A Place for the Workplace to Work

A system of performance indicators for strategic design, management and use of the workplace

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Abstract

New and easily applicable ways to attune the in-use quality of office buildings are needed in order to improve space, business and people performance. This research proposes a framework for key performance indicators (KPIs) to support decision-making processes in the design, management, and use of next-generation workplaces.

Office space has been going through radical changes lately. Recent financial constraints have contributed to modifying corporate real estate strategies and the traditional role of the workplace. Moreover, disruptive advancements in the Information-Communication Technology field have led to three main consequences. (A) New 'smart' ways of working are influencing the traditional office space in both quantitative and qualitative terms. (B) New communication modes and feedback channels empower clients and users of services/facilities. (C) New data are available and suitable to create value, which increases the importance of updated information. These trends converge in the workplace that is expected to evolve according to both organizations' needs and people's preferences. For these reasons, there is growing interest in studying the ongoing changes of the work environment and how its users perceive it.

In fact, various users hold a stake on workplaces, but research to date has not clarified who they are, with respect to their actual roles and responsibilities, and values and needs. Also, several kinds of performances get measured by organizational managers, corporate real estate managers, and facility managers. Though, the related indicators often remain separate in the respective disciplines and at a raw stage of elaboration, thus cannot be exploited to their maximum potential.

How are today's workplaces adapting to the mutable needs of their demanding users? Who are workplace users? How can we better design, manage, and use today's and tomorrow's workplaces? These are the main questions this study aims at answering to.

The goal of the research is twofold: first to acknowledge workplace users; second, to select interdisciplinary indicators that all these users deem important in workplace-making, and to systematize these into a manageable list.

The methodology applied to address this double objective develops throughout subsequent steps of investigation. A triangulation of research strategies is employed. Preliminary review of literature helps set a framework about the changing panorama of the workplace. In a next research phase, the characteristics of workplace users are examined through case studies. In the final phase, KPIs are extracted and elaborated by applying a Delphi technique.

Finally, the research provides a set of key indicators enabling the compound of different workplace users' perspectives into a unified system. This model is suitable to assisting the design, management, and use of next-generation workplaces, while enhancing the relationship between workplaces and their users.

Keywords

Workplace, Users, Key Performance Indicators, Interdisciplinarity.

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1 Introduction

"THE PROCESS, THE SOLUTION, AND THE STAKEHOLDERS CAN NO LONGER BE SEPARATED."

—REX MILLER, LEADER OF MINDSHIFT

WHY (AIM). Chapter 1 explains the main reasons to investigate the topic of workplace management and introduces a broad contextualization of this study. It briefly synthetizes the research development as an executive summary.

WHAT (CONTENT). The first section explains the ***motivation*** to undertake this research project, how it was born and why matters concerning the workplace captured the author's personal interest. The content explicitly takes a personal perspective, by telling a story whose aim is to connect the dissertation with everyone's real life. This section underlines the potential impact of this research for enhancing the quality of knowledge workers' everyday life.

The next section introduces the ***relevance of the research*** in a broader context. It brings up the framework within which the present project is inscribed and reconnects it to the main research domains. The study, in fact, has a strong interdisciplinary intent, thus it is necessary to recall the different fields involved.

Problem statement and general objectives orient the reader through the investigation, by explaining the goal of the dissertation.

The structure of the dissertation is briefly showed through the ***research methodology***. This paragraph draws a map of the logical flow of thought, which eases comprehension of the subsequent phases of the research.

Key findings encapsulate the main results that have been reached in the different phases of the research development.

Keywords' definition develops a critical review of the keywords that belong to the present research, citing some of the main sources involved in their meaning.

The chapter ends with an ***outline of the dissertation***. For a faster and more focused reading of the thesis, a synthetic summary is provided about the topics displayed in the next sections. This helps orientation in the research path and navigation through the contents.

1.1 Motivation

Visiting the brand-new 'Palazzo Lombardia' in the heart of Milan is exciting, especially when you climb it to watch the city from the top of its tower. I used to enter it 5 days a week over my 6-month internship at the Lombardy Region Central Offices.

My initial expectations were high. The office building is designed by Pei Cobb Freed & Partners, together with Caputo Partnership, and it was inaugurated in the 2011, only a few months before my arrival. It won the Best Tall Building Europe Award 2012 for its high performances in terms of environmental sustainability and social activation. All these news seemed to be promising for a satisfactory work experience.

Together with my colleagues, I would make use of the spaces, facilities and services provided within the building throughout my 8-hour working day. Though, despite all that fame and my early enthusiasm, pretty soon I started to experience several discomforts affecting the work and life of its occupants, me included.

It was relatively easy to observe that the occupants were not happy about that workplace. They often lamented being cold. Several workspaces wouldn't receive enough daylight because of the particular shape of the floor plates. Open space layout and desks distribution were not very effective, causing noise and frequent distractions, according to the employees' opinions. The break areas were small and not inviting at all. Moreover, the occupation density was very low, at least many areas of the building would seem almost empty for most of the day.

Here, I started to realize that a building is designed to be used by people, but the risk is that, once it becomes occupied, the satisfaction of those people is just taken for granted. On the contrary, mismatches between design intentions and results often occur.

Most of the people in today's developed countries are knowledge workers and carry out their activities in an office-like environment. That is why it is extremely important for workplaces to encounter the needs and preferences of their users.

This matter is challenging because employees are not the only actors holding a stake on offices. Several players nowadays run office buildings and attach some value to them (Coenen, et al., 2012). Along with the physical complexity required to today's office buildings, all the players have to handle contrasting priorities, personal agendas, and preferences. Among them one can find: designers, managers and occupiers (Leaman & Bordass, 1999).

All of them, though, are 'workplace users', to different extents. Thus, in order to manage at best the whole life cycle of an office building, from the designing stage, to the occupancy stage, these different perspectives should better dovetail with each other.

I asked myself a few general questions:

1. How can the interactions between users and office buildings be better managed in the daily operation? Does any model/system exist to support the inter-communication between all workplace stakeholders/users? How can the design, management and use of office buildings improve in the next-generation workplace?
2. What do the concepts of 'quality' and 'performance' mean by the perspective of office building users? Who are the stakeholders/users interested in the quality and performance of the workplace today and in the next-generation?
3. How can data produced by both buildings and users enhance the economic, environmental and social value of the workplaces?

1.2 Relevance of the research

By coming across those broad questions, the present research follows on in the school of thought of the studies on human-environment relations and environmental psychology (Altman, 1975; Vischer, 2008a), which date back to the first half of the 20th century, for example with the studies carried out by Elton Mayo (1933). Later on, research on the role of the users in the definition of building quality evolved and found application of its principles in Post-Occupancy and Building Performance Evaluation practices (Crozier, 2009). Nowadays, it looks like these concepts need to be recalled, as the most recent RIBA 'Plan of Work 2013' suggests (RIBA, 2013).

Most of the contributions to the field of post-occupancy studies elaborate on the office type (Mallory-Hill, et al., 2012). This is not surprising, if we take into consideration that knowledge workers, who sum up to more than 50% of the population in western countries, spend at least one third of the day, and the half of their waking hours, in an office environment (van Meel, et al., 2010). Their working life affects their wellbeing and life satisfaction, as stated in the Third European Quality of Life Survey (Eurofund, 2012). That is why satisfaction at work has become a widespread focus of research, currently counting more than 10,000 articles and publications about it (Harter, et al., 2006). However, some room for exploration remains open.

First, 'new ways of working' have been spreading lately, due to the fact that technology nowadays allows to work from anywhere and at any time. Two main elements characterize many companies' switch from traditional to new ways of working: Smart Working policies, and Activity-Based work settings. Smart Working (SW) policies entail flexible working hours and an evaluation of productivity, which is result-based rather than working hours-based (Crespi, 2016). Activity-Based Working (ABW) strategies complement this approach, by offering a variety of work settings that employees can choose from (Veldhoen, 2017).

This dynamic is increasingly expanding and has caused relevant alterations in the human-workplace relations, but also in the real estate domain. Some academic contributions (for example, Becker, et al., 1995; Engelen, et al., 2018; Manca, et al., 2018), along with publicity materials, white papers and grey literature (for example, Miller, et al., 2014; Methodos, DEGW, & Partners4Innovation, 2015; Morera, et al., 2017), address the topic of the new ways of working from different angles. Some authors focus on the spatial features of office buildings both at a urban/territorial scale (among which, Gensler, 2014; Slumbers, 2017; Mariotti, et al., 2017) and at a building scale (for instance, Hardy, et al., 2008; van Meel, et al., 2010; Ciaramella & Bellintani, 2015). Some others analyze the characteristics of the human element within this changing work environment (such as, Maher & von Hippel, 2005; Erlich & Bichard, 2008; Brown, 2009; Puybaraud, et al., 2011). A different area of the literature deals with the data that is potentially available within and about the workplace domain (among these authors, Waber, 2013; Suckley & Dobson, 2014; Brister, 2015; Bahr, et al., 2016). Also, a consistent corpus of knowledge is raising some issues regarding the potential values attached to the workplace (see, Hollingworth, 2012; Colpaert, et al., 2014; Palvalin & Vuolle, 2016). In particular, the values and impacts of the workplace seem to fall into three complementary spheres: social, environmental, and financial (Becker, 1990; Varcoe, 1996; Alker, et al., 2014; Epstein & Rejc Buhovac, 2014; Kämpf-Dern & Konkol, 2017).

Given the multiplicity of viewpoints, a systematization of the current literature is necessary to foresee the evolution of the workplace in its 'next-generation' as a whole. Only by understanding the multiple components of the next-generation workplace, it will be possible to improve its performance and overall quality. This study proposes an overarching framework for the interdependent components of the next-generation workplace.

Second, workplace performance and quality depend not only on the human-environment relations, but also on the human-human relations. That is to say that several 'users' interact with and within the work environment, such as human resources leaders, designers, builders, commercial brokers, facility managers, project manager, chief executives, and those who will work in the space (Miller, et al., 2014). All of them relate to one another, while participating to different extents in the process of workplace-making. Some of them hold the demand side needs (like chief executives and employees), some others hold the supply side responsibilities (among which builders and commercial brokers), and some others mediate between the demand side and the supply side (such as designers and facility managers). The literature addresses, on one hand, user values and needs (for example, Vischer, 1996; Leaman, 2003; Lindholm & Nenonen, 2006; Blakstad, et al., 2008; Niemi & Lindholm, 2010) and, on the other, user roles and responsibilities (for instance, Zeisel, 1975; Tucker & Smith, 2008; Heywood & Kenley, 2013; Haugbølle & Boyd, 2013a). Most of the time, though, these studies lack in-depth reflections on the differences that may distinguish the general panel of the users into a more detailed categorization (Olsson, et al., 2010; Haugbølle & Boyd, 2013b).

This deficiency induces to push research attempts in the direction of understanding who the users are expected to be and how they could better interact with one another in the next-generation workplace-making process. This research follows up on these themes.

Third, improving human-workplace relations entails the development of strategies that must be grounded in evidence-based decision-making. This is possible only if workplaces are carefully and constantly monitored, which nurtures performance management toward quality outcomes over time (Becker, 1990; Kaplan & Aronoff, 1996; Douglas, 1996; Amaratunga & Baldry, 2003; Jordan, et al., 2009; Gertler, et al., 2011). Management strategies that are based on data gathering through Key Performance Indicators – KPIs are deemed appropriate and effective in this scope (Lavy, at al., 2014b).

Several approaches to performance measurement and management through indicators emerge in the literature. One characterizes a demand-driven viewpoint on the workplace-making process, which corresponds to the organizations' perspective (such as, Kaplan & Norton, 1996; Brackertz & Kenley, 2002; Alker, et al., 2014; Chwalbińska-Kusek & Olszewska, 2015). Another approach defines a supply-driven viewpoint on the workplace-making process. This reflects, on one hand, the corporate real estate management – CREM perspective (represented in Krumm, 2001; Lindholm & Leväinen, 2006; Lindholm & Nenonen, 2006; Calder & McPherson, 2007; Jordan et. al, 2009) and, on the other hand, the facilities management – FM perspective (like in Varcoe, 1996; Hinks & McNay, 1999; Fleming 2004;Tucker & Smith, 2008; Lavy, et al. 2010a; 2014a; 2014b).

The state-of-the-art reveals some flaws of the extant systems of workplace performance indicators. In particular, indicators tend to reflect only a sectorial point of view, with the technical/economic-financial stance often prevailing (Brackertz & Kenley, 2002; Amaratunga & Baldry, 2003; Fleming, 2004; Calder & McPherson, 2007; Lavy, et al., 2014; Miller, et al., 2014). This hints at the need for a holistic overture (Lavy, 2014b; Fleming, 2004; Varcoe, 1996; Hinks & McNay, 1999), able to embrace all the different values and stakes that workplace users manifest, more or less explicitly.

Actually, successful workspaces integrate many areas and must take into consideration design issues, the needs of a multitude of stakeholders, several different corporate performance parameters, as well as implementation modalities (Kämpf-Dern & Konkol, 2017). Each of these areas is researched in different fields, such as civil engineering, sociology, management, and so on (Appel-Meulenbroek, 2014). Also, the workplace exploits its value and manifests its impact in three distinct but complementary spheres, namely: economic, environmental, and social (Becker, 1990; Varcoe, 1996; Alker, et al., 2014; Epstein & Rejc Buhovac, 2014; Kämpf-Dern & Konkol, 2017).

However, a framework allowing all these fields to integrate as a whole, which supports the measurement and management of workplace performance and impacts is still missing. Only limited research has tried to advance further theoretical and practical models in this scope (for instance, Amaratunga & Baldry, 2002; Kämpf-Dern & Konkol, 2017).

Thus, it is important to produce more knowledge to push forth the integration of different disciplines' and users' viewpoints in the design, management and use of the next-generation workplace. This research aims at working in this direction.

In addition, contributions to the field of workplace performance management and strategies, within the facility and real estate management field (van der Voordt, 2017), come originally from Anglo-Saxon countries, starting from Preiser (1989) and Becker (1990) in the US, and Leamann and Bordass (1993) and Duffy (1998) in the UK. It has more recently expanded in the German speaking area, for example with Kämpf-Dern and Konkol (2017), and in northern Europe, thanks to Appel-Meulenbroek (2014), Nenonen (2006-2009), van der Voordt (2004), and others like Jensen, Sarasoja, and Coenen (Jensen, et al., 2013). On the contrary, contributions from southern Europe are very poor. In Italy, this field of study and applications is still at an embryonal stage, both in the academia and in the professional sector. Hence, a contribution from the Mediterranean area can benefit the state-of-the-art by complementing it with an additional edge.

This research will be relevant to both the scientific and the practical spheres.

The findings enrich the existing corpus of knowledge with:

- An original interpretation of the prospective evolution of the workplace;
- Novel insights concerning workplace users and their role in the workplace-making process; and
- An innovative perspective on performance indicators that can be shared by different disciplines and users.

At the same time, the outputs inform the professional sector to several extents:

- Aiding organizations in their evolution toward new ways of working;
- Helping companies understand the impact of their workplaces on their people and their business;
- Benefitting companies that will be able to attract and retain talents by making their employees satisfied with the building they work in;
- Supporting corporate real estate executives to recognize and manage the value added by properties to business; and eventually
- Enhancing the overall quality of workplaces.

1.3 Problem statement and objective

The problem statement lies upon the following **question**:

What data should be kept under control in the design, management and use of next-generation workplaces, for attuning these with the needs of all their different users?

Therefore, the **objective and output** of this study is:

To develop and validate a system of key performance indicators that are shared by all workplace users and help attune their respective stakes in next-generation workplaces.

As an **outcome**, the system is expected on one hand to provide an evident link between workplaces, business performances and client experiences, and on the other hand to facilitate more data collection, on a more regular basis and in a more common way.

The final **impact** of attuning the next-generation workplaces with the needs of their users will be realized by enhancing communication among them over the design, management and use of the workplaces they share, and will eventually improve human-environment relations in the workplace.

1.4 Research methodology

The problem statement incorporates three main topics, which are worth of deep enquiry: workplace, users, and data. These three topics generate seven questions to be addressed in subsequent phases of investigation (**Table 1-1**).

The first two questions set up the background and are answered in the preliminary phase of the research, i.e. Phase 0 (**Chapter 3**).

The subsequent questions focus on one hand on workplace users – Phase I (**Chapter 1)**, and on the other hand on workplace data – Phase II (**Chapters 5 and 6**). The objective of **Chapter 1** is to answer the second set of two questions, whereas **Chapters 5 and 6** face the last three.

The methodology mostly relies on qualitative strategies. Techniques for data collection and analysis are briefly introduced below, but will be explained more in detail in the respective sections (**Chapters 4, 5, and 6**).

Table 1-1. Research questions: Strategies and methods

Questions to be answered	Strategy - approach	Methods of data collection and analysis
PHASE 0. WORKPLACE Q-0A. How is the workplace evolving? Q-0B. How is it possible to fine-tune the next-generation workplace with users' needs?	*Literature review*	• Primary, secondary, tertiary, and grey literature review mainly collected through a roll-your-snowball approach
PHASE I. USERS Q-1A. Who are the users involved in the process of 'workplace-making'? Q-1B. How is the negotiation between 'demand side' and 'supply side' handled?	*Descriptive-Field research* *Case studies* 1) Telecommunications 2) Pharmaceutical 3) Utility	• Semi-structured interviews • Documental analysis (plans, sections, …) • Numerical data • Structured & non-structured observation • Focus-groups • Questionnaires
PHASE II. DATA Q-2A. What are key indicators for designing, managing and using the next-generation workplaces? Q-2B. Which of them can be shared by all workplace users? Q-2C. How can the social, environmental and economic value of the next-generation workplace be enhanced?	*Delphi method* 2) Pharmaceutical 3) Utility 4) Automation 5) Insurance	• Focus groups, interviews and questionnaires to key users, according to the principle of purposive sampling

1.4.1 Research approach

The general epistemological attitude adopts an interdisciplinary approach, especially combining organizational studies, corporate real estate management (CREM), and facility management (FM). Thus, the dissertation proposes a specific outlook toward the object of study, the methodology, and the language (Rondinara, 2008). This outlook seeks for:

- A synthetic viewpoint on the object of study;
- A methodological development aiming at organizing the knowledge of complex systems; and
- A unitary language giving support to the integration of theoretical models obtained from different disciplines.

1.4.2 Research strategies

The strategy applied to address the three main themes is trifold.

Phase 0 expands upon the most recent trends in the work environment in order to build up the context of the research and support the next Phases. The first two research questions are mainly addressed through

literature study. The corresponding answers structure an overall theoretical framework and root the basis on which to develop field research.

The subsequent two work-phases, Phase I and Phase II, corresponding to the two main research areas of workplace users and data, are approached respectively through a case studies strategy, and a Delphi method, both of which follow an in-depth literature review, which is treated separately for each respective topic.

1.4.3 Research methods

1 Literature study

Bibliography consulted to build up the state-of-the-art has been collected by combining primarily two methods:

- Extensive web searches for keywords; and
- 'Roll-your-snowball' (Haugbølle & Boyd, 2013).

Web searches initially explored the general subject of the new ways of working. On the first results obtained, the 'roll-your-snowball' method was applied, as defined by Haugbølle and Boyd (2013a). This consists in following the links provided by the bibliographies and citations encountered in the readings. The same authors recognize a significant drawback of this method. This lies on the fact that research groups and stakeholders' networks can refer only to people and works that they know, consequently it is possible that some 'black holes' remain. Nevertheless, by combining the two methods in an iterative process, it has been possible to obtain a well-balanced list of references. This created a first framework that originated the following research questions.

The literature study has been performed in different and subsequent stages, in parallel with the search for answers to the research questions. Thus, in the present dissertation literature is reviewed in the respective three thematic areas. A first corpus of knowledge regarding the next-generation workplace is collected in Chapters 2 and 3. Sources and researches concerning workplace users are analyzed in Chapter 4. Whereas, publications and contributions on workplace performance and indicators are thoroughly scrutinized in Chapter 5.

2 Multiple case study

The main strategy applied to answer user-related questions (Phase I) entails a multiple case study analysis, and is based on empirical observation and participatory methods, as many researchers suggest (Niemi & Lindholm, 2010; Olsson, et al., 2010; Blakstad, et al., 2008; Vischer, 2008b). Taking into account the importance of approaching the investigation from both a quantitative and a qualitative perspective (Jick, 1979), the cases are examined, on one hand, through analysis of numerical data and questionnaires, and on the other, through observations, interviews, and focus groups.

The investigation strategy aims at referring to the 'design process approach', as suggested by Paolo Costa (2014). This approach consists in involving all the stakeholders, merging several disciplines and applying different techniques (such as observations, interviews and questionnaires) toward the full understanding of the observed situation. In the context of the present research, the observed situation corresponds to workplace users.

The whole Phase I embeds into an 'intervention research' framework (Avenier & Nourry, 1999). This approach to knowledge is typical of both the management sciences and the design sciences, with the objective of making new research problems emerge and *"to create intervention situations which are likely to enrich the thinking conduced jointly or separately by researchers and practitioners along the way"* (Avenier & Nourry, 1999, p. 56). An intervention research project entails the conjunction of two projects: that of practitioners, which typically consists of devising and implementing changes in an organization (for example in the ways of working); and that of researchers, which is mostly focused on long-term knowledge production (in this case, related to the workplace users and management). This attitude of research lead the approach to each case study to slightly vary according to the respective contextual situations of each company. Punctual description of the single methods that have been implied in each case is provided in **Chapter 0**. Here follows a brief overview of the different methods combined in case study analysis.

2.a Document and records analysis

The empirical study entails analysis of company plans, organizational charts, records of access to the buildings, and bookings of different types of spaces. All these analyses have been utilized to characterize different users' ways of interacting with the workplace.

Plans and maps analysis is also functional to prepare structured observations.

2.b Observation

Both unstructured and structured observation has been performed with the same end of representing different users' behavior in the workplace.

In particular, structured observation took place in each company thanks to the help of three researchers, in support of the author of this study, who was also responsible for supervising the whole process.

2.c Interviews and focus groups

Face-to-face discussion were applied to gain qualitative information concerning how users currently interact with their workplace and their expectations for future developments.

