Med-EcoSuRe

Mediterranean University as Catalyst for Eco-sustainable Renovation
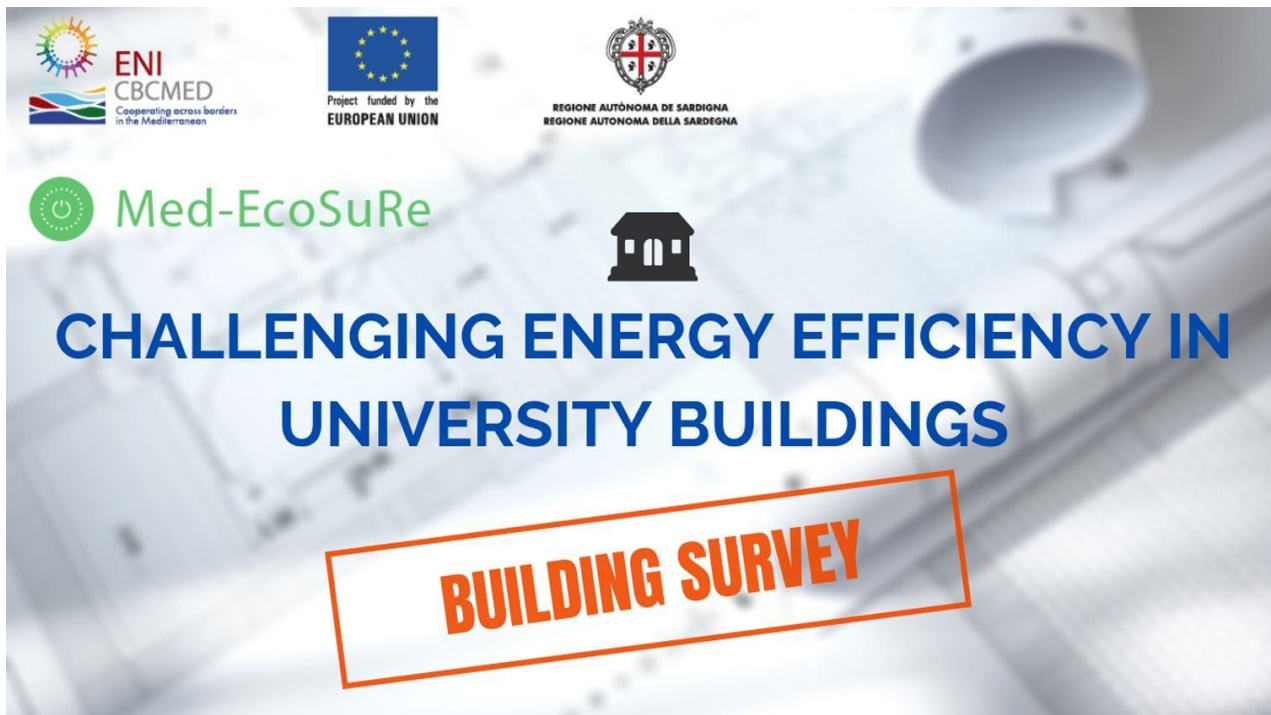
Survey Results Report

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Premise

The following report contains the results of the survey "Challenging Energy Efficiency in University Buildings" conducted within the WP3 - "Cross-border Living Lab Initiative" of the Med-EcoSuRe project ("Mediterranean University as Catalyst for Eco-sustainable Renovation"), financed by ENI CBC MED program.

Supporting the Med-EcoSuRe's general objective to promote and value innovative and eco-sustainable solutions for the retrofit of higher educational buildings in the Mediterranean Area, the WP3 (lead by the UNIFI-DIDA partner) introduced a Living Lab approach to stimulate the cross-border collaboration and sharing of information between the actors (academics, decision makers and stakeholders) involved in retrofit processes of university buildings in the Med area.

The survey is part of the activities promoted by the Mediterranean Cross-border Living Lab, and exploits the knowledge and know-how of project's partners and their local networks of stakeholders for the definition of innovative and eco-sustainable retrofit processes in university buildings, objective of the "Toolkit of Passive Solutions Design for Higher Education Buildings Retrofitting" - WP3's main output.

With the initial purpose to calibrate the Toolkit and make it useful, the survey was launched to explore the current approach of Mediterranean universities to the retrofit of their buildings, without any statistical scope. Nevertheless, the results permitted to delineate an interesting situation, analysed in this report starting from the received answers.

The Survey

The main aim of the survey "Challenging Energy Efficiency in University Buildings" was to understand the dynamics in the implementation of retrofit processes in university buildings.

The survey was organized according to the scheme proposed in the Toolkit, which looks at the retrofit as an innovation and quality process (circular) within the university building's lifecycle, and composed of the following phases:

1. Knowledge Framework
2. Analysis of Criticalities
3. Planning and Design
4. Intervention
5. Post- Management

Focusing on the first three phases of the retrofit process, the survey has been organized in three corresponding sections, beyond the introductory one related to the personal and university general info. For each section/phase, questions have been structured to obtain information about:

- People involved in the retrofit process (Who)
- Aspects considered for the retrofit (What)
- Procedures adopted to address the retrofit (How)

Implementing retrofits in university buildings is in fact a complex process, which requires reliable procedures for the coordination of different actors and the integrated consideration of interrelated aspects, such as the conditions of the physical building, its energy behaviour and the Indoor Environmental Quality experienced by users.

A total of 64 questions has been articulated into short answers, multiple choices, checkboxes and multiple-choice grid, according to the specific content of the question to be asked.

It has to be noted that the majority of questions regard the first section/phase, and that the number of questions decreases moving through phases; the reason behind is that an optimal retrofit process requires intensive and data-rich initial phases, starting from the knowledge framework.

In order to obtain reliable data from the field, the survey specifically targeted the three categories of actors directly involved in the retrofit process of the university building: university building managers, energy managers and decision makers.

For easy sharing and an user-friendly experience, the survey was developed online through Google Form.

In order to reach applicants from at least the four countries involved in the Med-EcoSuRe project, the survey has been translated in other 3 languages beyond English: Italian, French[1] and Spanish.
Thanks to the collaboration of Med-EcoSuRe partners, the survey has been forward to the wider number of universities in the Mediterranean area.

The collected information has been extracted into spreadsheets for the data analysis and visualization.

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[1] For the French translation of the survey, such as for the constant support and collaboration, a special thanks to Souha Ferchichi and Ines Khalifa of MEDREC.

