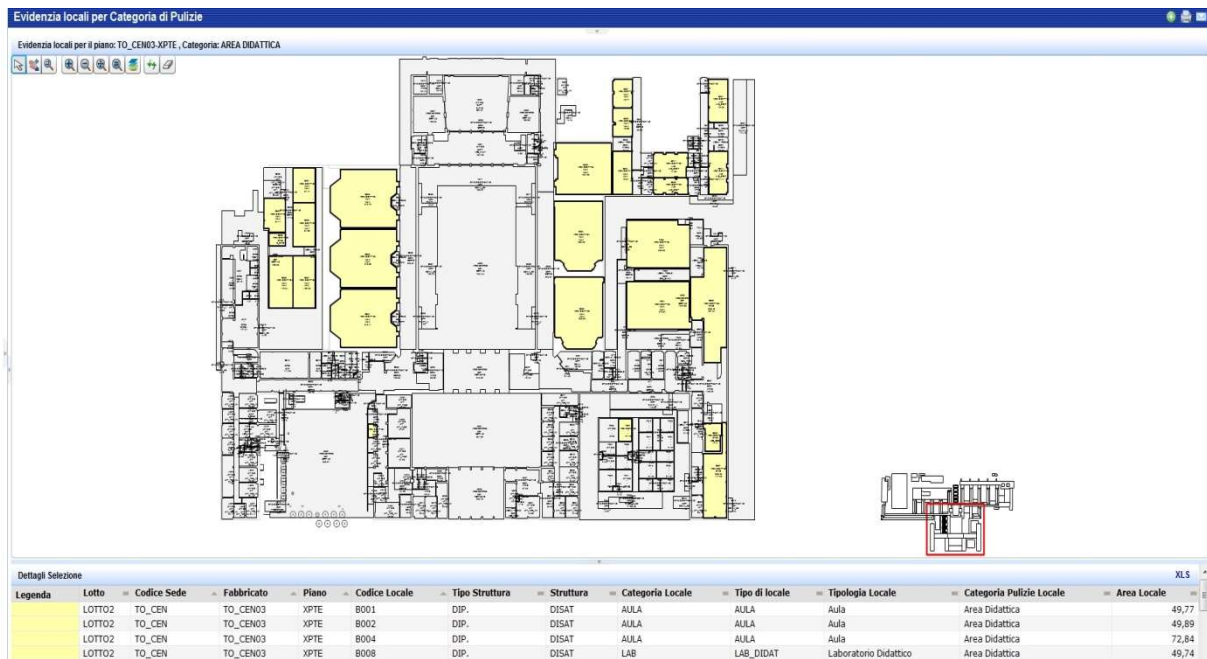


Fig. 3: All rooms thematization by teaching area cleaning category

All floor plans are printable and available for download from the Web by means of a “.docx” document that contains themed layout image and color legend as well as spatial references.

All the system outputs can also be used as technical annexes for tenders and for the audit service activities. The continuous updating of data in the unique FM system allows to have always the correct information and floor plans of the building, avoiding manual activities. The system outputs are also very useful for spot checks to test cleaning quality, which are performed on a timely base on random rooms of the university campuses.

The operations are conducted by an external certifying body, a representative of the administration and one of the supplier. On this event a list of rooms, with the cleaning category and procedures indications, and themed for plans are produced by the FM system.