In particular, semi-structured interviews were set up with the business roles appointed to manage the workplace change phase (i.e. supply side users).

More structured interviews were directed to those who utilize the workspace, such as employees and executives (i.e. demand side users). Focus groups were organized at times, when the topics under exam favored group discussion.

2.d Questionnaire

A questionnaire was administered during face-to-face sessions. This helped systematically collect some information. The questions enclosed several aspects, including workers' perceptions toward how they use the office building, and their satisfaction with it.

3 Delphi method

In the end, a Delphi method was chosen to wrap up the last research questions, namely those about the data (Phase II). The opportunity for applying such a method is corroborated by similar studies, i.e. the

ORBIT rating process (Becker, 1990); a bespoke set of KPIs for facility management extracted by Hinks and McNay (1999); and provisional research on work undertaken by De Masi (Cecco, 2017). This method entails an iterative process, thus favors the convergence of different viewpoints. It is generally applied for many purposes, among which of: gathering current and historical data; exploring planning options; putting together the structure of a model; delineating pros and cons of policies; uncovering causal relationships; exposing priorities of personal values; and so on (Linstone & Turoff, 1975). In the context of this research, it concurs to reaching consensus among different workplace users on shared KPIs. Punctual description of each single method is provided in **Chapter 6.2**. Here a brief overview follows of the different methods applied in the Delphi process.

3.a Preliminary interviews

Semi-structured interviews with the business roles appointed to manage the workplace change phase (i.e. supply side users) served the purpose of integrating the list of existing indicators gained through literature review with innovative KPIs derived from practice and experience.

3.b Questionnaire 1

A first questionnaire was submitted to participants with the aim of reducing a long of KPIs based on literature and preliminary interviews. This questionnaire resulted in shortlisting the most important indicators to workplace users, which deserved to be brought forth in next stages.

3.c Focus groups/interviews

Open discussion with the same participants allowed to comment on the short list of KPIs extracted from Questionnaire 1. This passage was functional to add, subtract or modify the remaining indicators, in order for those to better suit user needs and values.

3.d Questionnaire 2

A second and last questionnaire was submitted to the same participants with the aim of assessing KPIs on an 'opportunity scale', which matched the priority given to each indicator by users and the availability of data for that indicator.

4 Sample selection

Specific criteria for company selection have been applied both in the case study phase and in the Delphi phase, in order to guarantee representativeness of the sample and homogeneity in the two separate but complimentary stages. Companies had to respect the following parameters:

1. Recent or prospective implementation of new ways of working (i.e. introduction of SW and/or ABW). This to make sure that companies are familiar with workplace change practices, and have been interrogating themselves about workplace users, workplace performance, and the idea of the next-generation workplace.
2. Medium-large sized companies (> 500 employees). A medium size company assures a reasonable complexity of the organizational and managerial structure, thus is likely to offer a wide range of workplace users, along with implementing performance measurement.

3. Different types of business. Because the type of business can affect workplace change, the case studies belong to different industries.
4. Localization in Italy. Cultural issues are not addressed in this study, hence geographic homogeneity is necessary to avoid biases.
5. Attitude to cooperation in the context of academic research. The availability of data varies from case to case.

Based on these criteria, three organizations took part in Phase I of the research, and four in Phase II, for an overall number of five companies involved in the investigation, as showed in **Table 1-2**.

Table 1-2. Involvement of the five companies in different research phases

Co. No.	Organization/type of business	PHASE I	PHASE II
1	Telecommunication		
2	Pharmaceutical		
3	Utility		
4	Automation technology		
5	Insurance		

However, given the approach oriented to an 'intervention research' process, the chosen methods have been applied with slight variations across the five companies. Details about these misalignments are going to be explained in the respective chapters.

1.5 Key findings

The application of a multimethod investigation allows for answering all the questions that have been formulated to address the research problem and objective.

Phase 0 builds up an interpretive framework for understanding how current work spaces are evolving into the next-generation workplace (NGW). The argumentation leads to picturing a NGW that is going to be:

a. Highly diverse;
b. Data driven; and
c. Economically, environmentally and socially impactful.

Attuning the NGW with user needs encompasses careful performance management throughout the whole workplace-making process.

Phase I identifies different categories of workplace users, each of whom is involved to different extents in the workplace-making process. This work suggests that at least 11 different user categories can be outlined, namely:

1. Company owner, President, and Chief Executive Officer;
2. Financial administration;
3. Corporate Real Estate Management;
4. Human Resources Management;
5. Facilities Management;
6. Engineering and space planning;
7. Information Technology;
8. Executives and managers;
9. Employees;
10. Company consultants, collaborators, and internees; and
11. Customers and visitors.

Several of them (i.e. categories 1 to 7) fulfil the 'internal' supply side of the process, which means that are entitled to negotiate between the demand side and the external supply side (that of constructors, investors, developers, etc.). This task needs to be performed by a professional who is capable of an integrative and holistic approach.

Phase II offers a system of workplace performance indicators, which is suitable to support such an approach. The system is composed of 33 KPIs that are shared by all diverse user categories. This collects data expressing the economic, environmental, and social value of the workplace, and reflects nine different performance areas:

I. Building operation and management: contains metrics related to maintenance, security and safety, energy and resource management, and data related to the premises' daily functioning;
II. Business effectiveness: expresses the efficiency and effectiveness of the business activity;
III. Costs: collects all cost-related data;
IV. Environmental Quality: has to do with physical parameters, both quantitative and qualitative, identifying environmental conditions;

V. Productivity and ways of working: describes how people carry out their daily activities, their workstyles, and the adequacy of the spatial environment to their needs;
VI. Space usage: takes into consideration physical parameters of the space as well as the way it is utilized;
VII. Staff characteristics: embraces demographics and other objective/quantitative information related to company's personnel;
VIII. User attitude: includes subjective/qualitative measures about internal employees' and external customers' impressions, feelings, and engagement with respect to their daily work, the company more in general, the location of the office building and its image; and
IX. Value/Return/Yield: embraces indicators involving financial results of the company.

In conclusion, this research succeeds to develop and validate a system of key performance indicators that are shared by all workplace users and helps attune their respective stakes in the next-generation workplace.

By reaching these results, this research advances extant knowledge on the next-generation workplaces, its users, and methods to manage workplace design, management, and use.

1.6 Keywords' definition

Since the competences and disciplines herewith involved are numerous and varied (i.e. business, corporate real estate and facilities management), the need comes up for aligning the vocabulary related to the research topic. Leveling out a common foundation of meanings is important to guide the reader throughout the dissertation. The following keywords are listed in alphabetic order.

Indicators (measures and metrics)

The English Oxford Dictionary defines an indicator as *"A thing that indicates the state or level of something"* (English Oxford Living Dictionaries, 2018). Indicators apply to many fields and disciplines, such as chemistry, economy and business. In the business sphere, indicators serve to measure and manage organizational performance. Indicators differ from metrics and measures, even if they are often used interchangeably (Riratanaphong, 2014).

A measure is a value (i.e. a number) quantified against standards (i.e. a unit of measure, such as €, $, sqm, Facebook likes, etc.) at a certain point in time. It is a number that records a value or performance (Labate, 2016). For example: € sold in January 2017 (Mullins, 2008).

A metric is defined in the English Oxford Dictionary as *"A system or standard of measurement"* or, in business, as *"A set of figures or statistics that measure results"*. It expresses the degree to which a measure becomes meaningful. For example: total monthly sales in the time frame January 2017-January 2018 (Mullins, 2008). This will show if the sales are growing or not.

An indicator is a qualitative or quantitative factor/variable, suitable to express results or goals. It can aggregate multiple measures. For example: total monthly sales to budget in the time frame January 2017-January 2018 (Mullins, 2008). An indicator shows actionable information to lead business.

Usually, indicators in place to evaluate corporate performances, including real estate performances, are financial. A decisive milestone in the approach to performance indicators happened when Kaplan & Norton (1996) proposed considering a balanced scorecard, namely an instrument able to measure organizational performance across multiple perspectives. A scorecard as such embraces different facets of the business, among which is the customer. As the RICS Professional Guidance (2013) suggests *"measuring customer satisfaction is crucial to making decisions and implementing change in organizations"* (White, 2013). Hence indicators can be both quantitative and qualitative.

Interdisciplinarity - Transdisciplinarity

A contemporary tendency occurs toward seeking an integrated knowledge (Rondinara, 2008). Consequently, epistemological reflections have been rising in two different approaches: the re-evaluation of interdisciplinarity and the inception of transdisciplinarity.

On one hand, interdisciplinarity addresses complexity by combining the methodologies of distinct disciplines. This way distinct disciplines *interact* with one another. On the other hand, transdisciplinarity succeeds in facing complexity through a deeper relation between disciplines, which take them to *integrate* with one another. Transdisciplinarity indeed allows relations between disciplines to occur within a system without fixed boundaries between them.

According to these definitions, this research develops an interdisciplinary reasoning, while pursuing the objective to develop a system for transdisciplinary application.

Productivity

Oldman (2017) debates the difference between space productivity and employee productivity. He contends that too often more people in less space is considered to equal higher productivity. But in this case, only the 'productivity of space' is increased, whereas the 'productivity of human resources' is something more difficult to grasp. He explains the concept of employee productivity as *"working productively with the central responsibility that [an] employee has"* (Oldman, 2017, p. 1). For instance, lawyers will be productive when their workplace enables them to solve client's legal issues; information security specialists at a bank, instead, will be productive when their workplace enable them to protect the bank from hackers; and so on.

Research on evaluating employee productivity was undertaken especially from the 1990s, along with the development of environmental psychology. Kaplan and Aronoff (1996) recognize the difficulty of measuring productivity, particularly that of knowledge workers. Leaman and Bordass (1999) define productivity as:

> […] the ability of people to enhance their work output through increases in the quantity and/or quality of the product or service they deliver (Leaman & Bordass, 1999, p. 6).

Taking into consideration the uncertainty of meaningfully measuring work output for all building occupants (e.g. telephonists and managers in a call center are difficult to compare), they conclude that productivity can be reasonably treated as a self-reported issue. Building Use Studies (BUS) questionnaires, developed by the same Leaman, has incorporated a question about perceived productivity since 1987. The question would ask the employees to estimate how they thought their productivity at work was increased or decreased by the environmental conditions in the building, from -40% or more to +40% or more. These studies found productivity to be correlated with personal control of environmental conditions, responsiveness to complaints and adaptability of spaces to changes, building depth, and workgroups size.

Anyway, the BUS studies and the whole approach undertaken by Leaman and Bordass tends to focus on indoor physical parameters (heating, cooling, lighting, ventilation and noise) or, more in general, factors closely related to energy efficiency and environmental issues. It is no coincidence that those were the years when attention to environmental sustainability had risen up.

Van der Voordt (2004) reviews literature on real estate, facility management, business administration, and environmental psychology. From this scouting, he concludes that productivity in working environments can be measured in five ways: actual labor productivity (e.g. number of phone calls, number of completed tasks); perceived productivity (by asking people); amount of time spent (e.g. time lost in filing or clearing desk); absenteeism due to illness (as non-productivity); indirect indicators (e.g. how quickly employees solve a problem).

Later on, Haynes (2007) suggests that productivity must be differentiated from performance. Productivity, indeed, is to be considered as one of the components of performance, beside others, such as effectiveness, efficiency, quality, profitability, quality of work life, and innovation. Moreover, he questions whether measuring perceived productivity by only a single question can return valuable information, or this might be improved by a multi-variable approach.

The problem of understanding productivity is more complex in today's office context than in a traditional manufacturing context (Haynes, 2007). Indeed, today the office environment hosts a range of different tasks. This makes workers' productivity strongly dependent on the social dimension of it, besides the physical dimension. Haynes (2007) points out that:

> Whilst no one approach has gained universal acceptance, it is clear that the self-assessed measure of productivity is better than no measure of productivity. It is therefore understandable that research that has produced evidence has adopted a pragmatic self-assessment approach. This method of productivity measurement applies a "people-centred" approach to office evaluation, which is in alignment with establishing the end-user or occupier perspective (Haynes, 2007, p. 153).

However, in the words of the same author, workplace productivity deserves to be integral to any real estate strategy. In order to develop further productivity measurement, more links between real estate and

facilities performance metrics, and organizational performance metrics should be established, as suggested and to some extent proposed by the same author in future elaborations (e.g. Haynes, 2012; Haynes, et al., 2017).

Quality

The quality of a building can be defined as *"the degree to which the design and specification meets the requirements for that building"* (Clift, 1996, p. 22). That is, of course, a relative concept, more than an absolute one. Buildings are required to satisfy different user needs at the same time. This means that it is necessary to decide if it is more worthy measuring building quality against all identified requirements (eventually taking into account also those in conflict) or it is more commendable evaluating it against specific requirements expressed by one of the numerous stakeholders.

Stakeholders' opinions, among which occupants, can be well documented by post-occupancy evaluations (POE). Thus POEs are appropriate tools to account for building quality. Through POE studies, it is possible to identify ways to design, manage and use buildings and equipment more efficiently and effectively (Watson, 2003). This demonstrates that building quality is actually reached through a socio-political process, which is based on communication forums that help negotiate the relationship between people and buildings.

Since building requirements are becoming increasingly complex, good communication is fundamental to align facilities' quality (Watson, 2003). Thus, the concept of quality is even more challenging nowadays, when everything is continuously changing and evolving, including the spaces for work.

> The definition of quality shifted from buying the "best", to buying what fit the situation (Becker & Sims, 2001, p. 38).

Direct consequence of this shift is that organizations must keep themselves constantly updated on what the condition and circumstances exactly are, to satisfy their needs for quantifying and qualifying the characteristics of the building they occupy. Methods for doing that are those related to the performance measurement approaches (for instance, through key performance indicators), applied in different fields, such as organizational management, corporate real estate management, and facilities management.

Foti (2005) indeed highlights the importance of focusing on the *"quality of use of the built space"* (Foti, 2005, p. 145), that is to say the quality of the relationship between buildings and users over time.

User

In the built environment field, stakeholders, actors, end-users, occupiers/occupants, clients tend to be mentioned interchangeably when referring to people who have some sort of relation with buildings. However, each of these terms proposes a subtly different meaning. For example, stakeholders recur on the suppliers' side; when they are meant on the demand side, stakeholders fulfill a position of power. The term end-users stresses the human component: end-users are those who more passively receive goods or services, being individuals. Occupiers receive goods or services as well, but often are identified with organizations, or more structured entities; and so on.

In order to flatten all these multiple accepted meanings, the present research proposes to adopt the more general meaning of 'user' as: *"someone who uses a product, machine, or service"* (English Oxford Living Dictionaries, 2018), and *"a person who uses or operates something"* (Cambridge Dictionary, 2018). This definition of user aims at embracing all the people who are somewhat related to buildings and, more specifically, to workplaces.

Visitor

In the contemporary market, characterized by a serviced workspace model, offices are often populated by *"transient guests who visit to perform specific functions"* (McGregor, 2000, p. 5). These are to be considered users as well, with the particular trait that they use the office as a 'hotel for work'.

To this extent, Puybaraud and Kristensen (2015) hint at the potential 'rise of the workplace consumer', while imagining what the workplace will look like in 2040. In their view, the workplace is going to evolve into a *"high-performance collaboration hub"* (Puybaraud & Kristensen, 2015, pp. 66-68) that not only visitors, but all employees will use on an as-needed basis. Basically, all employees are destined to become workplace visitors. In effect, visitors are embraced as well in the definition of 'user' as *"someone who uses a product, machine, or service"* (English Oxford Living Dictionaries, 2018).

Work-space and work-place

Brill & Weidemann (2001) provide a definition for 'work-space' as:

> […] the space where an employee sits (mostly) when in the office. Generally there's one person to a workspace, and sometimes, two. Many workspaces are assigned to an individual, but in an increasingly used workplace strategy (hotelling), we see pools of shared workspaces that a group of individuals use on an as-needed basis, but not dedicated to any individual. While individual-use workspaces vary widely in size, there are two primary conditions of acoustic privacy… private (enclosed) offices and open offices (Brill & Weidemann, 2001, p. 17).

The term 'work-space' is utilized by Brill & Weidemann (2001) in a very material meaning, namely referring to the physical area, or portion of the environment which is utilized for work purposes. This matches the sense of this work for how it is described by Nenonen, et al. (2009). These authors state that the 'work-space' is defined more by distances, measures and quantitative characteristics, rather than by functions and qualitative features. This latter definition, on the contrary, applies more to the term 'work-place', according to the same Nenonen, et al. (2009). In fact, also Brill & Weidemann (2001) acknowledge the word 'work-space' as:

> [a] general term for the entire physical environment for work… the whole floor, whole building, whole campus. The workplace always contains large numbers of workspaces (Brill & Weidemann, 2001, p. 17).

However, it is true that the definition of workplace changes among people who came from the built environment industry, the human resources (HR) sector, or organization development (OD) backgrounds. By incorporating the notion of 'placemaking', as introduced in the 1960s by Jane Jacob and William Whyte, the workplace can be expressed by a simple equation:

> (Work)place equals to the sum of (work)space and culture (Ellison & Pinder, 2017).

1.7 Outline of the dissertation

The research consists of a theoretical part and an empirical part. The theoretical part is developed in the Background (Chapter 2) through Phase 0 (Chapter 4). The empirical part follows in Phase I (Chapter 4) and Phase II (Chapter 5).

The Background chapter acquaints the research field and sets the research questions into a historical context. This introduction explains the reasons for investigating Key Performance Indicators for workplace design, management, and use.

Phase 0 explores the latest workplace trends (how the workplace dimension has been evolving to date), workplace users (how the stakeholders involved in the process of workplace-making have been identified in literature), and workplace data (how performance measurement and management practices are applied).

The empirical part is twofold. Phase I aims at identifying workplace users. To do so, it proposes an in-depth examination of three companies as case studies. Phase II addresses the objective of extracting a system of indicators for attuning users' respective stakes in the workplace. This latter phase develops a Delphi method on four companies, two of whom correspond to the same cases applied to the previous phase.

Discussion is provided for what concerns both workplace KPIs and workplace users. Conclusions explicit the answers to the initial research questions. The dissertation ends with final thoughts on the sense of this research as a whole, and recommendation for the best use of the obtained system.

2 Background

"WE SHAPE OUR BUILDINGS, AND AFTERWARDS OUR BUILDINGS SHAPE US."

—WINSTON CHURCHILL, POLITICIAN AND WRITER

WHY (AIM). The Background formalizes the emergence of a problem to be addressed. The resulting research questions are listed synthetically, along with the research objectives.

WHAT (CONTENT). This chapter frames the historical setting when the research is being developed and defines the boundaries of the research domain.

The first paragraph approaches the problem of attuning spaces with users' needs and expectations in a broad panorama. The ***context*** sets the evolution of work processes and workspaces from the origins to the next-generation workplace, which goes hand-in-hand with the development of data measurement and analysis over time. Evaluating the human-environment relations in the workplace means combining quantitative and qualitative measurements. Measuring and analyzing significant information must be done continuously because it supports the design, management, and use of workplaces. Responsible for this process are workplace users, who get involved in the workplace-making process.

The main issues arising from this argumentation are formalized in the ***aims and questions to be addressed***. On one hand, product-related issues entail the next-generation workplace. On the other hand, process-related issues encompass the work-place making process. By combining the respective issues, three research themes are identified: workplace, user, and data.

2.1 Context

Meeting a traveller in the main hall of the Central Station in Milan (Italy) who asks *"Where can I find the rail platforms?"* seems a paradox, but it happens more often than one could imagine. This is a clear example of a gap between user expectation and designer purpose.

The history of architecture is not new to this kind of mismatches. The Farnsworth house designed by Mies Van der Rohe (1951), and the Frank house, by Peter Eisenman (1975) are among the most renowned design failures (Chiesi, 2010). After completion, the owners of those houses had to significantly modify the spaces in order to adapt them to their own needs. More recently, the Vitra Fire Station by Zaha Hadid (1991-93) encountered a similar destiny. The spaces turned out being inappropriate to the firemen at the point of endangering their health and wellbeing. Soon, the station was converted into a museum.

This research addresses the problem of attuning the spaces with their users' needs and expectations. Space-making is a process that involves several stakeholders. Their different viewpoints need to converge into one solution, which satisfies all of them at the same time. Collecting their multiple points of view is a key step to better inform the design, management and use of the spaces they hold a stake in.

An organic system is required to help share different needs and values among all the users who take part in the space-making process. This research aims to support the design, management and use of spaces by filling this gap.

2.1.1 Knowledge work and knowledge workplace

For most part of history, the human being has always worked at home, or very close to home. O'Mara (1999) describes some of the illustrations from the fifteenth century. These images remind us of how merchants used to locate their workshops on the ground level of their family house, and how one ground-floor room used to be designated for commercial activities. There, or in the immediate surroundings, they would undertake all the activities related to their job, and their daily lives more in general. That was an age when the rhythm of private life was combined with the rhythm of work life. Hence, the boundaries between home and workplace were definitely fleeting (O'Mara, 1999).

The birth of knowledge work, together with the advent of the post-industrial era, determined a new approach. With the beginning of the twentieth century, environments specifically dedicated to work needed to be set up, hosting specialized equipment. Consequently, the workspace moved out of home, most of the time actually far from home, as O'Mara (1999) points out.

Nowadays, to some extent, we can allude to a return to the origins. Boundaries between workplace and home start again to blur, together with the boundaries between work and life.

Approach to work and the spaces for work has gone through a radical development over the last century, which is worth retracing before observing more in detail today's context.

Van Meel (2000) proposes an original book that recounts the evolution of the office space taking into account national influences. He states that the history of the office, as intended in modern times, begins in the 1920s in the US, and since then it progressively evolved with geographical specificities until today.

The origins

In the 1920s, office work started a process of 'proletarization'. Administrative, business and financial functions progressively reached primary importance. At that point, from small residential buildings, offices transformed into the so-called 'white collar factories'. In fact, the appearance of these buildings reminds a

lot of the typical factory devoted to producing material goods. The assembly line of Taylorist memory was the reference model of work, and the spaces reflected the same idea (Pitt & Bennett, 2008). The workplace was composed of ample open spaces hosting rows of desks, in a school-like setting. The openness of space in this case was meant to facilitate the workflow and allow the chief to monitor employees' efficiency. The chief was the only one to take advantage of a private office. In general, the standard office facility in those times derived from the Fordist factory floor, and from close observation of process tasks and manual labor (Greene & Myerson, 2011).