Participants' profiling

The online survey was completed by a total of **18 applicants** related to 12 Universities and 2 national Ministries (Tunisian), distributed across the Mediterranean in all the countries involved by the Med-EcoSuRe project (Tunisia, Italy, Palestine and Spain).
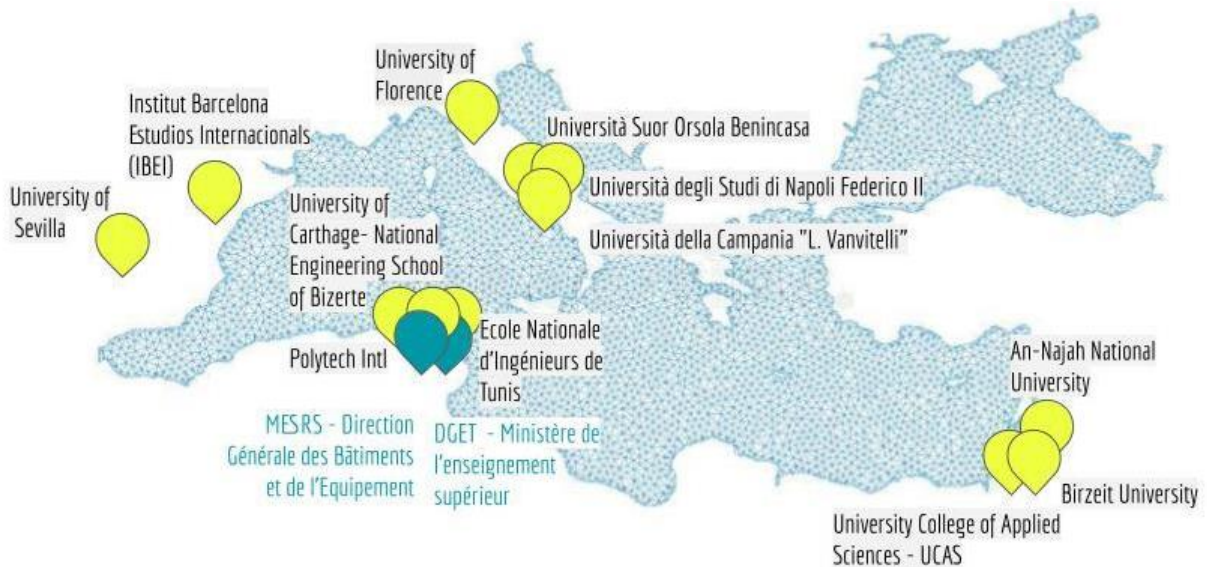
The majority of participants works for public universities (14/18), while less refer to mixed (2) and private universities (2).

Asking about the profession and the role occupied, participants are in the majority of cases engineers (10), followed by architects (6) and technicians (2). The most represented role is the building manager (9), occupied by engineers, architects and technicians, followed by the energy manager (3) and the decision maker (2), two roles entirely absorbed by engineers. For the presence of answers given by professors and researchers, a fourth category has been dedicated to the "University Staff"(4).

Profession/University role

	Building manager	Energy manager	Decision maker	University staff
Technician	1	0	0	1
Architect	4	0	0	2
Engineer	4	3	2	1
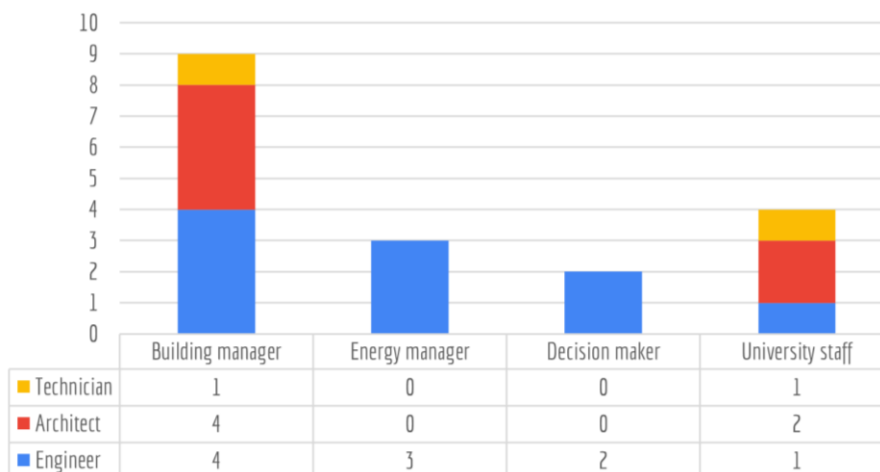
I section/phase: Knowledge Framework

The first section of the survey looked at the first phase of the retrofit process called "Knowledge Framework", which refers to the **systematization of the university buildings' data and information**, as the basis for the following phases of the retrofit process, starting from the analysis of criticalities.

a) People (Who)

In order to identify people involved in the definition of the Knowledge Framework, the survey asked who is the responsible for:

- Building management
- Energy management
- Decision making

The totality of participants agrees that the university buildings management is competence of the **University Technical Office**, which is also in charge of the energy management in the majority of cases (14). Focusing on these cases, the presence of **ESCOs** (Energy Service Companies) in half of the answers requires to taking into account the contribution of these external stakeholders for the definition of the knowledge framework, such as to retrieve energy data on consumptions.

If those responsible for the building and energy management of university buildings generally belong to the University Technical Office, the related **decision making is fragmented** to different actors according to the type/size of intervention.

Type of intervention / decision maker
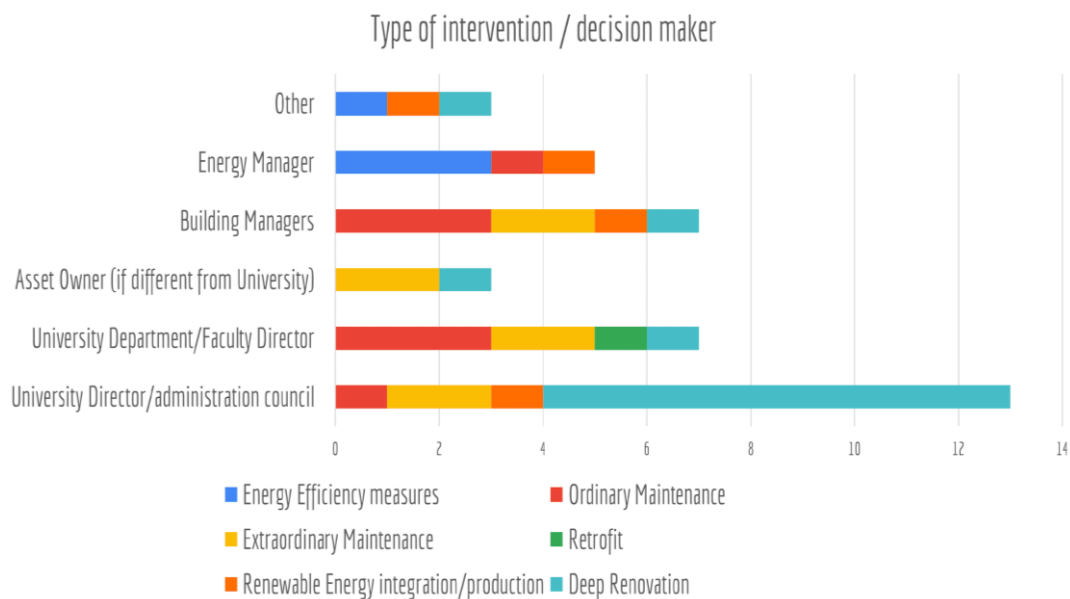
Building and energy managers are in charge of the decision making related respectively to the ordinary maintenance and the implementation of energy efficiency measures. Moving towards more important interventions (from extraordinary maintenance to deep renovations), it emerged the presence of decision makers belonging to three categories of actors: **asset owners** (if different from the University), **University Departments/ Faculty Directors and University Director/Administration Councils**. It is important to note that the decision making on interventions in university buildings is granted by actors that, for their natural role, **should not have specific competences on the issues**. This requires that the knowledge framework, such as the other phases of the retrofit process, has to be **very clear and comprehensible for all**.