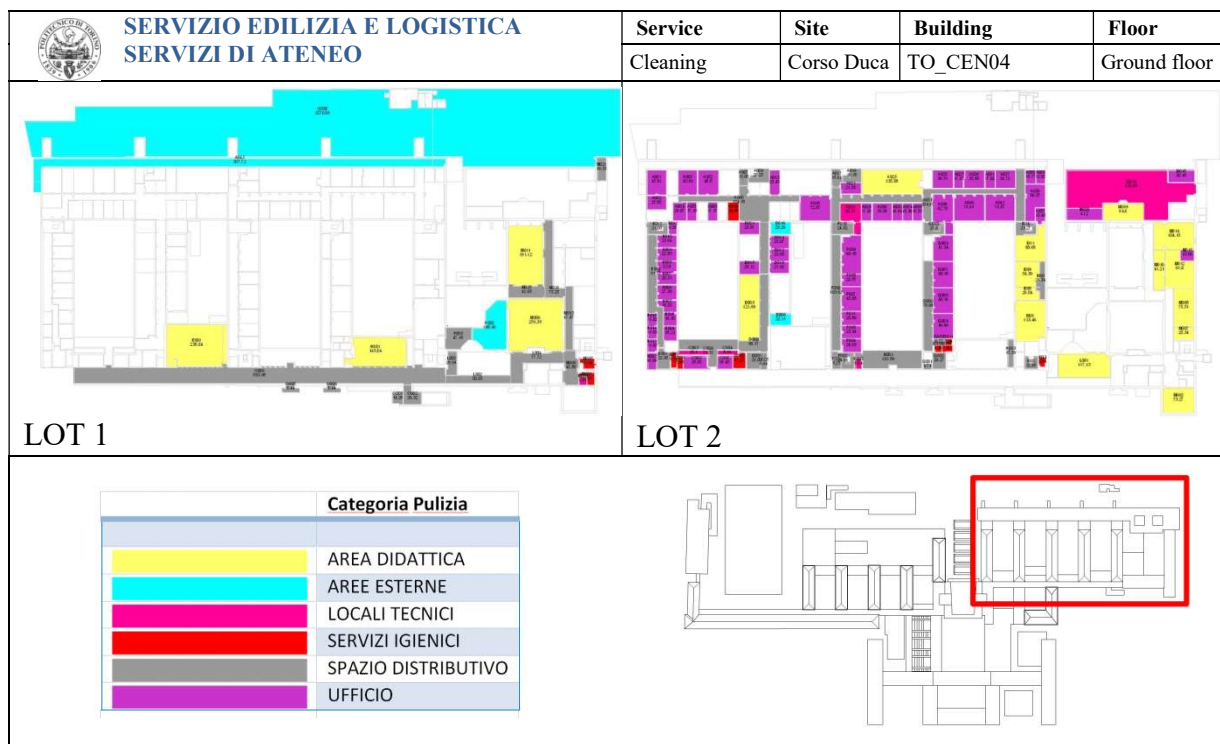


Fig. 4: Thematization by lots

In these sections there are also a summary cross table, that divides the rooms selected through the filters of planimetric view in the cleaning categories. By selecting each field in the table the details of all the rooms is retrieved. All data can be exported in Excel format.

Tab. 1: Total cleaning categories areas cross table

Riepilogo per Categoria e Procedura							
Edificio - Piano		Categoria Pulizia					
Totale		AREA DIDATTICA	AREE ESTERNE	LOCALI TECNICI	SERVIZI IGIENICI	SPAZIO DISTRIBUTIVO	UFFICIO
TO_CEN04-XPTE		10.934,2	2.147,49	3.731,64	522,84	99,76	2.421,68
TO_CEN04-XPTE		10.934,2	2.147,49	3.731,64	522,84	99,76	2.421,68

Lotto	Codice Sede	Nome fabbricato	Nome piano	Codice Locale	Categoria Pulizia	Tipo di locale	Cate locale
TO_CEN	Dipartimenti	Piano Terra	P001	AREA DIDATTICA	S. STUDIO	STUE	
LOTTO1	TO_CEN	Dipartimenti	Piano Terra	E001	AREA DIDATTICA	AULA	AULA
LOTTO1	TO_CEN	Dipartimenti	Piano Terra	H001	AREA DIDATTICA	AULA	AULA
LOTTO1	TO_CEN	Dipartimenti	Piano Terra	M009	AREA DIDATTICA	AULA	AULA
LOTTO1	TO_CEN	Dipartimenti	Piano Terra	M011	AREA DIDATTICA	AULA	AULA
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	A023	AREA DIDATTICA	BIBLIO	STUE
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	D003	AREA DIDATTICA	LAB_DIDAT	LAB
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	I006	AREA DIDATTICA	LAB_DIDAT	LAB
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	I008	AREA DIDATTICA	LAB_DIDAT	LAB
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	I009	AREA DIDATTICA	LAB_DIDAT	LAB
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	I011	AREA DIDATTICA	LAB_DIDAT	LAB
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	L001	AREA DIDATTICA	AULA	AULA
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	M002	AREA DIDATTICA	LAB_RIC	LAB
LOTTO2	TO_CEN	Dipartimenti	Piano Terra	M007	AREA DIDATTICA	LAB_RIC	LAB

The last section is related to the final accounting, in which cost reports are generated automatically based on the procedures to be performed. The cleaning procedure scheduling is done monthly, each report is consolidated and saved and can be recalled. The changes made on the procedures are accounted for and displayable properly in the prospectus of the next month.