Modern offices

After World War II, office buildings started to integrate technological advancements related to construction materials (e.g. glass and steel), and equipment (e.g. climate conditioning), which allowed for more flexibility in spatial organization. Interiors at these times looked pretty much alike in most offices: wide open plan areas with rows of desks for employees, and enclosed offices for important people (Bell & Anderson, 1999).

Communication gained a primary role in the 1960s, when more horizontal interactions arose, and hierarchical structures softened. These novelties were incorporated in the 'landscape office' model, between the 1960s and the 1970s. Companies started to restructure their work processes, and to use free standing panels between desks or plants to create semi-enclosed spaces for workers (Bell & Anderson, 1999).

In the 1970s developers entered the commercial real estate market with the aim of realizing and managing office buildings as their core business. Leasing and ownership of office buildings modified their logics, including space planning. To this extent specific laws came out to regulate several spatial aspects. For instance, the "Offices, Shops and Railway Premises Act", enacted in the UK in 1963, contained some basic requirements for the design of workplaces, even if only at general level.

The technological revolution that occurred in the 1980s has transformed offices into information-technology (IT) machines. Office buildings needed to accommodate cabling for personal computers and extra-cooling devices, so that raised floors and suspended ceilings became a must. With automated regulation of heating, ventilation and air-conditioning (HVAC), security and maintenance systems, office buildings developed into 'intelligent' bodies. Alongside, especially in the European context, workplaces came closer to the human scale, and attention focused on human behaviors and needs.

The prelude of the contemporary workplace can be traced in the 1990s. In this decade the ways of working significantly transformed as a consequence of information-communication technology (ICT) progress, which allowed work to dematerialize and make it ubiquitous and mobile (Duffy, 2000). These changes have happened progressively, in parallel to the evolution of organizational dynamics and major economic forces. All these spheres play a role in the context of today's ways of working.

Today's ways of working

The contemporary way of working is often referred to as 'Activity-Based Working' (ABW) or *"'agile', 'flexible', 'new ways of working' (NWW), 'future ways of working', 'flexi-iffice', etc."* (Engelen, et al., 2018, p. 2). In Italy, one of the most structured organizations studying this phenomenon is called 'Osservatorio Smart Working'. [1] Crespi (2016), head of the Osservatorio, defines 'smart working' as a managerial strategy, based on enabling people to be flexible and autonomous in deciding spaces, times, and

[1] Osservatorio Smart Working, Osservatori Digital Innovation, School of Management at the Politecnico di Milano, was born in the 2012 to study the most recent evolution of the way of working. See more details at the following link: http://www.osservatori.net/smart_working.

modalities/instruments/tools/devices through which they responsibly accomplish their work results. Therefore, space becomes an important variable in today's way of working. Work does not pair anymore with a specific space, but theoretically any space can become a workplace.

In its yearly report, the Osservatorio mentions a few major benefits of adopting a smart working strategy compared to traditional ways of working (Crespi, 2016). In particular, they have registered a 20% increase in workers productivity, and a 20% decrease in building management costs. These benefits display at an individual, company and society level. Anyway, their studies do not specifically analyze to what extent the physical dimension of the workplace concurs with reaching these results.

Engelen, et al. (2018) perform a thorough review over an extensive sample of the literature on the effects of Activity-Based Working on health, performance and perceptions. They found out that ABW is most of all beneficial to communication, collaboration and interaction, while it has a negative effect on privacy. In general research seems to document positive impacts of ABW on work performance and/or productivity (mostly based on self-reported measures).

However, the same researchers argue that more research is required with regard to objective productivity measures, and improvements in health conditions and healthy behaviors. Moreover, advancements are still necessary to develop design strategies based on the assessment of organization-specific needs in an iterative process that can meet the changing needs of organizations and people more in general. These matters deserve to be challenged in the next-generation workplace.

The next-generation workplace

An entire conference has been dedicated to the 'Next Generation Workplaces' in September 2017, in London.[2] The event was aimed at stimulating debate on the role of design for an agile workforce, the way of utilizing technology to enhance employee experience, the strategies to deal with the change, and tools to manage the related space.

'Next Generation Workplace' is the name Yorktel has chosen for labeling their renovated approach to the work environment (Brown, 2017). This is based on the idea that office design should support all different work styles in a flexible way. Consequently, the workplace is required to provide the employees with a mix of collaborative spaces, collaboration rooms, privacy rooms, and quiet space. While implementing this approach and looking for the right balance of spaces, Brown (2017) recommends to properly assess the mix of workstyles present in the organization.

'Next Generation Workplace' is also the name that Deloitte has given to its renewed design strategy for the work environment, that is going to be applied extensively in their locations all over the world (Deloitte, 2018). This strategy is based on three pillars: flexibility, technology, and collaboration. Hence their workspaces look now more open and informal than before. Basically their strategy provides the employees with a variety of different workspaces available to accommodate different kinds of work. Many other companies have been applying a similar attitude to high differentiation of the workspace to suit variable needs over the workday, such as CBRE, Google and GSA (Miller, et al., 2014). According to what employees at Deloitte declare, the new physical environment facilitates tacit learning and connectivity, both physical and virtual.

Physical and virtual work will integrate even more in the working mode of the future. The latest novelty of virtual offices is the possibility to simulate physical space, through 2D and 3D technologies. This is what Facebook has already been experimenting with, by integrating the Oculus Rift technology (Sias, 2017). By

[2] Next Generation Workplaces 2017. See more details at the following link: https://nextgenworkplaces.iqpc.co.uk/.

artificially reshaping the physical dimension of the office space, the intent is to recreate proximity and functionality of a real workspace. Contamination with gaming, Augmented Reality, and Virtual Reality is evident.

Projections and forecasts of the next historical phase of the workplace are rising.

Puybaraud and Kristensen (2015) try to foresee the workplace of the future in 2040, describing it as a 'smart workplace'. They state that the Smart Workplace 2040 will be defined by some main trends:

- Adaptable and radical working patterns;
- Free choice on where and how to work;
- Experiential environments as workplaces, making the office fruition a luxury as a form of reward;
- Entrepreneurial spirit flourishing in incubators;
- Prevalence of collaborative activities;
- Human services enabling the users to interact with the surrounding environment;
- Wellness being prioritized over work; and
- Crowd-sourcing, co-creation, and networks as the main modalities to production of material and immaterial goods.

Many of these elements can be found also in the idea of 'Future' described by Miller, et al. (2014). They state that the next workplaces will be shaped by:

- Mobility of work, *"Workplace as a Service (Waas) is coming"* (Miller, et al., 2014, p. 67);
- Easiness of information and communication;
- Internet of Things boosting buildings' intelligence through the collection of data;
- Big Data capturing the building-use and occupant experience data;
- Neuroscience applied to the work environment;[3]
- Combination of geographic information systems (GIS), crowdsourcing, gamification, Big Data, and analytics;
- Holistic approach to work and wellbeing; and
- Transparent markets and organizations.

Regarding transparency of markets and organizations, the same authors make an interesting point that:

> Employees can now give their opinions on their employers at eBossWatch, Glassdoor, RateMyBoss, and many other websites. Clearly, employers need to quickly improve their listening! They must also deploy all the tools available to gain deeper insight into and awareness of what is going on with their employees. Amazon is "listening" even when we're not directly talking to them. In 2014 they announced a patent for "predictive delivery"; in the future they will ship what you want, before you order it! (Miller, et al., 2014, p. 69)

In synthesis, they forecast a 'Pandorification of work':

> Pandora is an app that allows you to create your own Internet radio station. It builds your station around your musical tastes. […] If a song Pandora plays matches your taste for that station, you click thumbs up. If not, you click thumbs down. It's that simple for the user. (Miller, et al., 2014, p. 77)

These sparks on the future highlight the urgency for the real estate and construction sector to evolve in order to keep up with the approaching next-generation workplace. The required evolution is revolving mostly around the availability and management of data.

[3] This idea can be explored in Mallgrave (2015).

2.1.2 Data and measurement

Ackoff (1989) defines data as *"symbols that represent the properties of objects and events."*

First traces of data storage can be recognized in prehistoric ages, when tribespeople would use sticks or bones to track records of trading activities or food supply (Marr, 2015). The Library of Alexandria might be considered the largest collection of data in the ancient world.

The beginning of data analysis dates back to the first statistical purposes in ancient Egypt, when periodic censuses were necessary to manage building pyramids (Miyazaki, 2015). Retrieving data through censuses has always been used across the world especially for governmental planning activities, such as taxation. Miyazaki (2015) reports the example of analyzing population growth by district in order for governments to determine the number of necessary hospital facilities in different areas. Therefore, census takers collect data and transform it into information, by processing it in order to increase its usefulness (Ackoff, 1989).

From data to wisdom through measurement and analysis

Ackoff (1989) while drawing its renowned Data-Information-Knowledge-Wisdom pyramid (DIKW) states that: *"Information […] answers to questions that begin with such words as who, what, why, when, where, and how many. Knowledge […] answers to how-to questions. Understanding answers to why questions."*

Data measurement and analysis are embedded in a process that encompasses the collection of records from various sources and subsequent interpretation in order to unveil information, useful to make decisions. Data elaboration has always been at the basis of the human behavior in its attempt to get to know the surrounding world, and gain knowledge and understanding.

> For much of history, humankind's highest achievements arose from conquering the world by measuring it. (Mayer-Schönberger & Cukier, 2013, p. 32)

The advent of computers disrupted traditional ways of dealing with data by making its gathering easier. At the same time, this new computational capacity has been also revolutionizing our approach to data analysis, by opening up new evidence of correlations between phenomena (Mayer-Schönberger & Cukier, 2013). Since the advent of computers to date, the evolution has gone through business intelligence, data centers, the internet, until the emergence of Big Data (Marr, 2015).

Data analysis has been happening in the working environment as well for many years. In the old times, data came mainly from human observation (Waber, 2013). Subsequently, we augmented data collection tools applying interviews and surveys. Today plenty of hard data is available about the workplace from a variety of sources (Waber, 2013), that allow also relief from biases typical of social science disciplines (Mayer-Schönberger & Cukier, 2013).

Many companies, among which Amazon, Netflix, etc., are nowadays using data-driven decision-making for their business operations (Waber, 2013; Miller, et al., 2014). Unfortunately, data-driven decisions are rarely applied inwards, i.e. to face issues regarding the way people work, and the workplace, even though a variety of data might theoretically be available.

Evaluating the human-environment relation

In the newborn era of Big Data, evaluations seem to have gained a great importance in many fields. Multiple possibilities are available today for sharing information and opinions. Social media and mobile apps make commenting a popular practice. Many blogs, forums and websites are specifically devoted to collect users' feedback and opinions. Users can publicly comment on almost every experience they make throughout their days. When they visit a hotel, go eat at a restaurant, drink at a bar, buy goods and

products they are often invited to provide some sort of feedback. On one side, their opinions inform the suppliers and hopefully help them provide a better service or product to their clients. On the other side, rankings built out of users' ratings inform the users' community and orient future choices.

It looks like people's opinions and feelings are acquiring more and more value, since they can drive action.

> Social media has changed the way we can and do organize for action. It has removed traditional barriers to participation and makes it almost effortless to connect, rally and act. (Miller, et al., 2014, p. 3)

Thus, evaluation by every individual becomes relevant information for both the supply and the demand side. Anyway, this thirst for evaluating experiences and sharing viewpoints apparently has not reflected in the architecture field, yet. Here, human-environment relations are still a marginal topic of evaluation, despite misunderstandings between clients, designers and users being still too common (Costa, 2014).

Buildings and built environments that badly affect users' perceptions and lives are more than a few. The idea of quality from the end-user's viewpoint seems still barely relevant to building design and management. Therefore, a communication gap occurs between the parties involved in the space-making process, and this is likely to generate misleading inferences (Brackertz & Kenley, 2002).

Unfortunately, only a few professionals and organizations, from both the demand and the supply side, are committed to reducing this gap. A core challenge is the necessity for a shift in focus from building as a goal in itself to building as a means to achieve objectives strictly related to users' activities (Haugbølle & Boyd, 2013a).

Quantitative and qualitative stances

Watson (2003) defines buildings as socially negotiated solutions designed to meet the typical needs of the human being for shelter and support to the development of its activities. Hence, objective evaluations seem insufficient to produce an 'overall assessment' of their quality. Rather, a holistic approach would be beneficial, by integrating also the human component. Objective-quantitative certification methods must be balanced with the subjective opinions expressed by the stakeholders group. This approach to assessment is intended to capture the *"quality of use of the built space"* (Foti, 2005, p. 145), that is to say the quality of the relationship established between buildings and people.

A lack of information on the quality of use of the built space may negatively impact the results expected by both occupants and operators in the built environment. On the contrary, the key to good results corresponds to good levels of information and communication between the parties. Information and communication depend on continuous monitoring of the asset performance. Consequently, building users may benefit from specific methods and strategies to set the most appropriate conditions for the built environment they are interested in.

Quality and performance

Quality and performance of buildings are generally defined by two different perspectives (Ciaramella & Tronconi, 2011). First, *ex-ante* through feasibility studies. Later, *ex-post* through methods capturing aspects such as estimation and economic evaluation, safety conditions, energy performance, regulatory changes, and states of preservation/degradation. Both these areas of evaluation aim to recognize and accredit the capacity of the building to meet certain requirements. In the end, they both correspond to an objective statement, valuable to 'certify' the building product.

Not so common, instead, is the application of tools for assessing the overall quality of a building 'in the pipeline', which means during the phase of its operation. Over this period of time, a building lives its real life by interacting with the people who make use of it.

What happens after the construction of the building, when users occupy it, and before property disposal? This seems a marginal matter of interest, especially by architects, building owners and many other operators in the built environment field, for instance constructors and brokers. On one hand, correspondence is assumed between actual performance and initial requirements, as interpreted by the project on paper. On the other hand, once the building is in use, it is considered perhaps too late to remedy any errors or inaccuracies that occurred during the design and construction phase. The reason for this diffused attitude is partly economic and partly intellectual (Duffy, 2000). Economic motives have induced architects and designers to simplify and routinize their services to formulaic solutions, rather than to foresee challenges and respond to user stimulus. This dynamic has been exacerbated due to intellectual motives, namely the fact that architecture is far from being a research-based profession.

Moreover, there is a widely diffused tendency towards reporting only the good news and hiding the downsides, as Leaman and Bordass (1999) point out. This silence unfortunately leads to forgetting the issues that affect human being the most.

In effect, assessing the quality of a building proves to be somewhat profitable (in financial terms), by generating direct or indirect economic returns, exclusively in the case of a major change, such as a sale, an acquisition, or a renovation. In any case, property decisions are subject to long cycles by nature, due not only to the permanence of the physical asset, but also to the duration of ownerships or leasing contracts. This time scale leads management attention to focus on property decisions only once or twice every decade (Calder & McPherson, 2007).

However, *"[…] a more consistent approach to monitoring property performance is essential*" (Calder & McPherson, 2007, p. 50). Hence, acknowledging the quality of a property, its performance, and occupants' satisfaction at the 'up to speed' time of its life cycle can return vital information. This is useful to both guiding actual building management and facing future projects (Preiser, et al., 1988).

In addition, this has been demonstrated to improve also people's culture. For example, The National Renewable Energy Laboratory in Golden, Colorado, is using a dashboard called Energy DataBus providing a real-time look at energy consumption in an area of their campus (Miller, et al., 2014). They found that evidence of these data positively conditioned people's behavior toward reducing energy consumption.

Good communication among stakeholders is essential to align tangible performances to requirements. This principle is related to a design culture conceiving a project not merely as a procedure, whose evolution ends with the delivery of the construction to the client/user, but rather as a dynamic process, which continues all the life-cycle round.

An effective exchange of information lays the foundation for improving buildings' performance-operation and people's quality of life. A significant economic return is then attainable by optimizing investments on the property, with the result of keeping unchanged, or even increase, its value over time.

Throughout history, efforts to improve quality and performance of buildings have been done especially on commercial and office buildings. In fact, these are spaces where today's workers spend most of their awake

time. This means that their quality is expected to affect the whole quality of life of the people who use them. Also, most real estate market transactions (in terms of amount of money) are related to the office building type. This means that developers and companies are interested in this kind of investment and, of course, look for the best deals, which are those guaranteeing the best cost-quality/performance ratio to them.

Therefore, if decisions on office buildings are based on quality and performance, how do these get measured? Questioning what kind of performance and quality are today's workplaces keen on achieving seems a necessary question, given the disruptive change they have been facing lately.

Workplace-making

Place-making encompasses public and community participation in constructing the built environment (PPS, 2009). Pioneers of the term 'place-making' are Jane Jacobs and William H. Whyte, who introduced the idea of designing cities and public spaces for people, back in the 1960s. The concept mainly conveys the idea that a strong sense of place can affect the physical, social, emotional, and ecological health of individuals and communities.

Steuteville (2014) defines 'place-making' as *"the process of creating quality places that people want to live, work, play, and learn in".* Alvarez, et al. (2017) mention 'place-making' as a *"suitable route to deliver public engagement, active participation, and social capital enhancement"* (Alvarez, et al., 2017, p. 119).

This concept implies an active involvement of a large group of people who have to do with the space. The same idea is recalled by Haugbølle & Boyd (2013b) when they claim that the construction sector is affected by a conventional approach toward briefing, space planning and 'space-making'. They lament that these activities are undertaken only by studying the users, while giving less attention to the commissioning clients. Relationships between both clients and users are fundamental components of 'space-making'.

Here, the term 'space-making' is not limited to indicating the function of particular morphological elements of the man-made built environment (roof, walls, doors, windows, column, stairs and floors), as in Pandya's (2007). Instead Haugbølle & Boyd (2013b) apply it in a more comprehensive sense, entailing its processual nature.

In the context of the present study, the notion of 'workplace-making' is used according to the following definition: "workplace-making is the process of creating quality workplaces that people want to work in." This includes the idea that a collectivity is involved in the whole process of designing, managing, and using the workplace.

2.2 Aims and questions to be addressed

Organizational and technological progresses have occurred in the last few years. Workplaces are struggling to follow the pace of change, and satisfy emerging needs and work modalities. In particular, new offices are required to assure high building performances and enhance the employees' quality of life. However, there are still some frictions in the relationship between workplaces and their users.

As a broad aim, this study intends to identify methods and strategies to better manage the relationship between workplace users and workspaces, and more in general between people and the built environment. This goal is pursued, first, by analyzing the context within which the human-workplace relations embed, second, by identifying who the users of the workplace are, and third, by elaborating on how to manage workplace performance over time.

Leaman and Bordass (1993) recognize two basic dimensions of the office environment, *"one concerned* with *the physical properties of space and the environment and the other with management processes over time"* (Leaman & Bordass, 1993, p. 16). Thus, in the workplace domain, two orders of issues emerge, which refer on one hand to office buildings, as the product or physical setting where work takes place, and on the other hand to workplace-making, as the process of creating a work environment, from its design, to its management and daily utilization.

With regard to '**product-related issues**', research informing layout changings and optimization remains less quantifiable and needs to be further developed. In particular, for what concerns the extent to which a workplace can accommodate not only the specific type of work that gets processed there, but most importantly the individual needs of the people who get that work done (Alker, et al., 2014; Sander, 2014).

To this extent, it is evident that the **next-generation workplace** will be expected to adapt to: (a) the 'type of work', which might be highly differentiated; (b) the 'type of person', which seems also highly varied in today's work environment. Many companies are switching to a flexible way of working to accommodate all these differences, often called 'smart working'. Activity-Based Working (ABW) is the space planning approach usually chosen to enable the required level of flexibility. ABW configures as a standard provision of diverse work settings that users chose according to the type of work they need to carry out (Ross, s.d.; Rothe, 2017). A need rises for verifying whether this model helps organizations and employees reach their respective goals. Without any presumption of being exhaustive, product-related issues refer to:

- How office change happens nowadays, how contemporary offices are shaped and organized;
- How different types of people use the workspace, what their respective expectations are, what their roles encompass, if employees are the only workspace users;
- To what extent the type of work can affect a user's relationship with office spaces; and
- How the workspace can concretely accommodate all diverse types of work and types of users.

Talking about '**process/method-related issues**', the literature highlights the urgency for transferring feedback techniques and post-occupancy evaluation methods into everyday practices, along with the necessity for refining objective measurements that can assess people wellbeing and performance within the workplace (Mallory-Hill, et al., 2012; Sander, 2014; Engelen, et al., 2018). A few research opportunities derive from these sparks, which potentially lead to improving the **workplace-making process**. Process-related issues entail:

- What kind of data would be worth integrating in the current databases to best manage today's and tomorrow's places for working. What indicators should be regularly monitored, taking into account also users' needs and preferences;
- Who is responsible to support the interactions between the supply and the demand side. Who should gather data, and among whom data should be shared; and
- To what extent new technologies can help, together with Big Data and the Internet of Things. If questionnaires, interviews and workshops are still valid investigative tools, or innovative tools could substitute or support them. Whether 'real-time' data really make the difference.

The numerous problems that arose flow into three main research domains to be investigated, namely workplace, users, and data. Emerging issues have been condensed into a few key questions (**Table 2-1**).

Table 2-1. Emerging issues and key research questions

Product-related issues **NEXT-GENERATION WORKPLACE**	**Process-related issues** **WORKPLACE-MAKING**	**Themes + Research questions**
How office change happens nowadays. How contemporary offices are shaped and organized.	To what extent new technologies can help. If questionnaires, interviews and workshops are still valid investigative tools, or innovative tools could substitute or support them. Whether 'real-time' data really make the difference.	PHASE 0. WORKPLACE Q-0A. How is the workplace evolving? Q-0B. How is it possible to fine-tune the next-generation workplace with users' needs?
How different types of people use the workspace. What their respective expectations, what their roles encompass. If employees are the only workspace users.	Who is responsible to support the interactions between the supply and the demand side Who should gather data. Among whom data should be shared.	PHASE I. USERS Q-1A. Who are the users involved in the process of 'workplace-making'? Q-1B. How is the negotiation between 'demand side' and 'supply side' handled?
To what extent the type of work can affect a user's relationship with office spaces. How the workspace can concretely accommodate all diverse type of work and type of users.	What kind of data would be worth to integrate in the current databases to manage at best today's and tomorrow's places for working. What indicators should be regularly monitored, taking into account also users' needs and preferences.	PHASE II. DATA Q-2A. What are key indicators for designing, managing and using the next-generation workplaces? Q-2B. Which of them can be shared by all workplace users? Q-2C. How can the social, environmental and economic value of the next-generation workplace be enhanced?