Decision maker / type of intervention
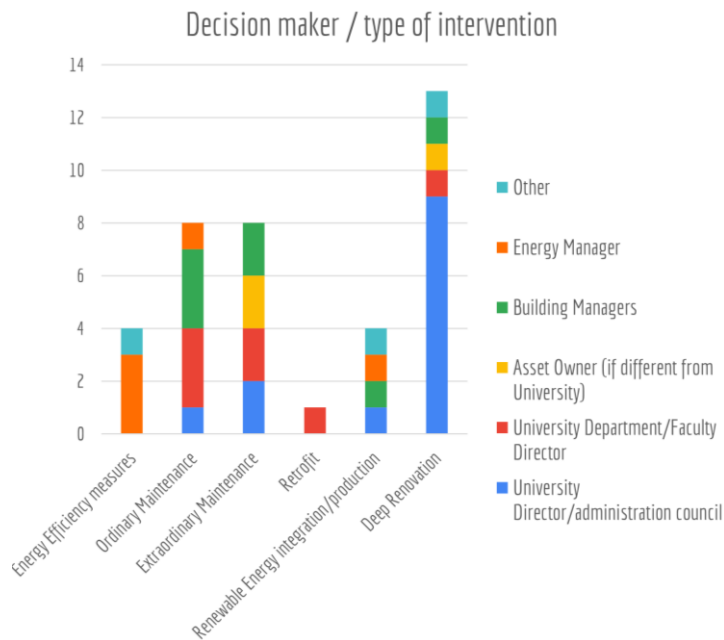
Moreover, looking at the different types of intervention, it emerged a high variability of competent figures: this reveals the need to define, within the single universities, a **clear framework of the roles and competencies**, in order to ensure a smooth decision making along the retrofit process.

b) Retrofit aspects (What)

Looking at the aspects to consider in the retrofit process, starting from the Knowledge Framework, the survey collected information about the physical buildings, the energy behaviours and the Indoor Environmental Quality in university spaces.
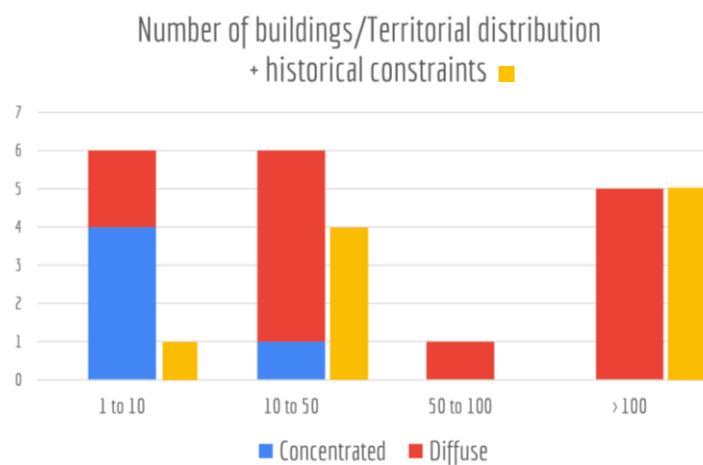
- Buildings

Both in the cases of public, mixed and private universities, the **ownership of the university buildings** does not belong entirely to the universities, but it is instead distributed between different types of owners, in particular private entities in the case of private and mixed universities, and public entities in the case of public universities.

Type of University/Building Ownership
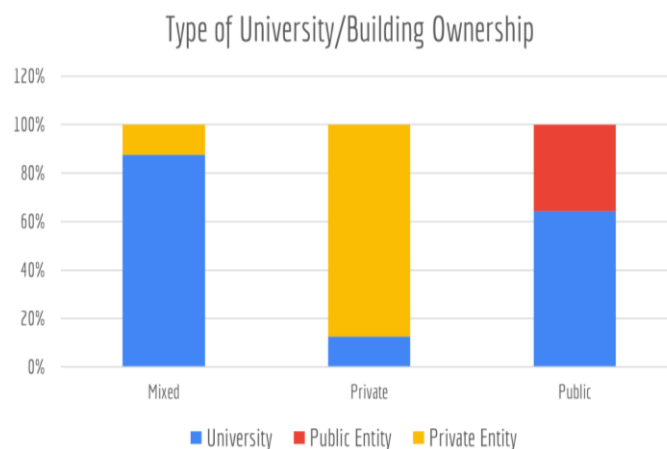
Focusing on public universities, the most representative case in the survey (14), they directly own all the university buildings in only 5 cases. In 2 cases public universities are completely hosted in public buildings, while in the remaining case the ownership is divided up between the universities and public entities.

Building ownership in Public Universities
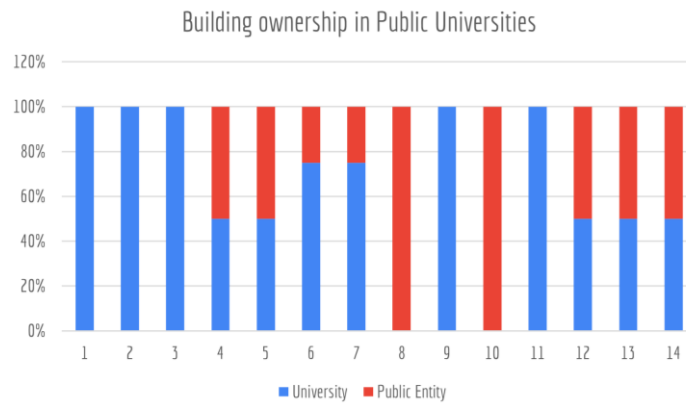
Still focusing on the physical aspects of the university buildings which impact the retrofit process, the survey investigated the **dimension of the university building park, its distribution at territorial levels and the presence of historical buildings with particular constraints**.

Number of buildings/Territorial distribution + historical constraints

According to the dimension of the university building stock, 6 cases refer to universities with a number of buildings between 1 and 10; 6 are also the cases of universities with 10 to 50 buildings; 1 refers to 50 up to 100 buildings; 5 cases refer to very big building stock, with more than 100 buildings.