Tab. 2: Final accounting cross table

		Categoria Pulizia - Procedura									
Lotto - Sede		Totale	Area Didattica- AREA DIDATTICA BUONO	Aree Esterne- AREE ESTERNE BUONO B	Locali Tecnici- LOCALI TECNICI BUONO B	Servizi Igienici- SERVIZI IGIENICI BUONO A	Servizi Igienici- SERVIZI IGIENICI BUONO B	Servizi Igienici- SERVIZI IGIENICI BUONO C	Spazio Distributivo- SPAZIO DISTRIBUTIVO BUONO A	Spazio Distributivo- SPAZIO DISTRIBUTIVO BUONO B	Ufficio- UFFICIO BUONO B
Totale	Costo Totale	653.534,98	308.505,44	10.723,98	7.135,67	35.968,60	4.406,74	11.875,10	210.214,53	34.239,36	18.590,46
	Area Totale (mq)	668.752,76	235.500,48	46.627,14	54.893,82	5.109,18	625,94	1.686,80	262.768,22	42.799,20	17.055,18
LOTTO1- Politecnico Lingotto	Costo Totale	652.472,29	308.505,44	10.723,98	7.025,52	35.968,60	4.406,74	11.875,10	210.214,53	33.571,62	18.305,66
	Area Totale (mq)	666.809,47	235.500,48	46.627,14	54.046,49	5.109,18	625,94	1.686,80	262.768,22	41.964,52	16.793,90
-Non Presente-- Politecnico Lingotto	Costo Totale	1.062,69			110,15					667,74	284,80
	Area Totale (mq)	1.943,29			847,33					834,68	261,28

Different web profiles were created for the Department representatives, so that they can enter and edit only the information related to their spaces and display only the final summary related to its Structure. The super user, however, can access to all information. All data entered into the system are historized, enabling the control of association's changes and the trends of costs incidence related to cleaning preventive maintenance.

### THIRD PHASE

In the third phase dashboard reports are developed for dynamic data visualization. In parallel to the implementation of the functionality for the cleaning services management, various dashboard reports were developed, within the larger Politecnico Data Warehouse, to allow end users a more precise control on data and on key performance indicators (KPIs). In this phase of the project only the surface data are represented in the reports, with no connection to cost. These dashboards were designed and developed with an external reporting tool, because Archibus natively does not allow the dashboards and dynamic reports creation.

The advantages of using these reporting dynamic models are:

- consolidating relevant data into a single database;
- exploring the associations in data;
- accessing and analyzing data in real time in every workplace and, in a near future, in a web browser from every device such as workstations, tablets and smartphones;
- browsing across all data in a "user friendly" interface;
- interacting with dynamic apps, dashboards and analytics;
- present KPIs in a flexible and transparent manner;
- allowing key users to build in few steps forecast scenarios and to achieve efficiency.