First, changes in office characteristics that anticipate the next-generation workplace, and the extent to which new technologies can combine with traditional tools in workplace-making processes are all matters dealing with both the spatial-physical and the functional dimension of the **workplace**. A couple of questions can formally summarize these research objectives:

A. How is the workplace evolving?
B. How is it possible to fine-tune the next-generation workplace with users' needs?

Second, different types of people dealing with the workplace, and their expectations and roles in the next-generation workplace, together with responsibilities for merging the supply and demand side of the workplace-making process, including gathering and sharing of the related data, are issues that refer to workplace **users**. Then, users are a second element worth of deeper understanding, through the following questions:

A. Who are the users involved in the process of 'workplace-making'?
B. How is the negotiation between 'demand side' and 'supply side' handled?

Finally, the problem for the NGW of relating to its diverse users and accommodating several diverse functions combines with a matter of availability and management of key information throughout the workplace-making process. This implies that the **data** domain carries the responsibility for easing the encounter between spaces and users. This responsibility can be addressed by a set of inquiries:

A. What are key indicators for designing, managing and using the next-generation workplaces?
B. Which of them can be shared by all workplace users?
C. How can the social, environmental and economic value of the next-generation workplace be enhanced?

In light of all these questions, the general objective of the present research is to put together a set of original indicators into one unified system matching both product-related and process-related issues. This system promises to be suitable for supporting decision-making processes for workplace design, management, and use. By its application, all workplace users' needs are brought together, with the aim of attuning companies' strategies with building management needs, and occupiers' expectations.

The next chapter faces workplace-related issues and answers the associated questions.

3 PHASE 0: New workers, new works and new places

"Work, in the future, will only be a verb."

—Philip Ross, CEO Cordless Group

WHY (AIM). Chapter 3 develops Phase 0 of the research, namely elaborating on workplace-related questions. Phase 0 sets the theoretical framework to be applied as a key to elaborating on the subsequent research questions. The literature review goes through the ongoing dynamics concerning diversity, data and values in the workplace. In the end, a few emerging issues compose a scheme, which defines the workplace panorama.

WHAT (CONTENT). The first section explores the two components of the workplace, which entail respectively human factors and technical/functional factors. Here multiple ***diversities in the software and hardware components of work*** are conceptualized. The 'software' component embraces culture and human resources, whose diversities emerge in individuals and in workplace management. The 'hardware' component embraces spaces and tools, whose diversities can be recognized in workspaces, and in work processes. Since all these differences appear, both in the software and hardware core of the workplace, it is important to find a way to acknowledge them. They should somehow be translated into 'data', and therefore led to become 'information' suitable to create more 'knowledge'.

The second section faces the matter of ***using data in the workplace***. A variety of data is potentially available today regarding environmental factors, occupancy patterns, social networks, and personal parameters. However, these data need appropriate integration that must be managed by the human being.

Decisions about how to integrate data should be made by taking into account ***the composite value to the next-generation workplace***, which shows social, environmental, and economic impacts in the last section.

3.1 Diversities in the software and hardware components of work

Four main elements compose the world of work (Becker, et al., 1995; Methodos, DEGW, & Partners4Innovation, 2015; Manca, et al., 2018):

- Culture;
- Human resources (HR) systems;
- Workspaces, and
- Technology.

Becker et al. (1995) draw these elements into the four perspectives of his *"Intergrated Workplace Strategy"*, namely:

> […] the nature of physical settings (where work is conducted); the information technologies used in the performance of work (how data, opinions, and ideas are accessed, processed, and communicated); the nature of work patterns and processes (when and how tasks must be performed to achieve business objectives); and finally, organizational culture and management (the formal and informal values, expectations, policies, and behaviors that influence all of the other factors).

Besides, Methodos, et al. (2015) theorize these elements as four *"cardinal directions"* that can help navigate in the new world of work. Similarly, Manca, et al. (2018) support the same four key areas of work. When the new way of working encapsulates all these four directions/elements in a harmonious system, this can be called *"Smart Working"* (Methodos, DEGW, & Partners4Innovation, 2015).

'Culture' and 'HR Systems' are embedded in the people that hold an interest in the office environment. For the human factor they carry, culture and HR can be defined as the '**software**' component of smart working. 'Workspaces' and 'technology', because of their material nature, can be defined as the '**hardware**' component of smart working (**Table 3-1**).

Table 3-1. The software and hardware components of work

Software		**Hardware**	
HR systems	*Culture*	*Workspaces*	*IT*
Nature of work patterns and processes (when and how tasks must be performed to achieve business objectives)	Organizational culture and management (values, expectations, policies, and behaviors)	Physical settings	Information technologies (how data, opinions, and ideas are accessed, processed, and communicated)

Plurality and diversity characterize both the software and the hardware component of the workplace. In the first case, these regard viewpoints and people, in the second case, these refer to physical and managerial solutions.

3.1.1 Software: Culture and Human Resources

Different authors (e.g. Miller, et al., 2014; Riratanaphong, 2014) when definining 'culture' recur to the definition proposed by Edgar Schein, organizational scholar at MIT: *"a pattern of shared basic assumptions that the group learned as it solves its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, and feel in relation to those problems."* (Schein, 1992, p. 9).

Miller, et al. (2014) explore the impact of the workplace on organizational culture. They say that companies want their culture to evolve in order for their people to develop new ideas and handle new problems. According to this reasoning, culture change entails people engagement. Thus 'human resources' and human resources management are pivotal enablers of change.

A company, defined by its culture, and employees, as human resources, are both involved in the workplace-making process. Zeisel (1975) would respectively define them as 'paying clients' (i.e. the company), and 'non-paying clients' or end-users (i.e. the employees). Within the workplace-making process, paying clients act as the interface between end-users and the supply side. Haugbølle and Boyd (2013b) attribute to clients the responsibility for a central role in developing the construction sector into a demand-driven sector and providing a better user/client satisfaction. This definition of responsibility hints at the existence of different kinds of workplace users, coherently with literature related to the 'usability' framework (Jensø, et al., 2004), and the work carried out by the CIB Working Commission W111 (Alexander, 2008).

Analyzing corporate culture and workforce leads to acknowledging plurality and diversity. Indeed, the work people do, and the people themselves, are not the same every day, nor in every moment of the day.

Software diversities can be recognized in individuals and in workplace management.

1 Diversities in individuals

On one side, plurality and diversity regard people as individuals. Knowledge workers are a highly varied population. On the other side, plurality and diversity decline in the way individuals approach work.

1.a Individual characteristics

Differences emerge by numerous points of view, first, in terms of individual characteristics:

- Cultural/religion customs (WGBC, 2013) – the office environment has become increasingly multicultural. The European culture will progressively need to combine with Middle-Eastern, East-Asian, and South-Asian habits. In such a multicultural environment what is noisy, smelly, or unattractive to one ethnicity might be pleasant to another one. In addition, traditions such as spiritual observance through prayers, rituals, and dietary requirements entail due respect and support (ACAS, 2005);
- Gender/family related issues (Miller, et al., 2014) – workers of tomorrow are a mosaic of nontraditional families and gender identities. These might need different types of support to balance out their work-life equilibrium;
- Age/generation – greater attention today is directed toward Millennials and the needs of the youngest generations (Methodos, 2015b). On the other side of the coin, though, the question of how to respect the needs of older knowledge workers rises too (Erlich & Bichard, 2008). A range of four generations (Haynes, 2011), soon becoming five with the Millennial generation, working all together 'under one roof' carries serious implications to planning and designing office environments, which should support both the youngest, and the aging workplace demographics; and
- Individual traits – many behavioral or cognitive traits, that used to be considered as disabilities, today are not excluded anymore from the world of work. Hence, workspaces are asked to host deaf, mute and sightless people, persons affected by the Asperger syndrome (counting now up to 1% of the workforce), and workers suffering from some deficit of attention or hyperactivity (summing to about 3-5% of the workforce). Moreover, the workforce seems equally split between

introverts and extroverts (Cain, 2012).[4] Actually introverts sum up to the 50% of the workforce (Miller, et al., 2014), which questions the appropriateness of open layouts. In conclusion, workers are characterized by several cognitive abilities, character traits and even neurophysiological structures (Methodos & DEGW, 2015) that make them interact in different ways with the external environment, both social and physical.

Even if no regulation requires companies to inspect how their workforce is made up, monitoring ethnic groups, gender and family composition, age and generations, and other individual traits is already considered good practice, as ACAS (2005) claims. Keeping this information under control might drive workspace management and corporate real estate strategies, and in the end benefit attraction, retention and the competitive advantage of companies.

1.b Individual work practices

On the other side, plurality and diversity characterize also how these diverse people carry out their own work tasks and activities. Individual work practices can differ by personal work styles (Goodrich, 1976):

a. Some people rely upon visual processing of information, others more upon auditory means, or some others upon discussion and oral conversation;
b. One can organize work horizontally or vertically;
c. There are intense organizers vs. relaxed organizers;
d. There are packrats vs. neat rats; and
e. There is who tends more to territorialize-personalize its space and workstation, against who is more flexible.

Moreover, given the freedom today's workers enjoy over the time and place where to accomplish their tasks, work practices depend also on the habit of employees to hang out at the office. Based on research by Johnson Controls (Puybaraud, et al., 2011), the most common reasons motivating employees to frequent the workplace are multiple, embracing to collaborate, to interact, to be informed, to be creative/get inspired, to be seen, to share knowledge (which entails tacit learning), to see, to read, and to print. Among these, the top three reasons for flexible workers to go to the office are: 1) meet (75%); 2) collaborate (11%); 3) interact (3.8%). These reasons actually vary depending on age, as **Table 3-2** shows.

Table 3-2. Top reasons for Flexible Workers to go to the office [Processing on Puybaraud, et al. (2011, p. 25)]

Age	Main reason to go to the office
21-25 years old	Participate See Read Greet Share
26-30 years old	Collaborate Create Read Share Greet
31-35 years old	Greet Participate Interact Print See

[4] Susan Cain on Strombo: Full Interview, https://www.youtube.com/watch?v=CWrHrTTcLEA.

The same research reports also that the older workers get, the more independent they appear from their working environment. This evidence is confirmed also in studies by Leesman (2017 February), where 84% of the employees under 25 years old hold low mobility profiles (namely, camper/squatter or timid traveler), which is most likely related to career progression. Despite their more static work habits, younger employees think their workplace is more effective, compared to the opinion of older colleagues. This strongly suggests that young people appreciate the bonding and tacit-knowledge environment that a physical office can provide them with.

Presence in the office is an important aspect of work practice, which companies are interested in keeping under control. Indeed, presenteeism is considered a measure of engagement (Miller, et al., 2014).

That is the reason why workplace characteristics should particularly address:

- *"Wellbeing (improved quality of life, stress and better way of working);*
- *Performance (productivity and creativity); and*
- *Efficiency and effectiveness (space optimization and building efficiency)"* (Puybaraud, et al., 2011, p. 29).

2 Diversities in workplace management

Not only the way of working has been changing, but most of all the 'nature of work itself' (Slumbers, 2017), which affects also the traditional ways of using and managing the workplace.

2.a Different expectations

More and more companies nowadays are recognizing that their actions on workplaces are affecting employees' engagement, empowerment and fulfillment (JLL, 2017b). Human experience is becoming a key issue for organizations. The new generation of workers wishes their work environments made them feel at home and believes in an ethos they can share.

This is probably one of the reasons why self-employment has been growing rapidly in recent years (OECD, 2017). Even though start-ups, spin-offs and self-entrepreneurs seem to be going to replace traditional organizations, large companies still attract more employees than the smallest ones (Puybaraud, 2017). Anyway, an entrepreneurial spirit characterizes today's workers, which means that they seek to personalize their own working experience. For example, they appreciate working flexibly, even as employed workers. Google states that in bigger companies of over 6000 employees 60% of them will work flexibly by 2018 (Slumbers, 2017).

This is an important aspect differentiating the contemporary work environment from the traditional one. Companies and corporations might want to take this differentiator into consideration to attract the new generation of talents.

In Puybaraud's words (Puybaraud, 2017), there is a need for the workplace to be empowered by the human experience. This happens by going beyond the traditional nature of supply, and providing a space that is specifically designed to enhance humans and let them do what they are good at (Slumbers, 2017). This concept encompasses a different approach to workplace management.

Jones Lang LaSalle (JLL) has recently launched the *"Future of Work"* program, with an ongoing global study called *"Workplace powered by Human Experience"*. In the framework of this project, a number of investigations are being carried out. One of the surveys they conducted registers that almost 70% of the employees seek for 'happiness' at work. Happiness is seen as the most important ingredient to guarantee a

unique working experience, followed by recognition, personal learning and creativity (Puybaraud, 2017). Moreover, 87% of the survey respondents are favorable to entitling a new job description, dedicated to the employees' wellbeing in the workplace. This would be hired as a 'Chief Happiness Officer' or an 'Experience Director', in line with Google's and Virgin's most recent practice.

Despite this evidence, rarely employees have been aware of the role of workplace designers and managers of the office environment because communication between the parties is not fluid, or is not existing at all (Brackertz & Kenley, 2002). Even when employees are involved to some extent in the project and planning stages, without proper feedback they cannot figure out whether the contribution they provided is actually utilized, nor can be aware of the trade-offs that designer and managers often have to deal with. Being apart of the information flux makes them hesitant about the new design features and reluctant to change. On the contrary, employees like to feel that their workspace has been modeled thanks also to their consultation (Goodrich, 1982, p. 376).

A user centered approach needs to be endorsed (Duffy, 2000; Vischer, 2008b). The success of a workplace strategy is surely related to increased opportunities of communication and a facilitated information flow between end-users and all the stakeholders during the whole office life cycle.

The Smart Working concept, based on the combination of four components (i.e. culture, HR systems, workspaces and technology), promises to help better communication and involvement of all the stakeholders. Indeed, it entails a new way of communicating within organizations, which is oriented towards a 'many to many' model (Methodos, 2015a). New forms of collaborative communication have been rising supported by ICT tools such as social networks, microblogging, forums, etc., with the goal of engaging people and stimulating innovation (Partners4Innovation, 2015b). This way of communicating is based on a constant exchange of information. The communication flow invites everybody to take part to it, enabling each person to enrich the content of conversation, no matter of hierarchical levels or roles.

2.b Different disciplines

PwC and ADAPT undertook a joint research about wellness at work and organizational welfare (Morera, et al., 2017). The collaboration of these two companies, focusing by mission on two different aspect of the world of work, highlights a couple of main key-points related to workplace management. Firstly, it makes it clear that wellness and welfare are both hot topics for businesses today. Secondly, it demonstrates the strong interdisciplinary stance required to approach these topics. The professional competences they incorporate range from employment law, fiscal and social security to business and human resources management, from information technology support to the evaluation of the return on investment. Morera, et al. (2017) state that the concept of 'wellness at work' has a multidimensional nature, and it takes into account not simply health, but the employees' psychosocial dimension as a whole. PwC and ADAPT approach the topic from an HR point of view, but they stress the necessity for integrating several disciplines and aspects, while studying matters concerning wellness at work. In effect, what makes a great user experience possible is the integration of three necessary and fundamental components: great data, great technology, and great humans (Slumbers, 2017).

In this context Puybaraud and Kristensen (2015) call for a renovation of the facilities management and real estate industry, which will be increasingly responsible for capturing users' experience and matching their offering with users' demands. In order to follow up the necessity for adapting service delivery, redefining real estate models, redesigning working environments, and digitizing support services, a concerted reaction is desirable. This encompasses a joint effort from Corporate Real Estate Management (CREM), Facility Management (FM), Workplace Management (WM), and Human Resources Management (HRM) functions.

Especially when the workplace changes, intersections between HR, IT, senior leadership, business units budget, turf issues, facilities, accounting become vital, since there is *"no one element of the company that doesn't have a stake and doesn't show up."* (Miller, et al., 2014, p. 126)

Companies have been starting to recognize that a range of diverse competences are necessary under the umbrella cap of a workplace manager. Especially, real estate teams are beginning to work side by side with human resources teams to ensure that people are at the center of the workplace strategy (JLL, 2017a).

3.1.2 Hardware: Spaces and technological tools

The same diversity and plurality affect also the '**hardware**' structure of smart working, which is composed of 'workplace' and 'technology'.

Throughout history advancements in technology have changed both the container and the content of work. This dynamic has modified from time-to-time the human-workplace relation. Indeed, not only working in a convenient **space** and with the proper **tools** can enhance engagement and involvement among employees, but also that office workers feel having a greater say in the workplace-making process positively increases their productivity and general satisfaction. Active user participation in the design process is usually regarded as important to encounter users' approval and meet users' needs. In fact, workers declare they appreciate attention by their company towards the workspace as a form of respect to them (Mannheimer, 2011). The workspace and the equipment provided for work become a medium between company and employees, and between the latter and external clients/users, as well.

According to the Osservatorio Smart Working, one of the key concepts of smart working lays exactly on the physical space (Becker, et al., 1995; Methodos, 2015; Manca, et al., 2018). At the same time, workers today can perform their tasks also independently from the surrounding space (Miller, et al., 2014; Puybaraud & Kristensen, 2015). New technologies, indeed, are the enabler of smart working. ICT allows people to do their job ubiquitously, by interacting remotely and sharing files from any place, so that workers can move around both inside and outside the building (Mannheimer, 2011). In general, the way people work, work processes, work patterns, etc. should reflect on the way spaces are organized.

Hardware diversities can be recognized in work spaces and in work processes.

1 Work spaces

Offices nowadays are made of a combination of elements, both physical/material components and non-physical/immaterial components. The combination of physical/material components can be balanced out through the interpretation of the actual ways of working undertaken in an organization. These latter correspond to the physical/immaterial components, which reflect the same organization objectives and work processes on one hand, and culture, corporate and business values on the other hand (Pitt & Bennett, 2008).

1.a Diversities outside the building

Outside the building, the smart working model permits high external mobility for workers. Employees do not have to go to the office every day, but only on an as-needed basis, coherently with the activities they need to carry out, and the people they have to meet with. Research confirms that today's employees like working at home or in third spaces (Puybaraud, 2017). In this light, many companies, in order to

accommodate their personnel's logistics needs, have been progressively relying on hubs or coworking spaces spread all around the city, where their employees can go to work on some days of the week. Slumbers (2017) envisions 'six modalities of spatial occupation' that companies are likely to be dealing with in the near future, namely:

- Central office;
- Hub space;
- Serviced office;
- Coworking space;
- Client office; and
- Home.

Demand for a specific type of space fluctuates, while choice over how and where to work seems a key requirement for achieving effectiveness (Gensler, 2014). It looks like a general switch in the 'demand realm' is occurring, namely from Product to Service, and from Ownership to Access (Slumbers, 2017). Slumbers (2017) gives the examples of Uber instead of cars, Spotify instead of CDs, Netflix instead of DVDs. In the real estate context, this trend extends beyond the provision of on-demand spaces, to including also on-demand services. That means that a future is close when spaces and services will need to be provided as a whole. In effect, the trend of combining services to products has already influenced the market, for example in the manufacturing industry. The phenomenon of product-service systems (PSS) is emerging mainly due to a market-driven shift, along with sustainability issues (Sundin, 2009; Tukker & Tischner, 2006). PSS encompasses the provision of a function rather than of a product – for example, the function of washing clothes instead of the actual washing machine as a product. The same approach, when manifested in the real estate market, leads to go beyond the Space-As-A-Service model, to a Service-As-A-Space model, being service a compound of space. This model reflects inside the building as well.

1.b Diversities inside the building

Inside the building, companies have been broadly adopting the so-called Activity-Based Working (ABW) approach to configure their spaces. ABW in fact promises to support at best knowledge-worker's needs in terms of internal mobility.

> Unless we live in a studio apartment, we do not cook, eat, sleep, and entertain in the same room in our home. Why should we discuss a project, type a report, or read a technical article in the same workspace? (Becker & Steele, 1990, p. 11)

As suggested by Erik Veldhoen (Veldhoen, 2017), who initially coined the term Activity-Related Working (ARW), this flexible work mode allows people to shift from one work setting to another one, according to their necessities of:

- Communicating;
- Collaborating;
- Contemplating; or
- Concentrating.

This trend can help compensate some of the critics and discomforts attributed to traditional open-plan offices, where people used to work in cubicles without much possibility to transfer elsewhere.

In addition, JLL's research found that employees today enjoy innovative spaces in their workplace. Non-traditional spaces for concentration, for restoring energies, and for getting away from their desks are

strongly desired (Puybaraud, 2017). These alternative spaces may include: spaces for contemplation, community-focused spaces, health-based environments, family-dedicated environments, healthy and controlled places for getting together, and collaborative and experimental spaces.

However, at least for what concerns Italian firms, ABW is not so common yet, and the prevailing structure of workplaces remains still traditional: enclosed offices, open space with assigned desk, and meeting rooms (Crespi, 2015). Despite the average standard, companies that are facing a workplace change have started to implement some differentiation in the types of spaces they provide their workers with. Ciaramella and Bellintani (2015) classify different types of spaces, resembling and partially integrating the various types of work spaces proposed by van Meel, et al. (2010), according to the following criteria.

- Workspaces:
    - Open office;
    - Team-aggregation space;
    - Cubicle;
    - Enclosed offices;
    - Shared/multiple offices;
    - Team rooms/group rooms/project rooms;
    - Study booth/quiet room/think tank;
    - Lounge/club; and
    - Touch down/check point/internet spot;
- Meeting spaces:
    - Small meeting rooms (interview rooms/drop in rooms);
    - Large meeting rooms (conference rooms);
    - Huddle;
    - Training areas;
    - Brainstorming areas; and
    - Meeting points;
- Ancillary/support spaces:
    - Archives;
    - Stationery spaces;
    - Photocopier spaces;
    - Mail area;
    - Cafeteria and break areas;
    - Locker areas;
    - Libraries;
    - Welcome and waiting areas;
    - Horizontal connections;
    - Phone booths; and
    - Game/fun/entertainment room.