The number of university buildings influences both their concentration in campus or their spread in the territory, such as the presence of historical buildings, resulting in the totality of the case of more than 100 buildings.

Relating the number of buildings to the type of university, it emerged that both private and mixed universities refer to very small building stocks (from 1 to 10 buildings), while the public ones tend to occupy much more buildings.

**Number of buildings/Type of University**
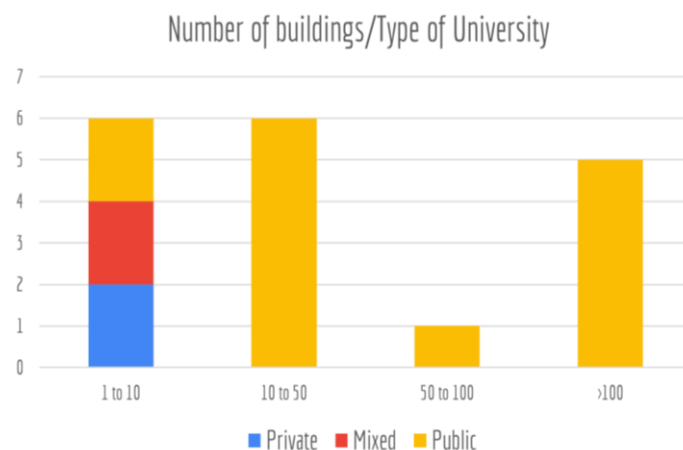
- Energy

Moving to the second aspect considered in the definition of the Knowledge Framework, the survey questioned if universities have developed an **Energy Audit in the last 5 years**. What emerged is that, if in 7 cases an energy audit has been conducted, in the majority of cases the answer is "no" (5) or "I don't know"(6). It is interesting to note that the "I don't know" refers to building managers of public universities with more than 100 buildings, revealing the difficulty to conduct energy audits when the number of buildings increases. Yet, the presence of

Energy Audit

energy audits does not depend on the type of universities: 2 of the 2 private universities do not have conducted an energy audit.
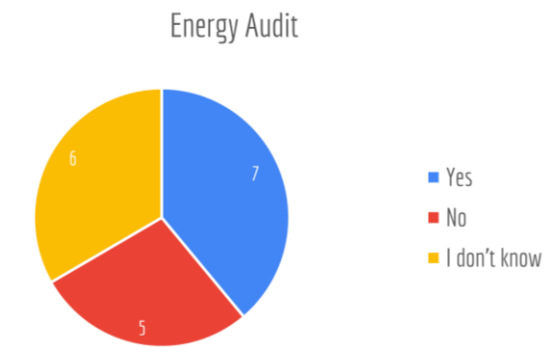
Referring to the cases of universities which had not developed an energy audit, the survey also asked why an energy audit has not been implemented. Answers revealed that the lack of energy audits depends on the **cost, the lack of personnel and on the fact that they are not compulsory by law**.

Another energy aspect object of the survey referred to the **regular collection of energy data** in the university buildings, such as energy consumptions. In half of the cases the answer is positive, followed by 6 negative answers and 3 "I don't know". Looking at single answers, it emerged that the regular collection of energy data did not depend on the number of buildings or the type of university (also private universities with small building parks do not collect energy data on a regular basis). Yet, it emerged a correlation between the lack of organized

Energy Data

energy data collection and the presence of energy audits (4 of the 6 cases in which energy data is not regularly collected correspond to cases in which energy audits have not been developed).
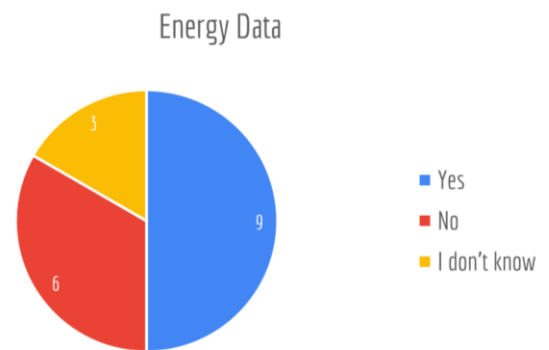
- Indoor Environmental Quality

Looking at the third aspect constituting "the what" of the knowledge framework for the retrofit process, the survey asked about Indoor Environmental Quality (IEQ) in university spaces.

First of all, the survey questioned the presence of formal measurements related to the IEQ. The answers revealed that in the majority of cases **IEQ is not considered as an important aspect to measure**, due an high number of "No" (8) and of "I don't know"(4).
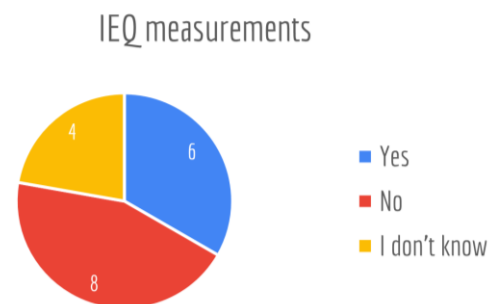
Looking at the positive answers of cases in which IEQ is object of formal measurements (6), the results showed that they refer to the three types of universities (public, private and mixed), but that the attention on IEQ is more present in small university building parks, with only a case in which this aspect