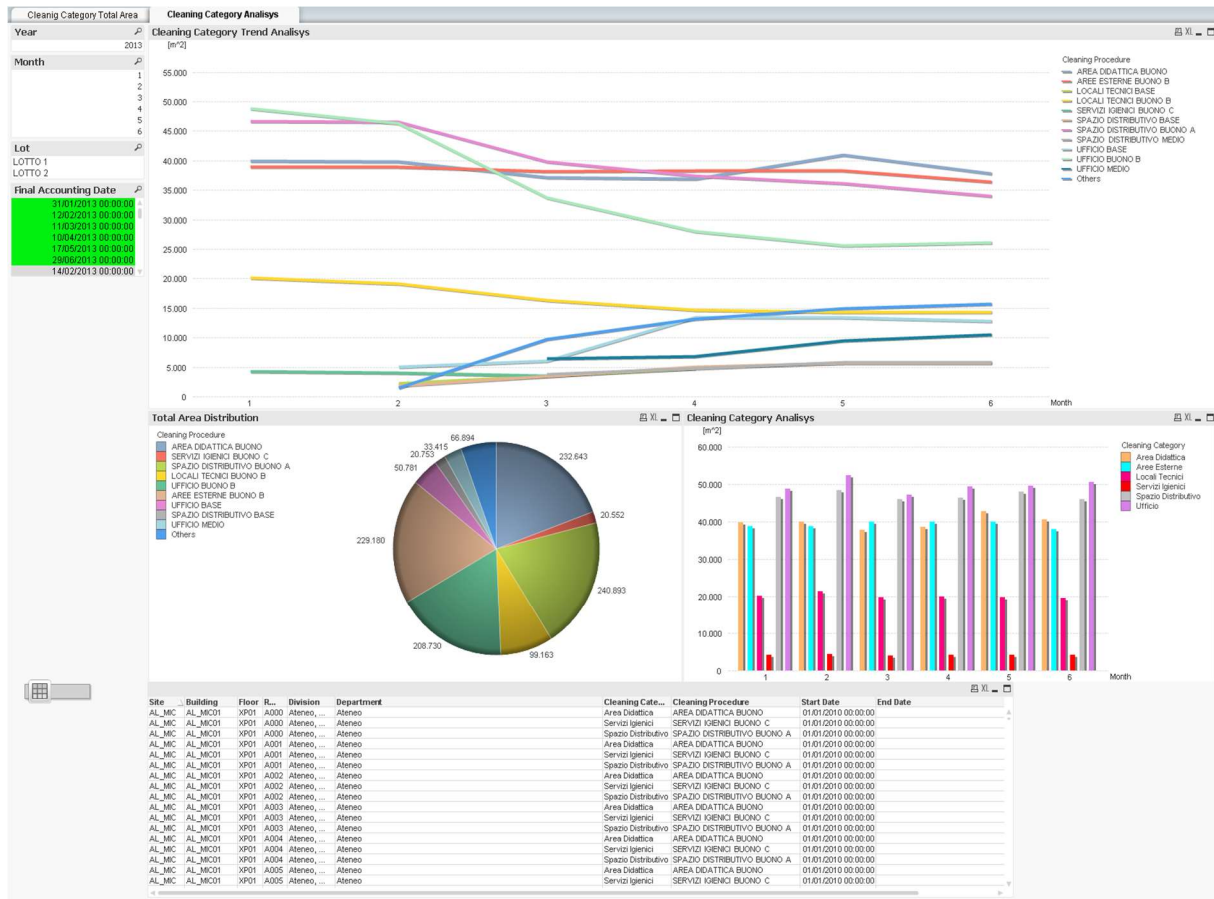


Fig. 6: Cleanliness different levels time course with room detail and total cleaning categories area

At the start of the process, a massive data load was made with all the room attributes; subsequently all data were individually checked and modified by the Structures representatives. Through this dashboard users can dynamically display the time course of the area associated to the cleaning procedures without the need to extract from the Archibus application the data to perform the analysis. Our next project activities will be oriented to the integration of the dash boarding tool with budget and finance data views. The innovative approach involved the BIM methodology that is based on a building model containing all information about the building construction and management. Currently BIM adoption is spreading in Italy nevertheless is not yet widespread compared to other European Countries. Since a few years at the Politecnico di Torino, many studies are developed by researchers in order to identify new possible applications of BIM. One of these is focused on the use of parametric software, like Autodesk Revit, for facility management, with special focus on space and cleaning activities. First of all, it is essential to realize a building parametric model, paying attention to include in the system all the information that are useful for a proper management. The “shared parameters” are used in order to customize the level of information

of parametric elements in Revit. In Politecnico di Torino case study, this command is used to include additional information to the “Local” object, which contains data about the room and allows to display these information through labels on floor plans. In this way, the “shared parameters” creation has allowed to enter all the room information, that are currently in the Politecnico, like for example: room code, room name, room categories and type, Structure type and Structure of belonging. The same procedure is adopted for the cleaning service data implementation, with the introduction of cleaning category, frequencies and service levels. The advantage coming from the use of BIM tools consists to have an information infrastructure, represented by the parametric model, able to archive, organize and export the metadata describing the building, thanks to the presence of a software database. The system potential is expressed in its ability to respond to complex queries and allows the model thematization with specific information. Traditionally, the data necessary to manage the building are stored in multiple systems and therefore they may be redundant, out of date or missing. The BIM procedure, instead, allows automatic updating of data related to possible model variation and a real time replacement of a room attributes in the case the room intended use is modified. Secondly, it is evident that the presence of easier complementary tools enables greater usage of the application also among the technical or administrative staff, which have little knowledge on the subject. DBlink, a Revit add-in application, is used to export all the information described above in Excel format. This allows multiple users to make the ordinary changes, such as a cleaning service level update. Any changes made to the information contained in the excel file can be suitably re-imported within the parametric model and in this way the update of database is made. Moreover, the model was linked to the Archibus management platform. Further activities are currently under development and include the use of augmented reality and tablet applications to facilitate maintenance operations.