This long list proves the large variety of choice today's workers have on where to undertake their activities. Factors to be evaluated in order to decide whether to apply specific workspace solutions rather than others are outlined across different literature sources. These factors mainly regard what can be generally called work process.

2 Diversities in work processes

Work processes depend on job description and organizational values. Work processes affect the needs of the employees within their working physical environment. Hardy, et al. (2008) built up an overview of the diversity of work patterns emerging in most organizations, calling them 'workstyles'.

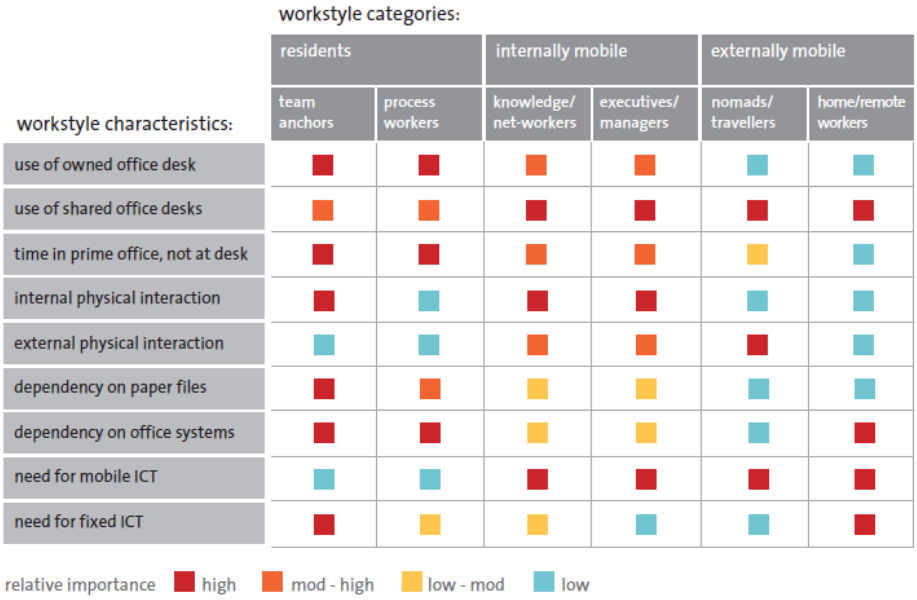

Figure 3-1. The new work-styles – what's important (Hardy, et al., 2008, p. 30)

In this light, designing workplaces as if employees only accomplished one defined work task in a certain way is an outdated approach typical of the Taylorist model, which was based on a 'scientific management' idea, (Waber, et al., 2014). Such a way of designing nowadays risks generating rigid solutions, with the result of tying people to procedures and attitudes that do not correspond to the current '**way of working**'. Rigidity of spaces can only restrict creativity and innovation, against what companies are looking for. In fact, the so-called Activity-Based Working (ABW) approach, as imagined for the first time by American architect Robert Lucchetti in the 1970s (Rothe, 2017), steers just into this idea. Indeed, different ways of working reflect diversity in work processes, which mainly articulates in different branches:

- Work patterns, i.e. low mobility vs. high mobility;
- Activities;
- Degrees of interaction, i.e. individual vs. collaborative; and
- Habits/needs with regard to identity, status and privacy.

2.a Work patterns

Greene and Myerson (2011) schematize four principal work patterns in consideration of the ways of working of knowledge workers, with their respective needs: anchor, connector, gatherer, and navigator. They define these patterns as "character types". These can be associated with the mobility profiles adopted by Leesman (2017 February), which are based on the same idea of mobility, but the two classifications do not fully overlap (**Table 3-3**).

Table 3-3. Work patterns: comparison between Greene and Myerson (2011) and Leesman (2017 February)

	Definition by Greene and Myerson (2011)	Definition by Leesman (2017 February)
Within office	Anchor – need for comfort Iconic sedentary office workers, most of their tasks are desk based, they move in the areas surrounding their workstation or other functional spaces, such as restaurant and meeting rooms. Their consistent presence in the office make them a reference point for information for colleagues, and knowledge transfer persons. They attribute a sense of ownership to their desk, combined with the ritual of arriving to the same space. They do not relate well with open plan offices because their tasks involve concentration, so that noise disturbs them a lot.	Camper/squatter Perform most/all of their activities at a single work setting and rarely use other locations within the office.
		Timid traveller Perform the majority of their activities at a single work setting but also use other locations within the office.
	Connector – need for different spaces Typically spend half of their time in other places than their workstation, such as meeting rooms, cafeteria, colleagues' desk. Their work is based on interacting with people from different departments of the company, but these interactions remain within the office building. Due to their tendency to communicate and collaborate with others, they need to work freely and visually.	Intrepid explorer Perform some of their activities at a single work setting but often use other locations within the office.
		True transient Use multiple work settings and rarely base themselves at a single location within the office.
External to office	Gatherer – need for networks Work on generating relationships away from the office. They spend half of their week at client or customer offices, at other sites, or using third space locations (cafés, members clubs, etc.). They travel within regional boundaries, but the office is still the central fulcrum of their activities. They communicate on the move. When they are in the office, they need to process and review information, therefore they look for spaces supporting both concentration and collaboration. In many companies the Gatherers work on a shared-desk or hot-desk basis, and they do not have a proprietary workstation.	
	Navigator – need to feel welcome Visitors to their own office, they rarely go to the office at all (less than one day a week), the office for them is seen as a node of their network. They move often internationally at a global scale. Examples of Navigator are: contractors employed on a project base; salesmen who have a nomad lifestyle; consultants who use meeting rooms and occasionally need spaces where to sit down and use their laptop.	

Greene and Myerson (2011) denounce that the more mobile the work character is, the less he is likely to be satisfied with the space he works. Indeed, facility managers and the people appointed to space planning seem barely knowing the needs of Navigators, hence find it difficult to address them. Nevertheless, this work character is becoming more and more common, gaining key responsibility, and assuming highly valued roles in organizations.

Similarly, Leaman (2003) reports that *"the more functions and activities people have to cope with, the less likely they are to say they are productive as well. So open plan often scores worse simply because the number of activities is greater."* (Leaman, 2003, p. 166)

In partial contradiction with this statement, are results reported by Leesman (2017 February). Their studies demonstrated that ABW environments enhance employee satisfaction on many key workplace activities. However, according to their studies, the less a worker is mobile, the less he is likely to appreciate the ABW approach.

2.b Activities

In addition to defining different mobility profiles, Leesman (2017 February) clustered 21 key workplace activities in the following five categories:

- Collaboration (collaborating on creative work; collaborating on focused work; informal social interaction; informal un-planned meetings; learning from others);
- Individual work (individual focused work, desk based; individual focused work away from your desk; individual routine tasks; reading; thinking/creative thinking);
- Formal meetings (audio conferences; hosting visitors, clients or customers; larger group meetings or audiences; planned meetings; video conferences);
- Conversations (business confidential discussions; private conversations; telephone conversations); and
- Other (relaxing/taking break; spreading out paper or material; using technical/specialist equipment or materials).

Bell and Anderson (1999) in the 1990s undertook a project at a company where they recognized a range of five to nine functional groups of employees. These sum up to five work-styles requiring ten different work settings. The same authors declare the most interesting aspect of their analysis being the identification of a high variance in work-styles, and the resulting work setting, required within a single job function. Their project comprised at least ten different types of spaces, each of which is meant to accommodate different types of activities, including:

- Open Team Rooms;
- Flexible Workspaces, with the possibility of easily relocating vertical screens and file banks;
- Focus Booths, for individual concentrated activities;
- Touchdown Spaces, for short-term use by employees or visitors;
- Closed Team Rooms, assigned to teams for a limited period of time;
- Closed Meeting Rooms, for three to four employees;
- Commons, for social interactions and individual or informal collaborative work (e.g. IT, writing, reading, and telephone); and
- Huddle Rooms, small enclosed spaces for one-to-one confidential meetings.

Despite different nuances can be recognized by different authors, the main effort remains acknowledging all the many different typologies of knowledge workers that can be found in the same company (Greene & Myerson, 2011). Most of all, the challenge entails accommodating knowledge workers need for choice over the spaces and services available in the office. Indeed, they need to adjust them according to their individual preferences and tasks (i.e. work patterns and processes). Thus, the same authors suggest companies would benefit from asking their employees what typology they think are and what typology they aspire to be. This may promote a fruitful discussion about the ways of working and facilities required by people.

2.c Degrees of interaction

Moreover, work processes have been switching from being mainly based on individual work to boosting collaboration. Increasing task complexity and market competition have forced more agile modes of work mainly organized through projects that allow flexible coordination between a wide variety of professionals in time and space (Hiorth, 2012). The hyper-specialization and division of labor led to a greater use of

outsourcing of independent professionals working in teams in a face-to-face or virtual mode (Coupasson, et al., 2016).

In effect, collaboration has been demonstrated to bring good outcomes to companies. Patel, et al. (2012) summarize the benefits of collaboration for business, which include:

> […] increased profit through sharing expertise across business units or companies; reduction in costs through sharing best practices; improved decision making through sharing insights and knowledge; innovation through sharing ideas; and an improved ability to pursue goals that involve distributed units or companies. (Patel, et al., 2012, p. 1)

These reasons explain why an increasing number of companies rely nowadays on the potential of collaborative spaces, which promise to have *"a positive influence on inter-personal interactions, thus being conducive to innovation and entrepreneurial behaviors, and, ultimately, to superior performance."*[5]

The new ways of working are characterized by a significant number of collaborative tasks and group activities. Kämpf-Dern & Konkol (2017) pinpoint both individuals and groups as relevant subjects in the work environment. Literature and empirical studies (e.g. Tagliaro & Ciaramella, 2016) confirm that, on a typical working day, the time employees spend carrying out individual tasks equals the time they are involved in collective activities. Employees today enjoy innovative spaces in their workplaces, among which collaborative and experimental spaces, and places for getting together (Puybaraud, 2017). Thus, it is of pivotal importance for organizations focusing on how well their spaces support this type of work and alternative goings-on, such as contemplation and community-focused activities. Indeed, providing companies with collaborative spaces does not automatically result in more collaboration (Brown, 2008). Therefore, appropriate indicators can help verify the impact of collaborative spaces on collaboration.

To this extent, Brown (2008) undertakes a thorough investigation about proximity and collaboration. He asserts that collaboration requires face-to-face (F2F) interactions, which means meeting in real space and time. F2F interactions can occur according to three modalities: (1) meetings planned and scheduled in advance; (2) on-demand meetings between a few individuals; and (3) chance encounters. Spatial configuration affects all these types of different interactions.

Spatial configuration is defined, among other parameters, by density and proximity that are independent from one another, even though they get often confused. In particular, Brown (2008) contends that proximity, which derives from functional distance, reveals to be a better criterion to measure the effectiveness of space configuration. However, he cautions that proximity requirements are strictly related to the character of the knowledge base of the industry. Knowledge can be analytical, synthetic or symbolic (Brown, 2008).

- Analytical knowledge, typically develops in scientific research institutions (e.g. universities), generates innovation through new knowledge production;
- Synthetic knowledge displays in the fields of engineering, technical design and production application. It generates innovation by applying preexisting knowledge in novel ways; and

[5] Information gained from the XXVIII Annual Scientific Meeting of the Italian Association of Management Engineering (AiIG) where a thematic track was specifically focused on *"Collaborative spaces as a new challenge for firms, accelerators, incubators, and research labs."*

- Symbolic knowledge leads to innovative aesthetic products and cultural artifacts (e.g. media, advertising, images, etc.) through the recombination of existing knowledge.

Each of them is likely to require different proximity solutions. Consequently, future work on collaborative spaces should start from figuring out the required spatial proximity in relation to the type of knowledge. The context is then further complicated by the abovementioned 'diversities' displaying in the workplace.

2.d Identity, status and privacy

Pitt and Bennett (2008) demonstrate that organizational culture is fundamental to maintaining employee privacy, status and identity. They analyze in depth the case of a company where different workspace options have been set up to accommodate their multi-faceted type of work and ways of working. Spaces available include: hot-desking, touchdown area, bookable individual offices, group collaborative workspaces, and break out spaces. In addition, the workspace is characterized by a flattened hierarchy structure, the use of glazed and transparent partitions, the display of colorful artwork, a palette of warm relaxing colors, and an area for gaming and recreational activities. In the context of this project, status, privacy and corporate identity have been achieved through the implantation of innovative elements. The authors affirm that: *"status has been managed through the implementation of electronic employee profiles, which display […] achievements and specialist areas of work. Privacy has been maintained by incorporating not only bookable offices but also through the effective use of lighting techniques in the informal break-out areas […]. Personal and corporate identity has been integrated through the effective display of artwork which [allows] to establish brand and identity through space."* (Pitt & Bennett, 2008, p. 300)

Leaman (2003) remarks several times how the ability to control the surrounding environment registers benefits to employees' productivity and satisfaction. People say they perform better when they themselves can adjust heating, cooling, ventilation, noise and lighting of the environment they work in (often in that order of importance). This has to do also with the possibility to claim identity, status, and privacy at work.

Brown (2009) discusses territoriality at work by categorizing different ways people express their territorial claims in office environments. The author defines territoriality as a social-behavioral construct that affects the relationships between people. Territorial behaviors are functional to different extents, such as: (a) maintain privacy; (b) facilitate task accomplishment and social cohesion, enhance group identity, and smooth functioning within social units; (c) satisfy various needs (e.g. efficacy); and (d) enhance wellbeing and job satisfaction.

According to Brown (2009) there are four types of territorial behavior, each of whom can be defined by different measures, and are partially independent from one another.

1. Identity-oriented marking, or personalization (e.g. a photo of a family member or hobby on a desk can help adapt to the job and commit to the organization, as well as distinguish oneself from the others increasing one's self esteem);
2. Control-oriented marking (e.g. creating a physical border so that other people are discouraged from entering the designated territory);
3. Anticipatory defending (e.g. locks on doors, passwords, which refrain others from infringing one's territory); and
4. Reactionary defending (e.g. hostile attitudes developed in reaction to an infringement).

Psychological ownership is especially correlated with identity-oriented marking. This can be explained given that the more people feel they own an object the more likely they are to mark that object with personalized items (Brown, 2009).

3.1.3 How to address diversity

Many studies have been rising on each of the two-sides of the 'diversity' coin, i.e. software and hardware.

Some of them pay attention to the effects of these new spatial solutions for work on the people, thus concentrating on 'hardware diversity'. For example, investigations by Maher & von Hippel (2005) prove that inhibitory ability, stimulus screening, perceived privacy and task complexity interact in determining employees' affective responses to the open-plan work environment. Here, the question is whether smart working, together with the ABW-model, can help employees find time-by-time the best places to work, according to their privacy requirements of both information and stimuli control (Congdon, et al., 2014).

Other researches instead address 'software diversity', while investigating workers' personality (Stolher, 2018) or characteristics (van de Koevering, 2017) in relation to how they are satisfied with certain spatial solutions.

Since all these differences start to emerge, both in the software and hardware core of the workplace, it is important to find a way to assess them. They should somehow be translated into 'data', and therefore led to become 'information' suitable to create more 'knowledge' – according to the definitions by Ackoff (1989).

The present study will focus on:

- The software component, by investigating how the new trends in workplace management are redefining user roles and responsibilities within the workplace (**Chapter 4.5.1**); and
- The hardware component, by reflecting on how the evolution of work processes affects user needs and values (**Chapter 4.5.2**).

In the end, all the abovementioned research interests are directed toward identifying the incorporated **value** of the workplace, which goes through capturing the right **data**.

3.2 Using data in the workplace

While actual offices still exist, nowadays they build up on a complex whole of data. Technological infrastructures embedded in the workspace potentially allow for an array of information, unimaginable only a few years ago. Available technologies can be implemented to four main domains: environmental, occupancy, social, and personal (Bahr, et al., 2016).

Environmental factors

Monitoring environmental parameters is maybe the most common use of sensor technology to date. It includes HVAC, lighting and security within Building Automation Systems (BAS), and Building Management Systems (BMS).

In general, more control over the office environment is handed to the occupiers. For example, Carlo Ratti and his team are working on responsive architecture, while redesigning the Agnelli Foundation headquarters in Torino, Italy (Ratti, 2016). Here they are applying a personalized heating, cooling and lighting system, as an individually-tailored environmental bubble. Occupants will be able to customize via a smartphone app their preferred environmental settings, which will follow them as they wander around the building. This case highlights a trend towards the creation of buildings that can be managed by the populations/crowds making use of them (Brister, 2015; Puybaraud & Kristensen, 2015).

Occupancy patterns

Besides environmental parameters, gathering occupancy patterns is likely to become common practice today. These data are dynamic, by their very nature, which makes measuring them more difficult. Historically this kind of information has been retrieved most of all through observations that are techniques typical of the ethnography domain. Otherwise this data have been derived from occupants' perceptions. Nowadays, occupancy can be an objective data, since technological advancements lead to a disruptive evolution of this kind of measurement (Zhou, Work in progress).

Thanks to sensors and other technologies it is possible to infer valuable information about circulation areas, rooms and work points, until detecting equipment's use (whiteboards, desks, seats), and people's location inside the building for navigation purposes (Brister, 2015).

Besides these important data, which is static in nature, also more dynamic/relational qualities of space occupancy can be retrieved, such as proximity between spaces, functions, and people. In management, policy, and economic theories there seems to be an assumption that space is homogeneous. This leads to deduce that proximity is a function of density, which results in believing that the higher the density, the greater the proximity. Though this assumption does not take into account all the barriers and paths that can hinder or encourage exchange among people. That is why: *"Proximity enabling contact is a more difficult, but more important, phenomenon to measure"* (Brown, 2008, p. 7).

Information about proximities can be assigned to methods such as and the Spatial Network Analysis (Appel-Meulenbroek & Feijts, 2007), which measures configuration and structural design of spaces. This method relies on the elaboration of isovists and visibility graphs which correlate with satisfaction, productivity, movements, and interactions in a work environment (Appel-Meulenbroek & Feijts, 2007).

To this extent Brown (2008) foresees advantages in combining spatial proximity with information and communications technologies. For sure occupancy patterns must be verified by spatial proximities and space syntax.

Social Network Analysis

Different types of social interactions and communication can take place at work (Becker & Steele, 1990). This can influence the necessity for organizing the space in different ways. Grouping people according to the project or product they are working on supports communication to coordinate the work. Grouping people according to their discipline/specialty/department enhances communication to keep individuals up to date with developments in their field. Communication to stimulate creativity is mainly enabled by chance encounters, being more unpredictable and informal.

Social Network Analysis (SNA) registers the quantity and quality (to some extent) of interactions between people. SNA offers a means for mapping channels of collaboration, often tacit, that may imply general social practices, knowledge acquisition, knowledge management, and innovation – both within and between groups (Suckley & Dobson, 2014). These might be used in the workplace to make adjacency decisions according to the idea of 'functional inconvenience'. That is to say that spatial proximity is established not following efficiency (the principle of least effort), but to promote effectiveness (Becker & Steele, 1990). The side effect of this strategy is also to stimulate movement during the work day. On one hand, this has a well-known positive impact on health; on the other hand, it increases the chances of causal encounters which in turn might reflect on wellbeing and creativity.

Social network surveys can rely on sociometric surveys, as in the case of Suckley and Dobson (2014), but more recently also on sensing devices, such as in the experiments undertaken at MIT by Waber (2013). As a technological device for 'people analytics' the 'sociometer' applied by Waber (2013) can detect an array of information by measuring signals like infrared light, motion and sound. This looks like a badge, and detects not only which employees are talking to each other, but also other data on their interaction such as how, when, where, and for how long they talk. Thus, sociometric badges are a potential tool for companies to apply to measure and learn about employee communication patterns and social interactions.

Personal parameters

In addition, personal parameters can be monitored as well. Morera, et al. (2017) remark that some corporations, especially in Anglo-Saxon contexts, already check their employees' health through both questionnaires and clinical screenings (e.g. gather data about weight, blood pressure, glucose levels, etc.). This kind of information is useful for executives to encourage employees to good and healthy behaviors. However, Engelen, et al. (2018) call for further research to reinforce the evidence on the effects of Activity-Based Working on health. Future research will probably abandon more traditional techniques that are going to become obsolete soon, since wearable technology is enabling 'biometrics' (Bahr, et al., 2016).

Health tracking devices have a mainstream success nowadays. Thanks to these devices, physiological endpoints can be tracked over time to increase self-awareness of personal health and wellbeing. Among parameters that can be recorded are there heart rate, body temperature, perspiration, movement, glucose levels, blood oxygen levels, brain activity. Imaging systems detect also non-verbal behaviors, such as gaze direction, facial expression, facial temperature, body posture and others (Bahr, et al., 2016). Companies are currently looking for applying them in their workplaces with the purpose of collecting precise and practical data about employees' physical parameters and use them for enhancing their wellness and productivity.

Data integration and value creation

The revolution in this sector encompasses the combination of all these systems, in order for them to intelligently react to the occupant needs in real-time. As demonstrated by Hua, et al. (2014) the workspace is the spatial unit where user and environmental data are encountered. For example, light intensity and color, temperature, airflow, air scents may be adjusted to restore occupants' responsiveness (Bahr, et al.,

2016). Facial muscle strain and skin temperature can be measured to derive participants' attention in a meeting.

Despite technology today that allows the recording of innumerable data, the objective is pointless if it is limited to measurement (Jordan, et al., 2009). Indeed, data and measurements must be put in relation to each other to become informative, and must be read in the correct way to increase knowledge (Ackoff, 1989).

The responsibility to integrate data cannot be transferred to technology. On the contrary this task is totally on people. On one hand, the human being can now refer to technologies for many activities such as data gathering. Slumbers (2017) reports the results from recent researches guaranteeing that up to 49% of tasks that make up today's work could be automated. On the other hand, the role of the human being becomes even more fundamental because he creates a unique value with his very peculiar skills, if compared to machines, such as for data integration and interpretation.