IEQ measurements


Number of buildings/Type of University
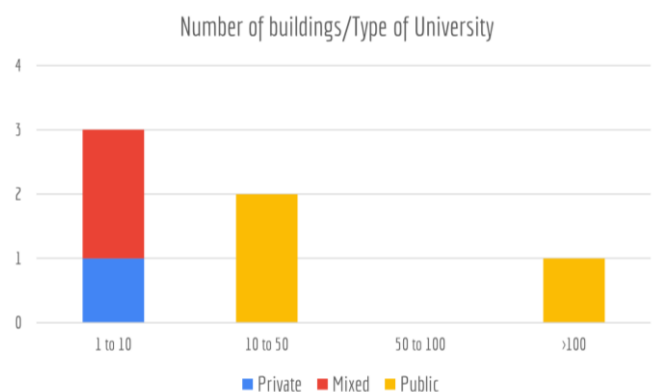
is considered in large building stocks. Still referring to the positive answers, the results revealed that there is a **high consideration of the different IEQ factors**, but that only in the half of cases these factors are checked in each university room, representing a criticality.
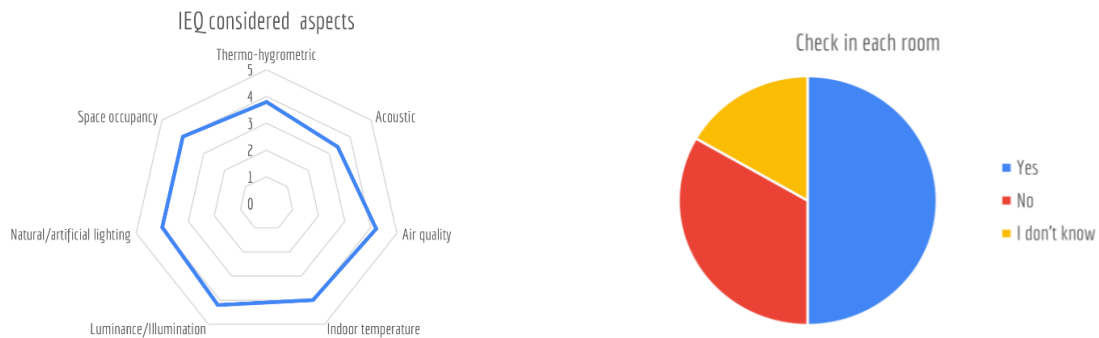
Going deeply in the investigation of IEQ in university buildings, the survey asked about the modalities by which IEQ is measured in university spaces. It has to be noted that participants previously declaring that there is **no** "formal measurement", give back information about how IEQ is measured (only one over 8 maintained the negative answer). This behaviour has been interpreted by the fact that, also if not the object of "formal" measurement, IEQ is in some way considered.
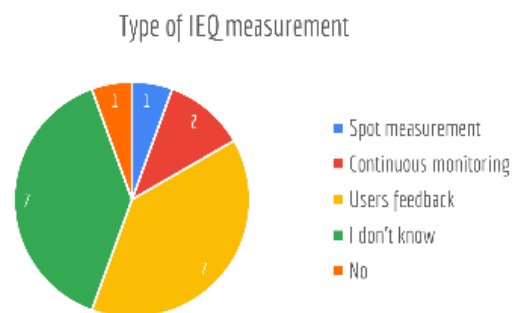
Looking at the answers about the type of measurement, the survey showed that, beyond the negative answer (1) and the high number of "I don't know"(7), the principal types of IEQ measurement refer to **users' feedbacks** (7), followed by continuous monitoring (2) and spot measurements (1). Asking about the frequency of such measurements, it emerged that if continuous monitoring verified IEQ conditions frequently or monthly, the users' feedbacks are considered only yearly or, in the majority of cases, **randomly** (such as the spot measurement).
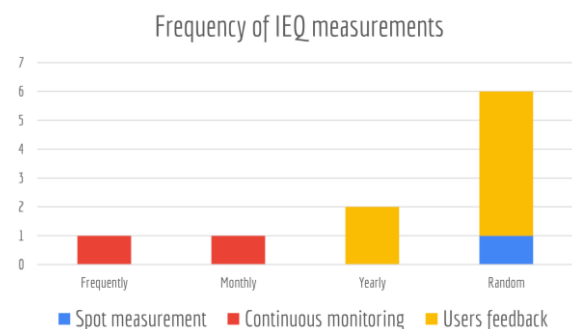
The survey revealed that IEQ is mostly considered via subjective data from users' feedback, and that just few instrumental verifications with objective data are put in place. Moreover, also the frequency of measurements does not appear satisfying, referring mostly to random verifications.

This behaviour should be comprehensible in the case of countries not dealing with national normative for minimal requirements on IEQ in university settings (according to the answers, Tunisia and Palestine), while cannot be justified in countries where such prescriptions are adopted (according to the answers, Italy and Spain).

c) Procedures (How)

Referring to the most operative part of the Knowledge Framework, linked to the procedures for its definition, the survey asked about the **management of building, energy and IEQ data in university buildings**.

First of all, the survey asked about the type of **support** used for the data management. The answers revealed that there is large use of digital supports (11), in comparison with paper-based (2) and mixed (2) supports (3 answers referred to "I don't know").
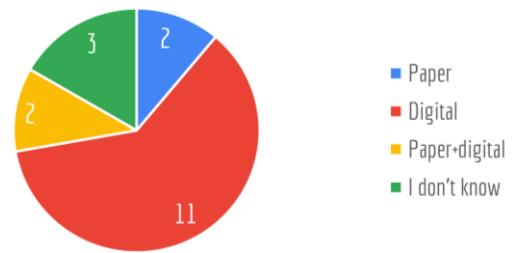
Another question was related to the **availability** of data: answers revealed an unsatisfying situation, in which in the majority of cases data are not easily available (8) or maybe available (3), while they are in 7 cases.

Nevertheless, the presence of digital supports does not correspond to an effective availability of data. The unavailability of digital data is a very worrying aspect, because it means that the investment for digitalization has not resulted in an improvement of data management.
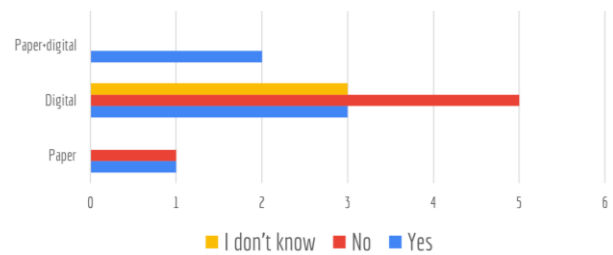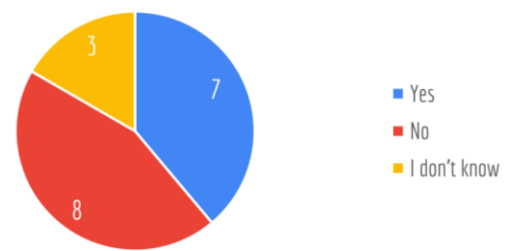
At the same time also the **accessibility** to university buildings' data is very limited: also in the case of public universities the access to data is limited to private access.