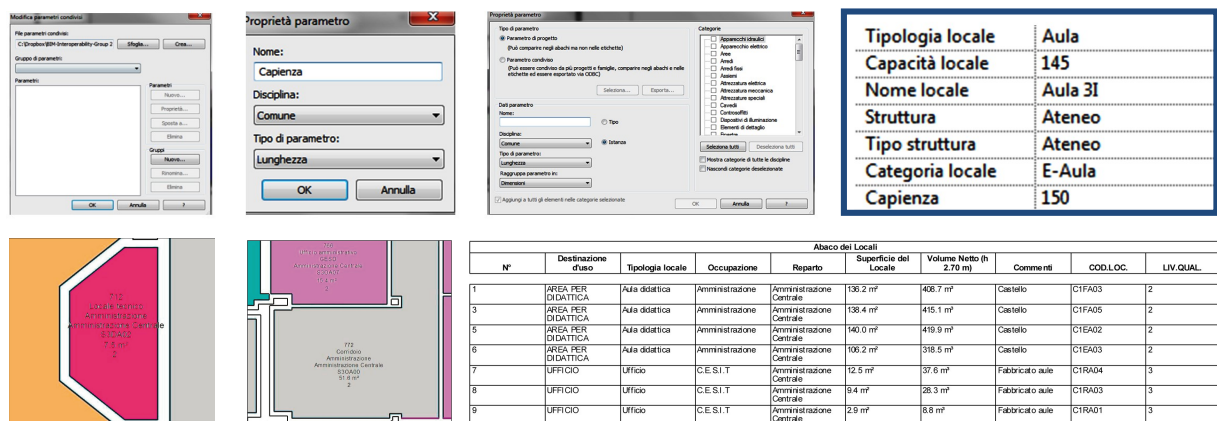


Fig. 7: Shared parameter creation



Fig. 8: Step for the connection of the parametric model to Archibus

### 3. Results

As mentioned previously, the aim of the project was to provide to the Politecnico Structures an integrated tool for the cleaning service management. The new agreement formulation allowed to completely transform the way cleaning service contracts are managed. Nowadays, more than 300.000 m<sup>2</sup> are managed by a single framework agreement and by a unique FM system in order to make synergies with the main aim of costs saving. The framework agreement has also simplified the procedures related to the cleaning safety that, in this way, are verified only once.

The innovative methodology introduced for the cleaning service management is based on a parametric approach, pursued both through the Archibus FM application and with BIM. In this way a dual-input cleaning data is tested. Through the introduction of a system supported process, obvious advantages are achieved in terms of Real Estate asset knowledge, to plan ordinary and strategic activity. The previous cleaning contract was based on one-time dedicated mapping of all the campus sites, performed at the time of tender definition. Subsequently only the macro modifications were managed. With the new system, instead, both room data and floor plans are daily updated by the representatives of the Department and the Central Administration. In this manner the cleaning procedure for each room is immediately modified according to the spaces modifications and it is also possible to “put out of service” the rooms that are not available due to renovations. Space information, cleaning category and procedures are linked to ensure that the variation of a parameter have an impact

on all related data. It has been proven on the field that the assignment procedure is simple enough and user friendly for the different Structures to support the annual contracts definition. The spaces information are available in real time and a punctual and visual control of the cleaning procedures associated is guaranteed by the dynamically themed floor plans. These represent an added value and an extremely useful and immediate tool for periodic inspections in the whole campus. The data are dynamic and therefore allow a close simulation of the monthly costs, providing a clear and detailed overview of the situation. By analyzing in detail the data, the main cost items can be highlighted and detailed in order to reduce the service inefficiencies or wrong accounting. Through parameters variation, it is also possible to envisage alternative scenarios of expenditure, on the basis of which to take strategic decisions. Each department, changing the SLA of its spaces on the system, can, for example, verify what would be the impact of the cleaning service cost. The continuous update of the room attributes made on a distributed basis by Department representatives allows a good central visibility and control on global data and eases simulations in case of need of new tender.

The BIM approach explores the possibility to use a 3D parametric model for Facility Management in order to manage all life cycle phases of a building through this methodology. Building management represents in fact one of the most important phases, including complex and expensive operations in addition to the ordinary activities. A parametric model, unlike CAD, is an information archive. The database can be exported and used both in analysis application (structural, energy software, etc.) and in management platforms. The planimetric changes are easier to managed and all related information are updated automatically. The architecture of the system is complex, but there are several applications that allow to share and update data in a simple way. The single central model adoption is an important achievement to use the same information (surfaces, room codes, etc.) for all activities, in particular for the management of facilities.

The cleaning activities are also integrated in the “on demand work” section of the FM system. A maintenance ticket can be opened to require any cleaning operation. All the interventions are traced in the system that produces summary reports to account extra costs.

Finally, the project represents a pilot case that allows to implement on the system a functionality for the correct spaces allocation, consumptions and costs distribution between

the different Structures, allowing cost chargeback. In fact, the views relating to the final accounting are differentiated in order to show the total amounts both by lots and individual Structures, allowing to properly re-allocate costs. A side benefits of this study is the fact that the model developed for cleaning costs re-allocation can be used for other facility management services. The next projects will focus on energy consumption monitoring and smart building.

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