Indeed, decision upon what data to collect and how to manage it is made based on values. 'Value' has a double meaning, as it can be interpreted either in a quantitative/economic way or is a qualitative/subjective way (Jensen & van der Voordt, 2017).

The concept of value, in this case, embraces a broader meaning than that generally enforced in general management and in the real estate context. Indeed, in management, value often equals to price (or time): *"The lower the price (i.e. the smaller the sacrifice), the better the value (i.e. the bigger the benefit)"* (Coenen, et al., 2012, p. 76). This is true also in the facilities management realm, where value is typically driven by an economic/financial rule of thumb (Coenen, et al., 2012). The real estate market, as well, by nature deals with market values (and transaction costs) or investment values (and financial flows).

As opposed to the abovementioned concepts, values that are implicated in the process of data integration I workplace management expand to more neutral definitions. The New Shorter Oxford English Dictionary reserves a long section to the definitions for 'values', identifying three main areas of meaning:

(a) *"The worth, usefulness, or importance of a thing; relative merit or status according to the estimated desirability or utility of a thing.*
(b) *Estimate or opinion of, regard or liking for, a person or thing.*
(c) *The principles or moral standards of a person or social groups, the generally accepted or personally held judgement of what is valuable and important in life."* (Brown, 1993)

The three meanings refer to: (a) what something is worth; (b) opinions about that worth; (c) moral principles (Dietz, et al., 2005). The first definition applies to the present paragraph of the research, while the third applies later, in the analysis of workplace users.

3.3 The composite value of the next-generation workplace

The workplace has gained a new value, lately, for both firms and employees. Today clients' main concerns lie upon *"extracting more value out of their real estate portfolios"* (Miller, et al., 2014, p. xi). This value composes of original elements, different from the traditional ones.

In the economy of yesteryear, workers created value by doing things, as described by Michael Porter's classic organizational value chain model (Porter, 1985). In today's economy, on the contrary**,** value creation happens by workers talking to each other. Palvalin and Vuolle (2016) say that knowledge-intensive companies produce value to customers *"through the knowledge and competence possessed by their workers."* (Palvalin & Vuolle, 2016, p. 166) Therefore, if in the past the office was devoted to support the manufacturing sector and the main tasks were those of paper handling, at present, office work has to do with the generation and communication of ideas (Goodrich, 1982).

According to recent researches (Colpaert, et al., 2014; Tagliaro & Ciaramella, 2016a), thinking, talking and brainstorming create the most value for an organization. Today, time spent at work in some type of conversation takes up to 50-80 percent of the overall working day. These conversations may occur face-to-face, one-on-one, in teams, over the phone, a conference call, through an exchange of emails, or even a chat on an enterprise social network. It is common belief that by talking together, people come up in the shortest time with new solutions that probably no one single person could have developed alone (Allen, 2007). Key activities in today's work are both concentrated (solo) and collaborative (together). On one side, concentration, observation, research, imagination, testing and planning require concentration. On the other hand, brainstorming, interviews, workshops, co-creation, debate and delivery require collaboration. Both of them produce value.

People, more than 'doing' work, today 'think' the work: analyzing, conceptualizing, reflecting, and communicating with others. These attitudes impact the traditional features of the workspace and how people perceive it. The cognitive nature of today's work implies that the concept of 'value' is more immaterial, thus it requires to be measured in novel ways.

However, in our knowledge-work world the challenge remains the same of creating the maximum value (V^{max}) at the minimum cost (C^{min}) (Hollingworth, 2012). Taking into consideration the 'new' organizational value chain proposed by Hollingworth (2012) (**Figure 3-2**), physical spaces are at the basement of a company's supporting infrastructure, together with IT and organizational culture.

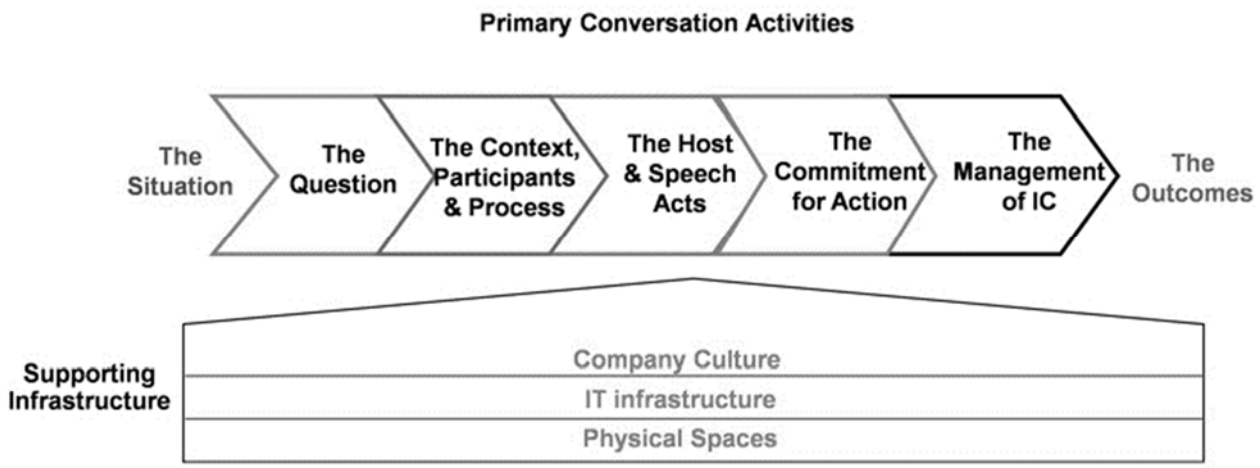

Figure 3-2. The (New) Value Chain – built on the Porter's model (Hollingworth, 2012)

These three components bolster value creation, which mainly happens through conversation activities between people. Actually, workplaces, technology, culture and 'people' (i.e. HR systems) resemble the four key-components of the so-called 'Smart Working' model, that Becker et al. (1995), Methodos, et al. (2015), and Manca, et al. (2018) all refer to.

Today, what defines the workplace value for an occupying organization is much more than the economic value of the commercial building as a real estate asset. In fact, workplace value goes hand-in-hand with the desired client experience. On one hand, companies are looking for an 'effective workplace' that supports all types of work in the right way, and therefore maximizes value creation for their business (Colpaert, et al., 2014). On the other hand, employees' expectancy about the work experience and the related 'value' dimension have changed, together with the 'psychological contract' linking them with organizations (Methodos, DEGW, & Partners4Innovation, 2015).

Therefore, if before, value was attributed most of all to the economic aspect of the physical assets, nowadays companies are more focused on the immaterial value their workplace allows to produce while supporting their people's work. How is it possible to measure this value? What does this value compose of?

There is large support in the literature for arguing that the workplace exploits its value and manifests its impact in three distinct but complementary spheres, namely: economic, environmental, and social (Becker, 1990; Varcoe, 1996; Alker, et al., 2014; Epstein & Rejc Buhovac, 2014; Kämpf-Dern & Konkol, 2017).

Becker (1990) describes the so-called *"Total Workplace"* as a trifold structure, composed of physical facilities, organizational elements, and social elements. Varcoe (1996) talks about facilities performance criteria that he relates to three main areas: customer satisfaction, flexibility, and productivity. Alker, et al. (2014) discuss the overall impact of the workplace by considering: economic/organizational impacts, environmental/physical impacts, and social/human impacts. Epstein and Rejc Buhovac (2014) argue that companies need to align their objectives with socially, environmentally, and economically sustainable decisions. Kämpf-Dern & Konkol (2017) identify three important aspects of a physical workspace environment impacting performance: ambient, material, and socio-spatial.

In particular, Epstein and Rejc Buhovac (2014) argue that companies, in order to achieve long-term values, must integrate corporate financial goals and business decisions with 'sustainability'. They underline that products, services, processes, and activities produce 'impacts' that need to be identified, measured and reported both internally and externally with regard to sustainability. The authors contend that corporations have become well aware of the impacts they have on society, the environment, and economy:

> Identifying the social, environmental, and economic issues that are important to key stakeholders and improving stakeholder relationships can foster loyalty and trust. […] The key is to identify the areas where good for society, good for the environment, and good for the company intersect. […] In order to improve the integration of social, environmental, and economic impacts into day-to-day management decisions, companies must tie the measurement and reporting of these impacts into decision-making processes. (Epstein & Rejc Buhovac, 2014, pp. 4-6)

In their book, Epstein and Rejc Buhovac (2014) apply their method around sustainability, as declined into a trifold perspective: social, environmental, and economic. In fact, largely based on the Brundtland definition (World Commission on Environment and Development, 1987), their description of sustainability in the context of corporate responsibility is synonymous with impact, performance, and value.

In conclusion, either by addressing workplace characteristics (Becker, 1990), performance criteria (Varcoe, 1996; Kämpf-Dern & Konkol, 2017), impacts (Alker, et al., 2014), or sustainability objectives (Epstein & Rejc Buhovac, 2014), the literature converges toward three main areas where impacts, performance and value of the workplace decline, which are: social, environmental, and economic. This framework is going to be used as a gateway to classifying Key Performance Indicators in Phase II of the research.

3.3.1 Social value (perceptual metrics)

Social value has no legal definition, although it is not a new concept (McCarthy, 2017). It has been explained as *"the quantification of the relative importance that people place on the changes they experience in their lives."* (Social Value International, 2018). The Business Dictionary defines social value as a *"larger concept which includes social capital as well as the subjective aspects of the citizens' well-being, such as their ability to participate in making decisions that affect them."* (Business Dictionary, 2018)

While Corporate Social Responsibility (CSR) is now a key strategic management driver for big corporations (McWillimas, 2015), social value, social capital, social sustainability, community benefits have still little space in debates around the built environment, especially for what concerns designers and architects roles to this end (McCarthy, 2017). Likewise, in the corporate real estate and workplace landscape, social value has not gained much importance to date. Nonetheless, changes are happening which might be worth interpreting through a social value lens. These changes entail impacts at different scales.

Impacts at city/development scale

The current release of work from space and time has made the concept of work itself less confined. Contemporary work has been defined with the acronym VUCA: Volatile, Uncertain/Unpredictable, Complex, and Ambiguous (Bennett & Lemoine, 2014; Miller, et al., 2014). This volatility, unpredictability, complexity and ambiguity alter the traditional relation of workspaces and workers within cities and territories.

On one hand, work comprehends a variety of individual activities, which can be performed anywhere and at any time. On the other hand, even in the context of today's *"virtual office"* (Haynes, 2007, p. 146), workspaces are going to become places for people who need to work together physically, as Domenico De Masi states (Cecco, 2017). Indeed, collaborative spaces are created to host collective activities of employees from the same company as well as external supportive figures. In addition, the phenomenon of incubators is rising, opening up many corporate spaces and resources to be shared with entrepreneurs, individuals, and complementary businesses (Gust, 2016).

Moreover, today's ways of working enable also several new dynamics towards inclusiveness of people from different countries, and of people with different abilities (see paragraph about diversity in individuals).

Hence, these dynamics have significant impacts also at the urban and territorial scale (e.g. Mariotti, et al., 2017; Boschma, 2005), as well as at the office building scale.

Impacts at building/portfolio scale

As work is increasingly conceived as a social phenomenon (Cecco, 2017), workplaces are required now to boost interactions and social value for the people who inhabit them. Indeed, individuals place greater importance on the physical quality of their work setting, also because it reflects some social qualities of the environment they work. In this respect, Kaplan and Aronoff (1996) state that:

> This is clearly reflected in the use of higher-quality work settings as a reward for superior performance and as a symbol of elevated status (Kaplan & Aronoff, 1996, p. 8).

In effect, the relationship between the physical qualities of buildings and social values is nothing new. Haynes (2007) attributes to Elton Mayo and F.J. Roethlisberger the merit to have contributed since the 1930s to shifting the attention from evaluating a work environment only in its physical dimension, to considering it in its social dimension, as well.

Today the social value of the workplace tends to be incorporated in the concept of wellbeing or wellness. Morera, et al. (2017) describes wellness as being composed of three complementary elements: physical (i.e. health), psychological (i.e. wellbeing), and social.

Morera, et al. (2017) lists 14 empirical dimensions of organizational wellness, derived from the Multidimensional Organizational Health Questionnaire - 2005 (MOHQ). They emphasize that the first dimension for importance is the provision of a healthy, comfortable, and hospitable environment. The list includes also other dimensions that have to do with the physical environment, to some extent. Among them: listening to the employees complaints, stimulating a communicative, open and collaborative atmosphere, and prevent injuries and professional risks. Though, the authors lament that the physical utilization of workspaces seems still a matter of limited importance for corporations.

At the same time, it is also vital to acknowledge the individual characteristics of the employees, the diversity of their work contribution, and their social relationships. Moreover, attention to their requests are fundamental to be listened to. However, despite literature encourages good practices, Morera, et al. (2017) denounce that the common approach is still limited to the respect of regulations, which lacks of a holistic perspective. On the contrary, the effectiveness of the strategies for increasing organizational wellness lies on the implementation of a multidimensional vision. Strategies should be articulated in: (a) preliminary evaluation of the work environment, internal relations, culture, knowledge about the company's population and its socio-demographic characteristics, information on the business and territorial context (e.g. absenteeism, turnover, and so on); (b) survey of the employees' needs and expectations, with a projection of the benefits and costs of the initiatives, and their sustainability; and (c) guarantee of transparency, which means informing all the stakeholders and involving all the personnel in every phase of the initiative, from the detection of the needs, to the intervention design, until its implementation.

Overall, wellness initiatives have been proved to gain good economic results for companies to several levers. As Morera, et al. (2017) reports, such initiatives shrink costs for absenteeism, boost motivation and productivity, reduce turnover costs, and attract talents. Also, according to the Italian law, they deserve special tax incentives.

Although several advantages seem to be accomplished thanks to these initiatives, RAND Corporation denounces that only the 40% of employers in the US perform systematic evaluation of the connected results, based on data (Mattke, et al., 2013). Thus social value expressed by wellness still needs to be properly acknowledged.

Impacts at individual scale

How the new vision of workplace is concretely realized by firms affects also the role of work in employees' private life. To this extent, smart working policies can lead to benefits in terms of reduction of time and cost of commuting, and better work-life balance. In turn, these advantages might increase motivation and satisfaction, especially among the youngest generations. Indeed, Miller, et al. (2014) report that Millennials are more demanding than the previous generations about workplace quality, and how and where they work.

For these reasons, many companies have been focusing on the social aspect of the work experience by implementing strategies to boost engagement among their employees, and the other people who connect to them. Miller, et al. (2014) point out that this is the main reason why 1,600 CEOs of global companies list innovation as their top priority. In a world in constant flux such as ours, innovation has been demonstrated to be vital for keeping engagement.

Innovation for a company's business can be pursued in different ways. For example, many companies are introducing online social tools towards the goal of connecting their people, creating a flow of ideas, and pushing innovation (Aurik, 2015). This way of involvement keeps the employees up to speed and lead them to a better understanding of the main business issues, with the result of making them feel more engaged, while being aware that their opinion counts. Innovation involves the spatial dimension of the workplace, as well.

Moreover, the definitions of social values given at the beginning or the paragraph entail the 'relative importance placed by people' and 'subjective aspects'. Thus it derives that social value highly relies on individual perceptions. Research suggests that *"perceptions may be more significant, and therefore more relevant than reality. This is likely to be true for any service industry"* (Tucker & Smith, 2008, p. 197).

That is the main reason why it is also important to carefully monitor aspects that can be less quantifiable and precise, but fundamental to drive corporate real estate strategies and office building management. Thanks to this information, the requirements of new workplaces can be better defined and monitored over time.

According to Tucker & Smith (2008), the concept of 'perception' can be defined as *"the users' observation, opinion, and awareness of both the environment they are in, and the service they are receiving"* (Tucker & Smith, 2008, p. 197). User perceptions differs from customer satisfaction and the two should not be confused. In fact, it is only when actual user perceptions is confronted against initial expectations, that the end product is assessed in terms of satisfaction level. Morera, et al. (2017) reiterate the same concept when they say that satisfaction at work means filling the gap between work expectations and reality, along with offering the workers the possibility to achieve their individual needs, and prevent psycho-social risks, which are all components of the social value.

How to measure social value and impacts

From the definitions outlined before, enhancing social value encompasses the involvement of the people who have to do with the product and processes under development. In the workplace this means involving the next-generation workplace users in the workplace-making process. One way they can contribute to the process entails helping measure the value and impacts produced on them.

Common approaches to measuring social value and impacts include (Kirkland, 2012):

- Social Return On Investment – SROI (proxies to translate social value into currencies);
- Creating outcomes frameworks across stakeholders' groups;
- Using digital technologies to understand the impact of a project across organizations, by linking a variety of measurements; and
- Storytelling.

Technology may be the key to check the extent to which the design of a physical environment affects human performance, in terms of the added social value (Kirkland, 2012). Waber, et al. (2014) notice that sensors, social networks and other technological tools are already applied by organizations in the branches of marketing or development of new products. The same could be favorably applied also in the corporate real estate function of the same organizations in order, for example, to understand whether their offices

positively boost productivity, wellness, innovation or other social values at the city, building, and individual scale. Brister (2015) foresees the diffusion of crowd-controlled management of office buildings and facilities in the near future. Technology might soon enable people to interact more actively with the physical environment surrounding them.

Despite tools and instruments that already exist, Alker, et al. (2014) claim how industry and businesses continue to under-invest in the occupant experience, missing out what is potentially a positive Return on Investment (financial evaluation based on life cycle costing – capital and operational). While empirical evidence is growing linking building design attributes to productivity, wellbeing and health (Alker, et al., 2014), the results have not been integrated into building design and management, yet. Especially, the quantification and the relative importance that people place on the changes they experience in their lives, including their workplaces, is still to come.

Employers, building owners and investors should recognize the social value of design decisions and investments in the built environment. Decisions made today have a social impact over the whole life-cycle of a company's workplace strategy. Not least are broader implications of engagement and satisfaction among employees that go beyond business. Indeed, some studies assert that workplace productivity and human performance are major determining factors in overall national outputs, influencing growth rates and quality of life (WGBC, 2013). Moreover, these decisions reflect also on the environmental impact of workplace strategies and on the long-term economic value of the corporate real estate assets.

Hence, measuring social value in workplace-making processes may be worthwhile to support decisions and evaluate the impacts of them on the wellbeing of individuals and communities, social capital and the environment. Ways to measure and report social value do exist, and can be both financial and non-financial. The Social Value Portal accounts over 1150 social and environmental impact metrics in use across the world.[6] In the next phases, this study is going to investigate which social value indicators can be identified in the workplace context.

3.3.2 Environmental value (physical metrics)

Some measurable positive outcomes of the new ways of working and the smart working concept involve environmental values, which are already included in some interpretations of social value.

It is renowned that the real estate sectors has a massive impact on global energy consumption, greenhouse gas emissions (including water vapor, carbon dioxide, methane, nitrous oxide, and ozone), CO_2 emissions, use of raw materials, and other environmental aspects, such as fresh water consumption and waste production (World Economic Forum, 2016). Better managing workplaces can thus affect the impact of office buildings on the environment.

Impacts at city/development scale

Spatial downsizing (for example by reducing the number of unnecessary workplaces per building) and decentralized hubs are examples of strategies being currently undertaken within the smart working logic that have a direct impact on the environment (Crespi, 2015). On one hand, with downsizing, smart working can contribute to reducing land consumption and pollution due to construction activities. On the other

[6] http://socialvalueportal.com/

hand, with hubs, it potentially allows to decrease CO_2 emissions and traffic, by shrinking unnecessary commuting.

From this, follows that correctly monitoring and assessing company's necessities in terms of space and accessibility can help them be responsive to their actual requirements in terms of resources and energy, and eventually be more environmentally sustainable in the urban context as a whole.

Impacts at building/portfolio scale

Also, some evidence has emerged all over the world about the relationship between sustainable buildings and market value. It has been demonstrated that buildings holding an environmental certification in the US are able to reach both higher rental rates and higher transaction prices (Holtermans & Kok, 2017). Research confirms that the green building approach can positively influence the property value of office buildings in Indonesia, especially in relation to its utility – which is the function or utility of a property in fulfilling the user's needs, and its scarcity – which corresponds to the property's level of availability (Sitanggang & Susanto, 2017). Owners and manager of commercial real estate in Australia and New Zealand say that sustainability plays a key role in the longevity of their portfolios (Warren-Myers, 2012).

However, some contrasting opinions emerge through studies which disconfirm that premiums at the asset scale reflect tenant willingness to pay for energy efficiency (Gabe & Rehm, 2014). To some extent, more research is required to better identify the distinct effects of 'tangible' (such as building height, size) and 'intangible' (or symbolic benefits from the green image) aspects of green building on properties' prices (Kim, et al., 2017).

In any case, it seems like the demand for green buildings will incessantly grow from now on, whereas less sustainable buildings will progressively lose their value (Ciaramella & Tronconi, 2012, p. 260). Even the possibility for financing, linked to the risk premium, will be greater for green building. Likewise, ethical and social responsibility will influence market demand and, consequently, the supply side.

Environmental sustainability connects also to Facility Management (FM) services. Greener FM services are recognized to improve the image of the organization, and decrease costs (Jensen, et al., 2013).

Impacts at individual scale

In order to gain the expected environmental performance, not only a company's policy is significant, but also employees' behavior. Good communication and information strategies can make people aware of the tuning of their building to optimal performance. Technology again, especially with the Internet of Things (IoT),[7] is a key protagonist for empowering the relationship between building performance, people's behavior and environment. For example, The National Renewable Energy Laboratory in Golden, Colorado, is using a dashboard called Energy DataBus, which provides a real-time look at energy consumption in an area of their campus (Miller, et al., 2014). They found that evidence of these data positively conditioned people's behavior toward reducing energy consumption.

In addition, green building has been blown its success becoming a global movement. The boom of rating tools measuring the 'greenness' of buildings have increased the appeal of low carbon and resource-efficient building products.

[7] Cisco says that 50 billion things, of the estimated 1.5 trillion existing in the world, will be connected by 2020 (Miller, et al., 2014).