Asking about **what kind of data are available**, the survey revealed that beyond, geometrical data referring to the building plans and to service bills, other fundamental data to approach a reliable analysis of criticalities and a successful planning and design of the university retrofit are not, or not surely, available (this is, for example, the case of buildings' sections and facades or the 3d).
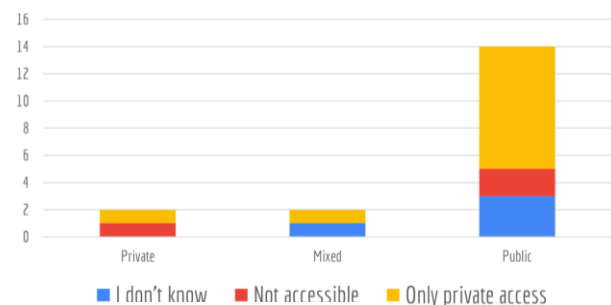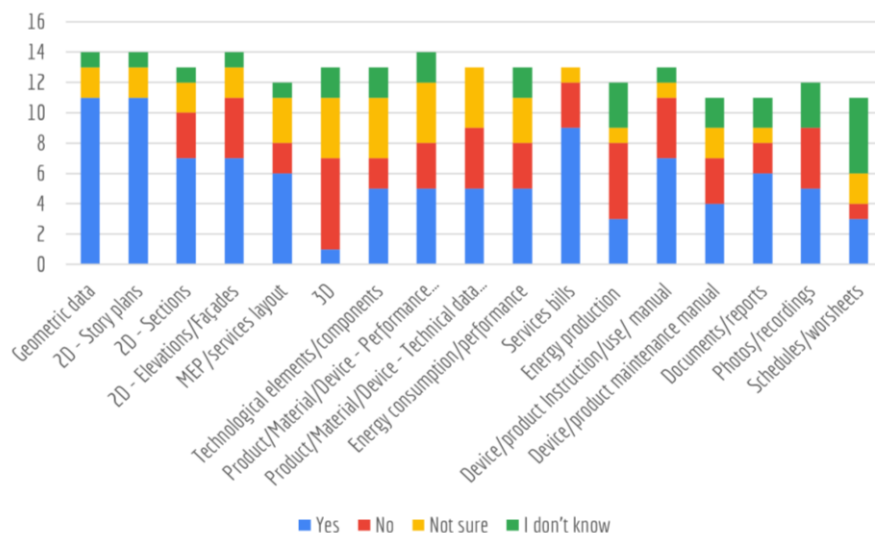
Support for Data Management

- Paper
- Digital
- Paper+digital
- I don't know

Data Availability

- Yes
- No
- I don't know

I don't know No Yes

Access to Data/Type of University

I don't know Not accessible Only private access

Type of Data / Availability

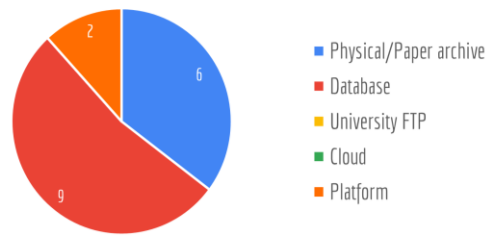Yes No Not sure I don't know

Going more deeply, the survey also questioned how the different types of data are aggregated. Results show an important use of **database** (9), the persisting of physical and paper archives (6) and, only in very few cases the implementation of a dedicated platform (2), consenting to a more dynamic management (one respondent did not answer). Internal FTP (File Transfer Protocol) or cloud system are still not implemented, representing an interesting innovation option for universities.
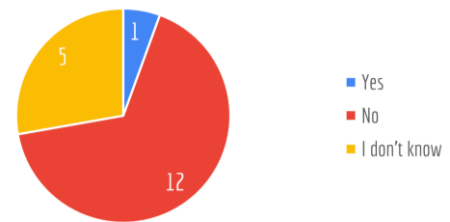
To cope with the large amount of information, the survey asked about the adoption **standardization systems** for the management of university buildings data. The prevalent answer is "No"(13), and just in one case positive. Moreover, the survey revealed that those who did not have a standardization system **"do not"** plan to adopt one, and this appears as a criticality.

Continuing in the understanding of how the university buildings' data are managed, the survey questioned the presence of a **sharing system** for the collaborative teamworking between building, energy managers and decision makers. Also in this case the prevalent answer is "No" (10). The survey revealed that the sharing system is not related to the use of "information containers" such as the **Building Information Modelling**, which has been adopted in only one case.
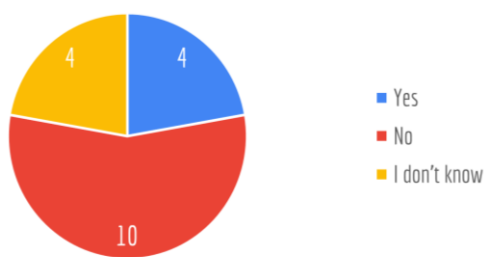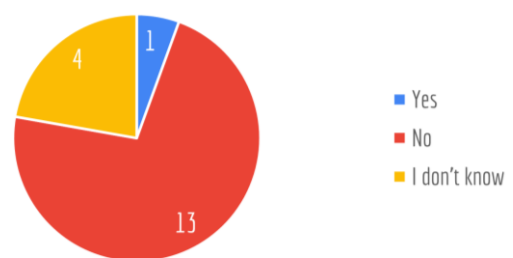

Data aggregation

- Physical/Paper archive
- Database
- University FTP
- Cloud
- Platform

Data standardization

- Yes
- No
- I don't know

- Standardization
- Plan to standadize

Sharing system

- Yes
- No
- I don't know

BIM adoption

- Yes
- No
- I don't know

II section/phase: Analysis of Criticalities

The second section of the survey was dedicated to the second phase of the retrofit process "Analysis of Criticalities", which refers to the **identification of the building, energy and IEQ criticalities** in the university buildings, as the basis for the definition of the retrofit actions to be implemented.

a) People (Who)

In the first instance, the survey asked about the presence of a **dedicated office or person** in charge of the detection of different types of criticalities related to the three aspects identified in the Knowledge Framework: building, energy behaviour and IEQ. The results showed that the presence of a dedicated person/office to detect criticalities is more related to building aspects, less to energy and even less to IEQ, revealing more attention to those aspects which have more "visibility".
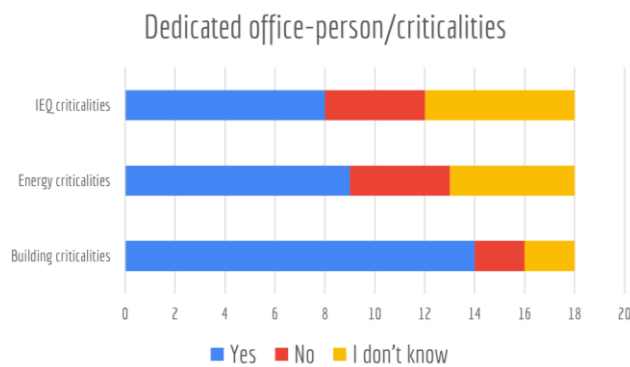

b) Retrofit aspects (What)

Looking at the three aspects to consider in the retrofit process, defined in the Knowledge Framework, the survey collected information about the kind of criticalities related to physical buildings, the energy behaviors and the Indoor Environmental Quality in university spaces.
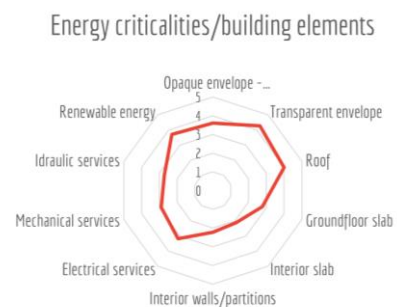
- **Buildings**

The survey questioned which building elements represent a criticality in term of buildings decay: the result demonstrated that, beyond "hydraulic services", the main criticalities refer to the **building envelope**, both transparent and opaque (external walls, roof and ground floor slab).
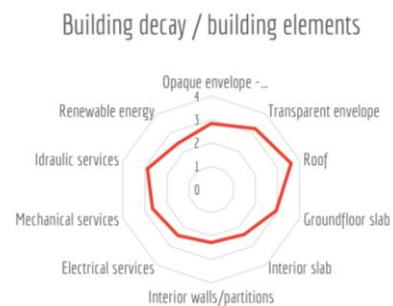
- **Energy**

Confirming the relationship between building and energy criticalities, the question about which building elements represent a criticality for energy efficiency reported similar answers: the main building elements considered responsible for energy criticalities referred to **building envelope**, and in particular the external walls, the transparent fixtures and the roof. It has to be noted that also the integration of renewable energy systems has been considered as a critical element. An explanation to this result should be the difficulty to integrate the renewable

energy production within the ordinary management of the university building's energy aspects.