The business community is more and more interested now in how green building design can benefit its people. The question is shifting from "How much will building green cost to my organization?" to "How much will not investing in green building cost to my business?" In fact, studies (WGBC, 2013) suggest that green design attributes of buildings and improved indoor environmental quality can enhance workers productivity, health and wellbeing (Jensen, et al., 2013). Even if more research is needed to measure productivity in the modern workspace in terms of financial metrics, it is now empirically evident that investing in better indoor environments leads to better returns on one of every company's greatest assets – the employees. That is why, even though green building rating tools were born with the specific purpose of rating environmental impacts (energy, water, waste, etc.) some socio-economic issues have started to add in due course, as Alker, et al. (2014) point out.

How to measure environmental value and impacts

A widespread application of the smart working model, and related workplace management strategies, can lead to significant environmental benefits. Those benefits reflect on (a) every cities' sustainability goals, by reducing resources and energy consumption; (b) business performances, by enhancing the market value of their assets, reducing costs related to energy and space consumption, and improving their overall image; and (c) people's productivity and quality of life, by reducing commuting, and their self-awareness about the impact of their behaviors on the environment.

Some studies address how key environmental factors affect property prices, such as greenery, surface water, noise impacts, and landscape features (e.g. Cellmer, et al., 2012; Nikolaos, et al., 2011).

Other researches face the topic of environmental values with a sociological lens, by exploring how individual values may affect attitudes toward the environment (e.g. Tadaki, et al., 2017; Diets & Shwom, 2005).

Some others address the organizational approaches toward environmental values. To this extent, the World Economic Forum conducted a study to analyze corporate statements of environmental policy and sustainability targets (World Economic Forum, 2016). The result of this study shows that the real estate sector is still retarded in facing matters of environmental sustainability. In particular, approaches are highly varied, and incoherent with one another, and most of the policies, when exist, focus merely on measurement and monitoring rather than on strategic decision-making.

In order to encourage the adoption of more sustainable practices, the report draws 10 possible solutions to adopt with the end of enhancing environmental values (see **Table 3-4**). These solutions are applicable at the single building, at the whole portfolio scale, or even at the development/city scale:

1. Data Management Platform, matching both physical Key Performance Indicators (KPIs) such as energy use, water usage, waste disposal, space utilization, greenhouse gas emissions with real estate and organizational KPIs such as rent, lease detail, head counts, etc.
2. Smart Asset Optimization, by implementing workplace sharing solutions through technological aid (e.g. smart desk booking, smart parking, mobile apps and collaborative Internet of Things – IoT) platform for resource sharing.
3. HVAC Analytics and Occupancy Adaptation, applying technological devices and equipment able to collect points data about heating, ventilation, air conditioning and so on, and to set operational efficiencies accordingly (e.g. by altering operations to live occupancy rates).
4. Digital Inspections and Predictive Maintenance for equipment, in order to avoid catastrophic failure.

5. Soft Landing, accompanying the users during the beginning of the operation phase of a new or refurbished building. This process entails the commission of designers and constructors to interact with the clients beyond the completion of a project.
6. BIM and 3D Mapping, controlling the project in the design, construction, and management phases concerning sustainability issues within the whole life-cycle.
7. Material Efficiency, minimizing construction waste, by applying computer modelling techniques (e.g. 3D printing for additive manufacturing).
8. Green Lease, compounding the standard lease with additional responsibilities both the landlord and the tenant must undertake regarding the sustainable operation of a property.
9. End of Life and Zero Waste Construction, considering how buildings can be disassembled rather than dismantled, and re-employed by parts for different purposes.
10. Retrofit and Adaptation for Life-Span Extension, changing the internal layouts and intervening on the envelope, in order to avoid the need for building new.

At the end, the report proposes an implementation assessment tool, which may help organizations structure principles, fulfilment criteria, indicators, and verification data (**Table 3-4**).

Thus, extracting the environmental value in workplace-making processes is worthwhile to support decisions and control the related impacts at a trifold level: at city/development scale, at building/portfolio scale, and at individual scale. Ways to keep environmental values under control are numerous, though mostly rely on physical indicators. Verifying how they cross-relate to social and economic impacts can be useful to share decisions with all the stakeholders of workplace-making processes. In the next phases, this study is going to investigate which environmental value indicators can be identified in the workplace context.

Table 3-4. Examples of Environmental Initiatives in the Built Environment (processing on World Economic Forum, 2016)

Initiative	**Applicability**			**Key benefits – Value for**					
	Single building	*Portfolio*	*Development/ City*	*Property Owner*	*Developer/ Retrofitter*	*Constructor*	*Designer*	*Estate manager*	*Occupier*
Data Management Platform	●○○○	●●●○	●●●●	X				X	
Smart Asset Optimization	●●●○	●●●●	●●●●	X				X	X
HVAC Adaptation	●●●●	●●●○	●●●●	X				X	X
Predictive Maintenance	●●●●	●●●○	●●●●	X					
Soft Landing	●●●●	●●●○	N.A.	X				X	X
BIM and 3D Mapping	●●●●	●●●○	●●●○	X			X	X	
Material Efficiency	●●●●	●●●○	●●●●	X			X	X	
Green Lease	●●●●	●●○○	●●●●	X					X
End of Life & Zero Waste	●●●○	●●●○	●●●○		X	X	X		
Retrofit and Adaptation	●●●●	●●●●	●●●●	X		X	X		

Legend: ●○○○ Poor; ●●○○ Medium; ●●●○ Good; ●●●● Excellent.

3.3.3 Economic value (financial/organizational metrics)

Economic value (EV) is defined as: *"Assessed value of an asset based on its ability to generate income"* (Business Dictionary, 2018). This regards the economic value of the goods and services produced by a company, as well as the economic value of real estate properties. To this extent Leaman (2003) states that buildings are wealth-producing thanks to their role in property and property-related investments. He affirms that in the UK their value as property even exceeds their 'activity' value.

Given this meaning, the economic impact of the workplace is composed of two elements: (a) the value created by spaces, thanks to their efficiency; and (b) the value created by employees, thanks to their productivity.

Moreover, EV is often related to the Economic Value Added – EVA (Stern Stewart & Co., 1999), which is recognized nowadays as the best measure of the true profitability of an enterprise. This corresponds to the: *"After-tax profit that exceeds the required minimum return on capital […]"* (Buisiness Dictionary, 2018). EVA comprises the Net Operating Profit, which excludes from the Operating Profit a few variables, among which Operating Expenses. Operating Expenses of course encompasses the costs related to spaces, and the costs related to people. Hence, enhancing economic value added entails also optimizing costs.

Impacts at city/development scale

The impact of a business on the surrounding and supporting community is well pictured by Coca-Cola company (Pogány, 2015) by saying that, through their core business activities, they generate jobs and salaries for employees (both direct and indirect), they pay suppliers and contractors, improve customers' profitability, and support the public wellbeing and infrastructure through tax payments, dues and fees.

A major business activity, e.g. an office, moving in or out, expanding or contracting, starting up or closing down, has a direct economic effect on the given impact area (Weisbrod & Weisbrod, 1997). This effect corresponds to change in the standard industrial classification category of the area, and the related change in business activity, including outputs, jobs and income.

Businesses indeed generate benefits to the society as a whole thanks to their localization strategies. The financial health of organizations boosts the whole economy of a country, expressed through measures like local and national Gross Domestic Product (GDP). GDP in turn impacts personal finance, investments, and job growth (Amadeo, 2018).

Impacts at building/portfolio scale

Progressively in history, properties have evolved from being considered as a tangible asset for a company's market value, to being regarded as an overhead that is necessary to minimize the cost of (Calder & McPherson, 2007). Given the inception of new ways of working, since the beginning of the 2000s, one of the primary issues concerns cost control, mainly through space savings. Constraints faced from the 2008 global financial crisis have led companies to focus prior attention on the impacts of the office environment relating to economic aspects.

There is plenty of literature reporting punctual data about downscaling trends in space and office buildings occupancy costs (Miller, 2013), thanks also to many organizations contributions, such as Jones Lang Lasalle (Colpaert, et al., 2014), CBRE (CBRE, 2012) and the British Council for Offices (BCO, 2013). Along the same lines, many companies (particularly those where people work often from home or travel a lot) have moved some of their business units, or all of them, to the so-called 'hoteling' or 'hot-desking', by providing workspace to their workers on an as-needed basis. According to O'Mara (1999), this model, conveniently

combined with teleworking (i.e. working from home using virtual technology) saves at least 15%-18% of space requirements, with an estimated 25% increase in productivity. Efficiency in the use of space grows and occupancy costs shrink, while employee productivity seems to rise. However, research provides contrasting findings about the appreciation of hoteling, hot-desking and more in general Activity-Based Working practices among employees, and their impact on business (e.g. Leesman, 2017 February; Pitt & Bennett, 2008). Thus, the tendency to downsizing of workspaces needs to be more deeply investigated, in order to assess the potential of its applicability beyond the only advantages of cost reductions.

Literature is still scarce with regard to the impacts of space shrinking on the productivity of workers and on the effectiveness of businesses. Among the few, Mike Brill, founder of BOSTI Associates[8], conducted an important client-based research to explore what effect the workplace has on productivity and job satisfaction (Brill & Weidemann, 2001). He found that, when facility departments work to reduce costs, the question that raises is: "How will it impact employee performance?"

Impacts at individual scale

As many contributions confirm, corporate executives always wander how any design investment on the workplace will move the business forward and how to prove it (Armstrong, 2013). Moreover, the challenges we face today in organizing the workforce over space and time require a new approach to decision-making. Establishing indicators to enhance the economic value of new workplaces is worth to support decisions on both space and people.

In fact, companies' expenditures are distributed among the following cost items:

- 82 percent is used for employee wages and other benefits;
- 3 percent is destined to operations and maintenance;
- 10 percent to technology; and
- The last 5 percent is put for facilities, including design and construction of the building (Miller, et al., 2014, p. 148).

That is to say that the cost of physical space (i.e. the occupancy cost) is a significant cost category for operating a business (Brown, 2008), but it is still secondary to the cost of people. This produces evidence that any kind of intervention must be directed primarily towards enhancing the employees' experience, and maximizing the effectiveness of human resources. Indeed, an even modest improvement in employee health, productivity and satisfaction can have a significant effect on the overall financial outcome for the employer, and indirectly be important also for building owners and shareholders.

How to measure economic/financial value and impacts

Economic value in the organizational context is mainly expressed by financial performance measures (Riratanaphong, 2014). These measures recur to currencies, relating to each other via mathematical formulas. However, many companies have started to expand their traditional methods, mainly focused on measuring shareholder value creation. Hence, now organizations look for measures that are able to reflect the economic value created (Epstein & Rejc Buhovac, 2014).

These aim at quantifying broader impacts of projects and programs. These can be evaluated in terms of economic indicators such as business output (also referred to as revenue or sales volume), value added, wealth (including property values), personal income (including wages), or jobs (Weisbrod & Weisbrod,

[8] The Buffalo Organization for Social and Technological Innovation (BOSTI, based in Buffalo, NY) is a group with more than 30 year experience of continuous innovation in workplace planning and design.

1997). Weisbrod & Weisbrod (1997) contend that different measures address different purposes of analysis. More specifically, in the case of benefit/cost (B/C) analysis carried out to aid decision-making, a comparison of the benefits to the costs of implementing a project, program, or policy is necessary. Different tests can be applied for decision-making: feasibility, cost effectiveness, net present value (NPV), and benefit/cost ratio (B/C). In the next phases, this study is going to investigate which economic/financial value indicators can be identified in the workplace context.

3.3.4 How to manage the value of the next-generation workplace

This chapter described the theoretical composite value of a workplace.

Some measurement systems and indicators exist that identify the sustainability value of an organization reflected through its impact on the people, the environment, and the business. These measures are important to drive decision-making toward sustainable corporate strategies. In the opinion of Epstein and Rejc Buhovac (2014), systems for measuring performance and encouraging employees to improve social, environmental, and economic impacts are fundamental to businesses. Indeed, these can support senior executives in understanding the causal relationships between sustainability performance and business performance, and work toward corporate goals. Examples of successful measurement systems of this kind are shareholder value analysis and the balanced scorecard, according to Epstein and Rejc Buhovac (2014). These authors attribute three main roles to performance measurement: first, to capture the logic behind strategies, and facilitate agreement; second, to monitor progress; and third, to support the ongoing discussion to improvement.

These systems should collect a mix of objective and subjective measures. However it is not clear to what extent these measures capture the workplace dimension. In fact, considerations about the impact of spatial characteristics and choices seem still left behind for what regards business functioning on the whole and its economic, social, and environmental impacts.

In this respect, Alker, et al. (2014) recommend implementing metrics that assess health, wellbeing and productivity.[9] However, they also acknowledge the difficulties inherent to evaluating the related metrics. Indeed, few of these metrics are quantifiable and reliable. Others instead are qualitative, therefore seem not surely trustworthy to measure returns (for example, collaboration, creativity, recruitment, engagement). Anyways, the latter metrics are actually those characterizing the new ways of working that should be paid more attention in the present context.

Difficulty in accounting for subjective and qualitative metrics is reported by both Alker, et al. (2014), and Epstein and Rejc Buhovac (2014). This may be one of the reasons why managers seem often reluctant to assess the value of an investment on the workplace. Many companies aim at increasing scrutiny and data collection. However, most of them lack a formal process by which to measure the overall value created by investments in the workplace. This attitude may lead to losing opportunities for maximizing Return on Investment, gaining lessons for future projects, and acquiring knowledge about the present management strategies.

[9] The terms health, wellbeing and productivity encompass a whole range or related issues, as defined by the World Green Building Council (WGBC, 2013). Health encapsulated physical and mental health; wellbeing refers to feelings and perceptions of satisfaction and happiness (and it is therefore closely related to the concept of mental health); productivity refers more explicitly to business-oriented outputs and includes a number of task performance-related metrics.

Based on these evidences, research exploring indicators that represent the complex relationship between organizational goals, user needs, and office space requirements is necessary in order to manage the social, environmental, and economic value of next-generation workplaces.

3.4 Remarks

Office buildings are not static settings, but integrated and dynamic systems made of people, technology, activities and many relationships between these components. Since today's work is more thinking-oriented than product-oriented, people become more and more important in the process of 'workplace-making'. The user is the central part of this dynamic system, supported by the building infrastructure, in the creation of value.

Haynes (2007), among many others (for instance, Vischer, 2008), claims the importance of an 'occupier perspective', also with the end to address the criticism that office providers are detached from office users. Consequently, a user-centered perspective should assume prior importance in building management and building in use assessments.

The inception of the new ways of working and the implementation of the so-called 'smart working' model bring numerous changes in the office features and consequently in the lives of its 'inhabitants'. New possibilities are rising to facilitate the match between real and perceived quality of an office building. Workplace strategies should become a key driver to growth, given the social, environmental and economic impact that can benefit companies and organizations.

Epstein and Rejc Buhovac (2014) highlight that successful companies have now put more attention on the impacts of their products, services, processes, and other activities. They are, indeed, looking for a *"[…] comprehensive set of social, environmental, and economic impacts on a broader set of stakeholders."* (Epstein & Rejc Buhovac, 2014, p. 3). Therefore, methods to measure and evaluate the impacts of workplace performance are required for management decisions that will benefit various stakeholders.

To sum up, the next-generation workplace takes shape as (**Table 3-5**, **Figure 3-3**):

a. Highly diverse, both in the hardware and in the software components, therefore the necessity to investigate this diversity in depth for what concerns the users and their ways of working;
b. Data driven, hence the need for systematizing the large amount of data potentially available today. Data about people behavior, environmental performance and economic-financial returns of a building in use may be selected, systematized and eventually converted into information. This will be viable to create new knowledge and support better decisions toward future advancements; and
c. Economically, environmentally and socially impactful/valuable, thus understanding how different users evaluate key information on the workplace is pivotal to effective decision-making.

Table 3-5. Phase 0: Action plan

Q-1A: How is the workplace evolving?	*Q-1B: How is it possible to fine-tune the next-generation workplace with users' needs?*	
Characteristics of the NGW	**Necessity for action**	**Object of action**
Highly diverse	Investigate diversity more in depth (a)	Users and ways of working
Data driven	Systematizing the large amount of data available (b)	Performance indicators
Economically, environmentally and socially impactful/valuable	Matching data with values and impacts (c)	Users and indicators

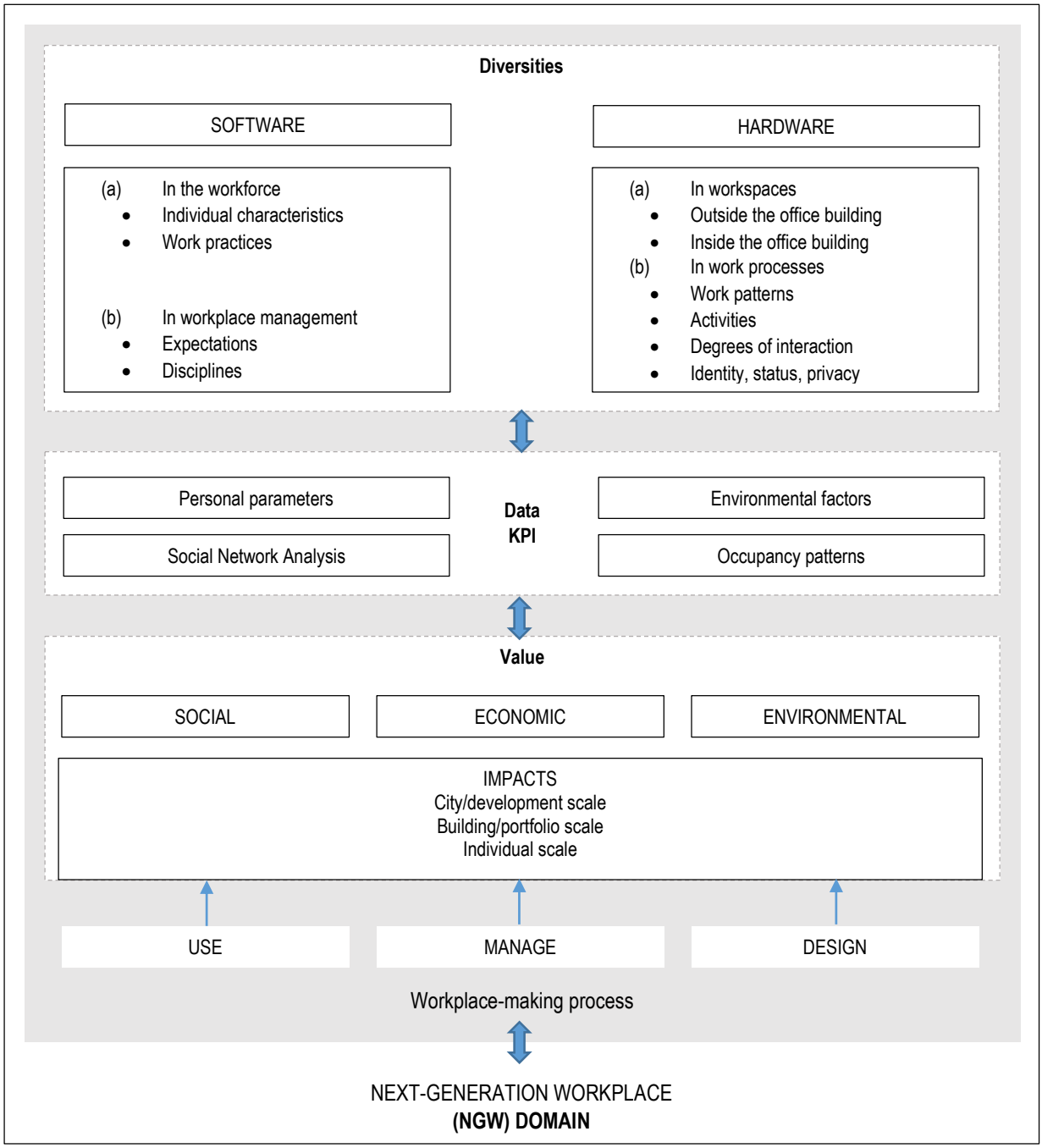

Figure 3-3. The next-generation workplace (NGW) domain

3.5 Roadmap to Phase I and II

In Phase 0, the thesis shows how work, workers, and workplaces have mutated over time. This chapter has addressed the first research area, namely the questions about the 'workplace':

- How is the workplace evolving? How is it possible to fine-tune the next-generation workplace with users' needs?

A conceptual framework about how the workplace has been fundamental to face the next steps of the study. On the basis of the abovementioned issues, a few questions remain to be answered:

- Who are the **users** involved in the process of workplace-making? How is the negotiation between demand side and supply side handled?
- How can the social, environmental and economic value of the next-generation workplace be enhanced? What **data/indicators** are valuable for designing, managing and using the next-generation workplace? Which of them can be shared by all workplace users?

An in-depth analysis of the 'users' of the built environment is necessary to clarify such a term, and to correctly place it into the office setting. This is the topic that is going to be developed in Phase I.

4 PHASE I: Workplace Users

"Failure is less frequently attributable to either insufficiency of means or impatience of labor, than to a confused understanding of the thing actually to be done."

—John Ruskin, Art critic and social thinker

WHY (AIM). Chapter 4 develops Phase I of the research, by addressing the questions on workplace users. It proposes a critical state-of-the-art and practice related to building users, in particular in the office environment. It seeks for: (a) capturing different office users, and (b) acknowledging how they play in the workplace-making process. Finally, a framework of the most significant workplace users is created.

WHAT (CONTENT). The ***introduction*** reflects on the office environment, which has been undertaking radical transformations in both its spatial features and the characteristics of its users. The workplace-making process has become more complex over time and involves several roles and responsibilities, which are not always well defined. Indeed, the ***literature*** review reveals scarce efforts towards a systematic understanding of the heterogeneous group of building users. From here it emerges that definitions of 'user' are diverse and dispersed, mainly due to a supply-driven approach that distorts the dynamics in the built environment sector.

Thus, the goal of this part of the research it to identify some main user categories, by taking a demand-driven perspective. ***Objectives and framework for analysis*** explain the necessity for defining workplace users by both their roles and responsibilities, and their values and needs.

The ***methodology applied to Phase I*** entails a multiple method analysis of three case studies. The cases are investigated through both quantitative methods (questionnaires and analysis of numerical records) and qualitative methods (semi-structured interviews, and observations).

Several groups of workplace users result from ***analysis***. A new framework for categorization is proposed, according to a matrix of criteria, which updates the existing definitions and categories of users that have been scouted in the literature.