- IEQ

Looking at the Indoor Environmental Quality in university spaces, the survey questioned which are the main criticalities related to this aspect. The answers depict a situation in which the main criticalities are related to the **indoor temperature** in the university spaces, resulting both "too hot" and "too cold", and to the **lighting**, causing both "low illumination" and "glare effects"; also the acoustic condition has been considered as criticality.


IEQ criticalities

c) Procedures (How)

The third part of the "Analysis of Criticalities" section was dedicated to the understanding of the modalities by which the different types of criticalities are detected. It emerged that in majority of the cases, the **users' feedbacks and complaints** represent the principal modality to individualize the criticalities (6), followed by the use of monitoring instruments (5) and the on-site visits (4). Asking about the **frequency** of such detection modalities, it resulted a not satisfying picture: the majority of answers, in fact, refer to "I don't know", diminishing the value of the criticalities 'detection.

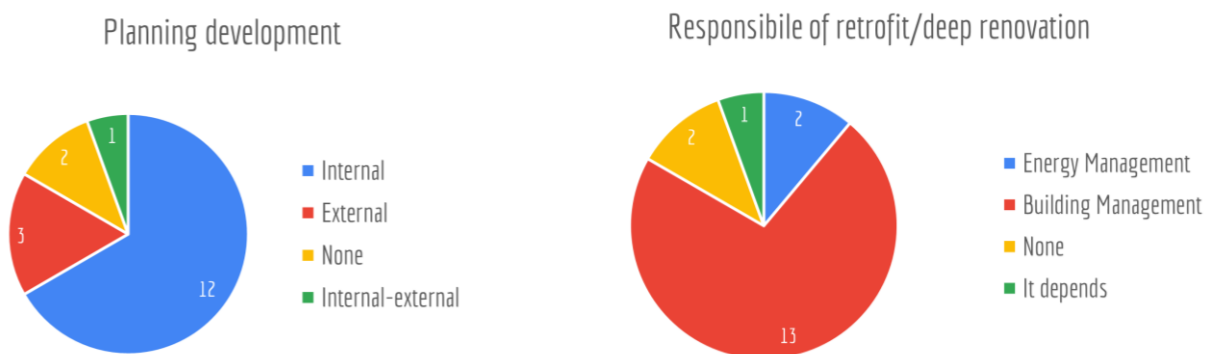Detection mode
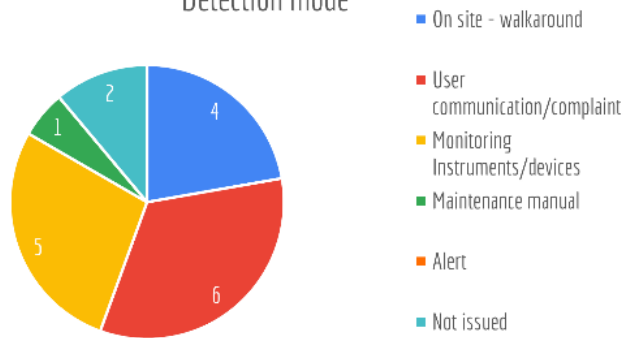
Detection mode/frequency
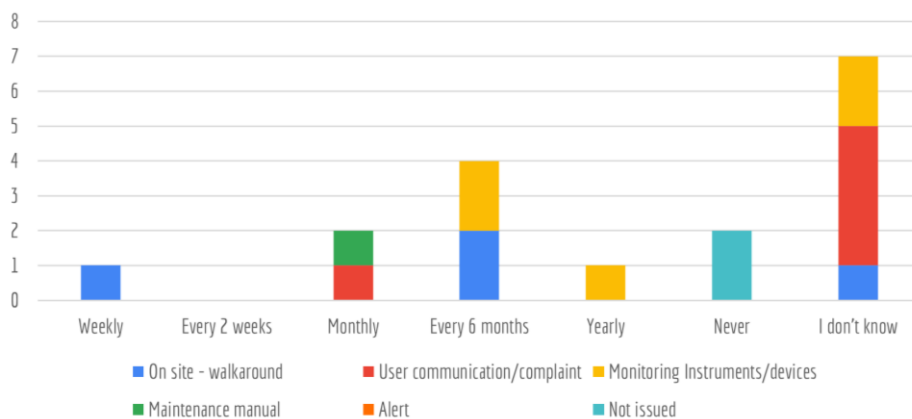
III section/phase: Planning and Design

The third and final section of the survey regarded the central phase/core of the retrofit process "Planning and Design", which refers to the proper **planning and design activities** related to the implementation of the retrofit project in the university building, on the basis of the contents individualized in the previous phases of Knowledge Framework and Analysis of Criticalities.

a) People (Who)

In order to identify people involved in the planning phase, the survey questioned who is **responsible for the planning, feasibility analysis and/or the development of procedures for retrofit/deep-renovation projects**. Answers revealed that the planning of retrofit and deep renovations are responsibilities of the building managers (13), that in the majority of cases (12) are internal to the university. Nevertheless, there are cases (3) referring to public universities in which the planning of the retrofit/renovation projects is entrusted to external actors.


Planning development

- Internal
- External
- None
- Internal-external

Responsibile of retrofit/deep renovation

- Energy Management
- Building Management
- None
- It depends

b) Aspects (What)

Looking firstly at the building planning activity, the survey asked if **University Action Plans**, containing the main building interventions to be addressed, have been recently developed (5 years): in the majority of cases this happened (11), in just one case not (1), with an high number of respondents which did not know (6). Referring to the planning activity specifically related to the energy aspects, a question was dedicated to understand if **Energy Efficiency Plans** have been adopted in the universities. Answers revealed that in less of half cases (8) an Energy Efficiency Plan is present, with an high number of answers in which this did not happened (6), followed by the "I don't know" (4). It has to be noted that in the majority of the cases in which an Energy Efficiency Plan is present (7/8), related projects have been executed or are in phase of execution, revealing the necessity of planning.

Planning activity

- Yes
- No
- I don't know
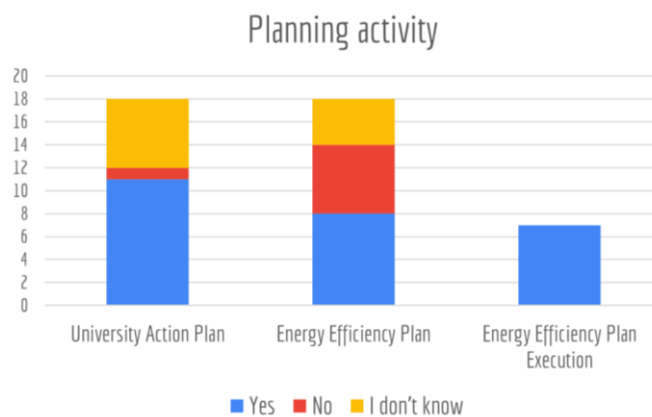
Moving to the scale of building design, the survey revealed that **design activity** is developed mainly inside (10) the universities, but also outside (6); the entrusting to external actors, present both in public, private and mixed universities, is more prevalent in the cases of universities with more than 100 buildings.
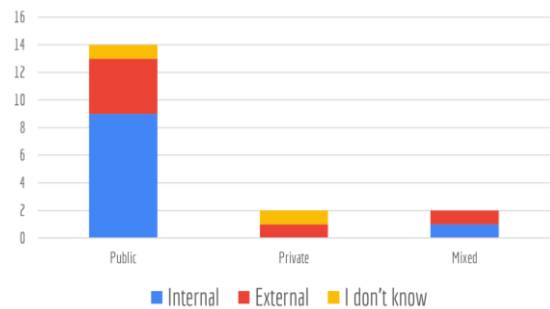
Project development
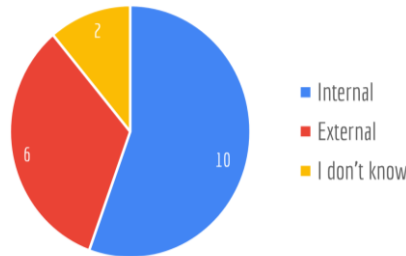
Project development/Number of buildings
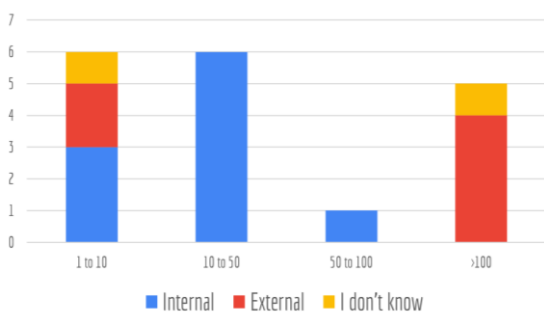
**Project development/Type of University**

c) Procedures (How)

The activation of plans and projects to improve the energy efficiency in university buildings can be stimulated by the presence of specific **national financing programs**. Questioning about them, the results showed that, beyond the "I don't know" (6), in an high number of cases national financing mechanisms exist (8), revealing a huge opportunity.

Nevertheless, financing schemes are usually based on the effective proving of the achievement of high energy efficiency targets. For this reason, the survey asked about the presence in the universities of competences for the definition of **energy certifications**: considering the negative (6) and "I don't know" (6) answers, this aspect does not appear as an object of particular attention in the pool.

Finally, the survey asked if **IEQ aspects** are considered in the cost-effectiveness analysis at the basis of the planning activity: if the positive answers are encouraging (8), in the majority of the case these aspects are not considered (4) or under-considered (6).
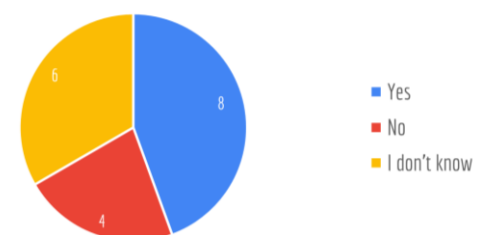
National Financing Programs
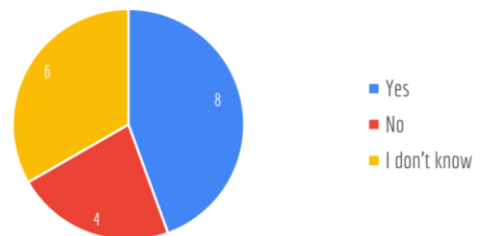
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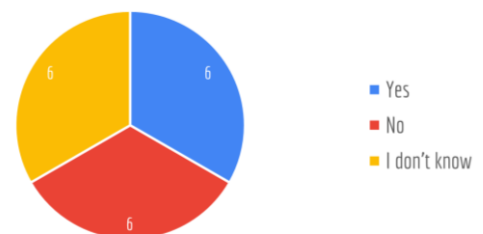
Integration of IEQ

Summary of Results

The following matrix contains the main critical aspects emerged from the survey and organized according to the phase of the retrofit process and to the three elements analysed: people involved (who), aspects considered (what) and procedures (how).

	KNOWLEDGE FRAMEWORK	ANALYSIS OF CRITICALITIES	PLANNING AND DESIGN
People	Decision makers are not necessarily competent on building and energy aspects	Less attention to energy and IEQ criticalities, in comparison to the most "visible" building decay	Responsible are both internal and external to the university
Aspects	Building: large university building stocks (with historical constraints) + different owners = spread out of information	Building: Criticalities mainly refers to the envelope	Building: Not all universities have implemented a recent Action Plan to foreseen building interventions
	Energy: lack of energy audits and of regular energy data collection	Energy: Criticalities mainly refers to the building envelope	Energy: Not all universities have implemented an Energy Efficiency Plan
	IEQ: high consideration Vs poor evaluation (mainly subjective)	IEQ: Thermal and lighting criticalities	IEQ: Weak consideration of IEQ factor in cost-effectiveness analyses
Procedures	Data digitization does not correspond to availability and accessibility + poor consideration and adoption of standardization systems (i.e. BIM)	Not satisfying detection: reference to subjective data, lack of quantitative and continuous monitoring	Presence of national funds for EE in university buildings Vs lack of energy certification procedures

The identified critical points will be specifically addressed by the "Toolkit of Passive Solutions Design for Higher Education Buildings Retrofitting", which will provide suggestions and tips to overcome them and sustain better retrofit processes in Mediterranean universities. In particular, the Toolkit will identify a best path based on the implementation of the BIM (Building Information Modelling), which has the potential to solve the individualized criticalities by connecting people under a common language, by collecting and combining building, energy and IEQ data with standardized procedures that encompass the whole retrofit process: from the definition of the knowledge framework to the post-retrofit building management, impacting in a positive way the future life of the university building. Moreover, the Toolkit will also envision the possibilities to experimentally develop more advanced Digital Twins, buildings' digital replicas able to consider real-time data fed by IoT sensors, consenting a more advanced management.