In the ***discussion***, the author contends that deeper knowledge on the identity and characteristics of office users can be valuable for better designing and managing both spaces and services for next-generation workplaces. Hence, ***conclusions on workplace users*** stress the importance of their active involvement throughout the initialization, planning, and operation of next-generation office buildings.

4.1 Introduction

Since the beginning of the 2000s, some main trends have been affecting the way people work: their activities are extremely varied, they are highly mobile, and they are more demanding in their workplace. These trends have put stress on the way workspaces are used. Therefore, organizations are called to update their workplace strategies according to the emerging spatial needs. Workplace strategists and managers should be able to foresee how the new ways of working will shape the relationship between office buildings and their users. To this extent, understanding who these users are is an urgent question to address. Indeed, users of the built environment have not been well-established yet.

This part of the research aims at defining a framework of workplace users, suitable to support better designing, management, and use of next-generation office buildings.

Users in the construction sector

In effect, the whole construction sector is typically affected by a lack of consideration to the users' side. Haugbølle & Boyd (2013b) sketch some main research themes within the area of clients and users in construction, namely: agency, governance, and innovation. With regard to agency, they draw attention to the necessity for a shift in focus from building as a goal in itself to building as a means to achieve objectives related to the activities of the users.

This is true for office buildings, today more than ever before, since changing conditions have made workplaces and their users more complex and diverse. Haugbølle & Boyd (2013a) emphasize the importance of reaching different goals in research on agency:

- Firstly, clients' and users' **values and needs** should be acknowledgeable in relation to other stakeholders' ones;
- Secondly, recognizing their capabilities permits identifying their **roles and responsibilities**; and
- Lastly, a set of theories and **conceptual frameworks** is required to achieve the abovementioned goals. Among these, the full understanding of the terms 'client' and 'users', and their various configurations under different structural conditions is imperative.

In fact, clients and users are often put together in literature and treated as a whole category within the construction sector. This probably happens because the real estate and construction theory is usually supply side dominated. Nevertheless, every activity in the real estate economy exists to meet the demand side's needs, when a consumption perspective is embraced (Heywood & Kenley, 2013).

Reversing the common supply side approach allows for coming closer to the user side of the changing office environment. Therefore, the present part of the research, builds up a conceptual framework of workplace users by aligning to a demand-driven perspective.

Users in the context of next-generation workplaces

The topic of users in the workplace is particularly relevant nowadays, when new ways of working are inducing transformations in this sector. In the previous chapters, new ways of working and the consequent workplace changes have been thematized toward the next-generation workplace. The next-generation workplace is highly complex, combining physical spaces, technologies, organizational culture, and human resources (for example, Methodos, et al., 2015). Thus, workplace users must deal with these four components interacting with one another. More complexity to deal with for users is added due to the diversity which regards all these spheres, as Phase 0 of this research shows.

First, as for organizational culture, workplace change can be an opportunity to rethink a whole company strategy. Thus, many companies have been undertaking modifications of workstations density, proximity between departments and, more in general, spatial layout, coherently with the goal of renovating their business strategies and model. In effect, when the change involves the work setting, the working experience for people radically transforms (Maher & von Hippel, 2005). That is why, those are delicate matters, involving several stakeholders who do not have a clear identity and role yet.

Second, for what concerns the physical workspaces, in the next-generation they are likely not to have specific characteristics, but rather to be transformative spaces, suitable to be tailored from time-to-time in order to respond to organizations', teams' and individual's changeable needs (Gensler, 2014). Hence, fine-tuning users' perceptions with the new spatial features is going to be a challenge to boost productivity of both the spaces and the people.

Third, technology advancements have influenced work processes, while altering well-established relations between individuals, and between people and spaces. Again, workplace users are facing novel situations which might in turn change their own responsibilities and needs.

Lastly, human resources, i.e. knowledge workers, are an evolving entity as well, as Bell & Anderson (1999) assert when elaborating on future "Workplace Solutions". Even if these authors do not explicitly mention 'workplace users', they clearly refer to next-generation knowledge workers. Within those workers, they recognize a range of job function groups and work-styles, according to which a certain variance of work setting requirements can be detected.

They state also that tomorrow's 'workplace-making process' should be managed by a spectrum of professionals and disciplines, much broader than the traditional model of workplace design. The old model was composed of representatives of the business units, the design team, and the corporate real estate or facility departments. In addition to these components, the new model should include also HR specialists, IT professionals, and workplace consultants – when possible (Bell & Anderson, 1999). Miller, et al. (2014) as well discuss the stakeholders who have a role in creating the spaces we work in today and for tomorrow. Among these they list: human resources leaders, designers, builders, commercial brokers, facility managers, project manager, chief executives, and those who will work in the space.

In sum, users of the next-generation workplace appear numerous. An in-depth understanding of who 'workplace users' are seems beneficial to both identifying their roles and better addressing their specific needs. This is suitable to impact both the next-generation workplace features and the facility management delivery (Tucker & Smith, 2008).

4.2 Literature

4.2.1 Definitions of user

Users in the real estate and construction sector are discussed by a few authors. They appear as a broad group of stakeholders, potentially composed of different figures. Differences between clients and users are reported by Zeisel (1975). He defines them respectively as paying clients and non-paying clients. Paying clients are identified as the interface between supply side and users/non-paying clients.

Brackertz & Kenley (2002) describe the stakeholders of local government authorities' facilities in four groups: the community, also defined as end-users or customers of the facility; the service providers, making use of the facility for providing services; facilities managers, who run the facility and assure its well-functioning; and the management level, making decisions about both facilities and services.

Lindholm & Nenonen (2006) define users of buildings as all the people with an interest in a building, herewith included staff, managers, customers or clients, visitors, owners, design and maintenance teams, and particular interest groups (such as the disabled).

Vischer (2008b) remarks that there is a need for agreeing on who the users are. They may use the built environment by carrying out activities either inside enclosing architectural elements or outside them (being office buildings, or others). She points out that there may be more than one unique user group, uneven for interests. The same conclusion can be derived from Blakstad, et al. (2008), who claim that, in studies of usability[10], it is important to distinguish between multiple users, actors and stakeholder roles: end-users (among which, individuals, teams, departments, etc.), facility managers, building owners, visitors and, at a larger scale, society.

Haugbølle & Boyd (2013b) deeply analyze users and clients in construction, within the framework of the CIB Working Commission W118[11]. They state that *"the client role is defined through its relationship between supply chain (production) and the various stakeholders including the owner, the customer (users) as well as society in general."* Clients have a central role in developing the construction sector into a demand-driven sector and providing a better user/client satisfaction (Haugbølle & Boyd, 2013; 2013a).

A few authors define in more detail users of workplaces.

Leaman (2003) state that ordinary building occupants are the people who work in buildings on a daily basis, but usually do not participate in designing nor managing the buildings they use. Other classes of user are facility managers, on one hand, and designers, on the other. They have two different perceptions of need and ideas of how to address them: the first tend to work for a 'good enough' level of service provision, the latter tend to oversimplify or parody user needs.

According to Tucker & Smith (2008), the user is *"the customer or client in an organizational sense receiving facilities management (FM) services within a workplace environment"*. These authors assert that the user is applicable throughout the whole delivery process, being relevant to the definition of the initial inputs and expectations (pre-delivery), in the experience of the functionality and productivity of the product/service delivered (mid-delivery), and in the evaluation of the final performances (post-delivery).

[10] Most of the studies addressed to define the user and its role in the architecture and built environment field lie upon the base of the usability research stream (Jensø, et al., 2004) within the work carried on by the CIB Working Commission W111.

[11] Working Commission 'Clients and Users in Construction', within the International Council for Research and Innovation in Building and Construction - CIB. For more information visit: http://www.cibworld.nl/site/commissions/index.html.

Niemi & Lindholm (2010), while measuring workplace occupier needs, perform their analysis at two levels: the occupier level and the office user level. In this context, the occupier is intended to be the organization, either owner or tenant, representing the management level that physically occupies the office space and takes long-term strategic decisions. Office users, instead, are the employees and other prospective individuals using the office space, who are more involved in short-term organizational objectives.

Coenen, et al. (2012) propose to take into account the views of several stakeholders *"such as the organization itself (policymakers, staff, controllers, FM managers), owners (investors, shareholders), visitors, suppliers, customers, and society (local, regional, national, global)."* (Coenen, et al., 2012, p. 79). However, from a demand side perspective, they apply their Facility Management Value Network to three main key stakeholders of value who are: the client, as the organization that procures facility services by means of an FM agreement; the customer, that is the organizational unit ordering the services; and the end-user, or the person receiving facility services.

Heywood & Kenley (2013) contend that users can be differentiated into: the occupying (Corporate Real Estate - CRE) organizations; their sub-entities or business units (if any); the individuals within those organizations; and members of the general public that interact with the CRE.

From the literature it emerges that users in the whole construction sector look numerous, and somewhat confused. In the workplace dimension there is no clear definition of different stakeholders, as well. An interesting attempt to establish a complete framework of users in the built environment across different building types, has been made by Olsson, et al. (2010), but it has not received much attention, yet.

Olsson, et al. (2010) contend that the concept of 'user' is often affected by a simplistic approach. Most of the time, due to an implicit assumption, it is common to consider only a generic group of users. On the contrary, they note that there are numerous types of users, so the question *"Who is the user?"* can find a multiple answer in some cases. On the basis of this statement, they make an important effort in systematizing several users into a framework, based on the degree of their involvement and role throughout the development of projects. To this end, they deliberately adopt a supply chain perspective, where services are produced originating in the building. The schema proposed in their study can be found in **Table 4-1**.

Table 4-1. Processing on different user categories defined by a supply chain approach (Olsson, et al., 2010)

			SUPPLY CHAIN			
	SUPPLY SIDE			*DEMAND SIDE*		
Different user categories as defined by Olsson (2010)	**BUILDING OWNER**	**BUILDING OPERATION / FACILITIES MANAGEMENT**	**MANAGEMENT** of the organization based in the building	**SERVICE PROVIDERS**	**DIRECT SERVICE RECEIVERS**	**INDIRECT SERVICE RECEIVERS**
Description of the role	May not be directly involved in the operation that take place in the building	Acting on behalf of the users at the "supply side", but at the same time actual users of the building performing services to the other user groups	SERVICE PROVIDING ORGANIZATION (Customers of facilities management) Strategic level	EMPLOYEES of the service providing organization based in the building (Customers of facilities management) Operative level	Users benefitting from the services provided by the ORGANIZATION	With a relation to the direct service receivers
Example SCHOOL			Headmasters	Teachers	Pupils	Parents
Example HOSPITAL			Hospital management	Doctors and nurses	Patients	Relatives
Example BANK			Bank executives	Bank clerks	Customers	Business relations of the customers

They speculate on building users in schools, hospitals and banks. In their view, some user categories appear in the process:

- **Owners** of the buildings, even if they are not always involved directly in the operations happening in the building.
- **Facilities management** are service providers operating the building, who *"act on behalf of the users […], labelled as the 'demand side'"*, and at the same time are also actual users of the building.
- **Service providing organization** is the customer of facilities management and can be divided in two components: **Management** of the service providing organization, as the strategic level in the user organization; and **Employees** providing the service, also defined as 'service providers'.
- **(Direct) Service receivers**, who are customers to whom the organization provides its services.
- **Indirect service receivers**, who relate to the direct service receivers.

To support their argument, Olsson et al. (2010) examine three case studies, namely a hospital, a university college and an airport, where they apply the abovementioned user categories.

The same authors encourage the application of their model on a wider range of buildings, in order to push more advancements in the field.

In effect, a step further seems still missing to develop the issue more specifically with regards to the office building type, and to understand what workplace users are involved in the 'workplace-making' process in today's context.

4.2.2 Differences in acknowledging users

Many authors refer to different extents to 'users' of the built environment, and actually imply several terms to appoint people involved in one way or another in the place-making process. Among these, we can mention:

- Stakeholders;
- Actors;
- End-users;
- Occupiers/occupants; and
- Clients.

However, all these terms refer to the many figures that deal with the planning/design, management, and occupation of buildings and the built environment. The definition of user that is being applied in the present research entails the broader meanings of: *"someone who uses a product, machine, or service"* (English Oxford Living Dictionaries, 2018), and *"a person who uses or operates something"* (Cambridge Dictionary, 2018), therefore it embraces all the previous terms.

The framework proposed by Olsson, et al. (2010) can be used as a template to schematize the numerous records of users scouted in the literature. **Table 4-2** juxtaposes all the figures appearing as users of the built environment.

What can be observed is the extreme heterogeneity of the pattern, where authors approach the topic from various perspectives, thus recognize different figures without necessarily covering all the categories that Olsson, et al. (2010) describe. To this extent, the work of Olsson, et al. (2010) can be seen as the most comprehensive, therefore suitable as a handful framework for further elaboration.

Table 4-2. Comparison of different definitions of user with Olsson, et al. (2010) framework

Olsson, et al. (2010)	Building Owner	Building operation / facilities Management	Management of the organization based in the building	Service providers	Direct service Receivers	Indirect service Receivers
Zeisel (1975)	Paying clients			Non-paying clients		
(Brackertz & Kenley, 2002)		Facilities managers	Management	Service providers	Community	
Leaman (2003)		Facility managers Designers		Ordinary occupants		
Lindholm & Nenonen (2006)	Owner	Design and maintenance teams	Managers	Staff		Customers Clients Visitors
Blakstad, et al. (2008)	Building owners	Facility managers	End users (individuals, teams, departments)			Visitors Society
Haugbølle & Boyd (2013b)	Owner	Client	Customer			Society
Tucker & Smith (2008)		Facilities management	Customer or client in an organizational sense			
Niemi & Lindholm (2010)			Occupier as organization (management level) taking long-term decisions	Office user (employee) level involved in short term organizational objectives	Other prospective individuals involved in short term organizational objectives	
Coenen, et al. (2012)	Client		Customer	End user		
Heywood & Kenley (2013)	Investment RE (IRE)	Occupying organization (Corporate Real Estate – CRE)	Organization sub-entities or business units	Individuals within the organization		Members of the general public

Framework for interpretation

By comparing different sources and their respective definitions of users, it is possible to appreciate different perspectives that can be applied to identifying users. Users can be distinguished in different groups by:

- Who pays (Zeisel, 1975);
- Who carries an interest (Lindholm & Nenonen, 2006; Coenen, et al., 2012);
- How they use the built environment, from a usability point of view (Vischer, 1996), (Blakstad, et al., 2008);
- What relationships they establish within the supply chain (Haugbølle & Boyd, 2013a);
- What role they play in the delivery process (Tucker & Smith, 2008);
- What needs they express as occupiers (Niemi & Lindholm, 2010), and how these needs are interpreted (Leaman, 2003); and
- The degree to which they interact with the corporate real estate (Heywood & Kenley, 2013).

Haugbølle & Boyd (2013a) suggest to observe the differences between clients and users according to their values and needs, on one hand, and roles and responsibilities, on the other. In fact, these two perspectives embrace all the various viewpoints that emerged from the literature, as shown in **Table 4-3**.

This framework is going to be used as a key to structure the following steps of analysis.

Table 4-3. Theoretical framework for user categorization – elaboration of the author after Haugbølle & Boyd (2013a)

Values and needs	Roles and responsibilities
Interest	Payment
Use	Relationships - Interactions
Need	Role

4.2.3 Interpreting values and needs

One of the definitions for 'values' in the New Shorter Oxford English Dictionary reads: *"The principles or moral standards of a person or social groups, the generally accepted or personally held judgement of what is valuable and important in life"* thus, refers to opinions about moral principles (Dietz, et al., 2005) or, in other words, alludes to how one should consider various states on the world, and hints at the actions individuals and groups are called to make coherently to their considerations. This definition applies to the present paragraph of the research.

The **'value'** dimension has changed over the past years, together with the psychological contract that links employees and organizations (Methodos, DEGW, & Partners4Innovation, 2015). Large companies and corporations aim to create value by boosting employees' commitment, satisfaction and productivity (Miller, et al., 2014). Therefore, driving corporate investments towards a workplace that helps gain those results is a top priority for organizations. In order to maximize value creation (Colpaert, et al., 2014), companies are looking for an effective workplace that supports all types of work in the best way, by setting up an engaging physical environment. Indeed, studies demonstrate that *"engaged employees take 10 times fewer sick days, make 37 percent more sales, and stay in their jobs 5 times longer than disengaged employees"* (Miller, et al., 2014, p. 13).

At the same time, employees as well search for engaging workplaces, especially Millennials who are going to be the main occupiers of next-generation office buildings by 2020 (Brack & Kelly, 2012). Indeed, they value most workplace quality, consequently they are more demanding than the previous generations with regard to how and where they work (Miller, et al., 2014, p. 101). Despite this evidence, employee disengagement is very diffused (Pech & Slade, 2006), which is confirmed in the recent Gallup's 'State of the Global Workplace' (Gallup, 2013). Disengaged employees are unhappy and unproductive, register higher absenteeism, more turnover rates, and so on. Leaman and Bordass (1999) state that up to 15% of losses or gains in turnover might be dependent on design, management and use of the indoor environment.

To this regard, environmental psychology studies show that the physical work environment strongly affects employee wellbeing and engagement (Augustin, 2014). Positive results are obtained when the work environment satisfies employees' expectations of work experience, and their **'needs'**. If employees are very satisfied with the places they work, they feel also more engaged (Steelcase, 2014). The office environment should have an active role in meeting its occupiers' needs, such as protecting the health, enhancing the wellbeing, and encouraging the productivity of workers (Alker, et al., 2014), that in turn boost satisfaction and engagement. This is why, some primary goals belong to office design, by shaping the physical working conditions (Goodrich, 1976): (a) facilitating communication skills and relationships; (b) providing stimulus; (c) creating meaningful organizational climate; and (d) supporting user needs.

In this picture, two main workplace users appear to hold an interest in the office, namely the employees on one hand, and the organization on the other. This distinction recalls the schema that Niemi & Lindholm (2010) adopt in their analysis. Workplaces are asked to satisfy both their values and needs, as Haugbølle & Boyd (2013a) claim.

In sum, values and needs are a key to differentiate workplace users. Niemi & Lindholm (2010) suggest that user perspectives on the workplace can be distinguished based on the time frame when their values and needs require to be accomplished, from short-term to long-term. Indeed, decisions that are taken at the organization level regard real estate in general, hence they are often long-term and directed to develop strategies on a global level. Beside the organization level, employees' needs can vary frequently according to internal and external dynamics that affect the organization, hence they typically reflect the short-term. Also, the financial value of these needs is not much significant to the employees' interest (Niemi & Lindholm, 2010).

Therefore, a time gradient is applied later on to interpret different users' values and needs, from short-term to long-term.

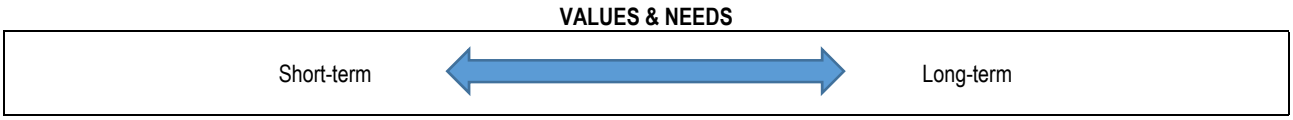

Figure 4-1. Time gradient of users' values and needs – elaboration of the author

Who takes care of how the workplace aligns with users' values and needs?

4.2.4 Interpreting roles and responsibilities

Needs can be defined as the *"desired or valued supplies of real estate"* (Niemi & Lindholm, 2010, p. 36). Needs become requirements when they get identified by the organization itself (Niemi & Lindholm, 2010).

The most recent RIBA 'Plan of Work 2013' (RIBA, 2013) stresses the importance of fine-tuning building quality against users' requirements, expectations and opinions. This objective is recognized as a fundamental part of the construction process and users are important stakeholders within it.

In the office environment, there are specific job descriptions entitled for taking care of workplace responsiveness to users' needs and the formulation of these needs into requirements, such as real estate managers, facilities managers and workplace managers. They have a fundamental **role** in satisfying users' needs, handling the desired quality, and obtaining the expected design outcomes.

While playing this role, they take the **responsibility** of guaranteeing certain outcomes, therefore bridging the gap between demand and supply. In order to verify outcomes, they can rely on several practices, devoted to review past and present functioning of buildings (Lavy, et al., 2010a), many of which involve the end-users and their perceptions, such as post-occupancy evaluations, and key performance indicators. Still, even though numerous evaluation techniques exist and performance assessments have been conducted, the demand side remains weak. That is why a user-centered approach needs to be more widely diffused, as Vischer (2008) advocated. Especially in non-Anglo-Saxon countries, e.g. Italy, the academia is poor in theoretical circulation on building users and the professional sector refrains from performing evaluations.

Overall, only few professionals and organizations, from both the demand and the supply side, do apply methods and techniques to feed back and manage building quality against users' needs. Thus, means are required to maximize capturing customer/user feedback (Tucker, 2014).

The marginalized state of feedback techniques might be explained due to the fact that, often, building users are barely acknowledged by both the supply side (developers, constructors, and so on), and their representatives on the demand side (owners, facility managers, etc.). This probably happens because of a couple of main reasons.

On one hand, the office environment has been significantly transforming lately, together with its traditional users. This ongoing evolution complicates the analysis of their needs and values, and multiplies their roles and responsibilities.

On the other hand, a supply side perspective has been often dominant (Duffy, 2000). Such 'external' points of view tend to flatten the users' spectrum. On the contrary, Haugbølle & Boyd (2013b) recall the importance of moving the focus away from the supply side of the construction sector, to identifying clients' and users' roles. Niemi & Lindholm (2010) state that there is an ongoing market shift from a typical supplier-driven approach towards a more demand-driven business. This trend influences the whole real estate market. Thus, methods should be refined enabling investors, developers, service providers, and all the actors involved at the supply side of the chain to understand needs and preferences at the demand side.

In sum, one way of interpreting different users is to outline their role in translating needs into requirements and taking a responsibility in managing the relations between the demand and the supply side. This interpretation resembles the approach of Olsson et al. (2010). Therefore, a gradient is applied later on to interpret different users' roles and responsibilities, from the supply side to the demand side.

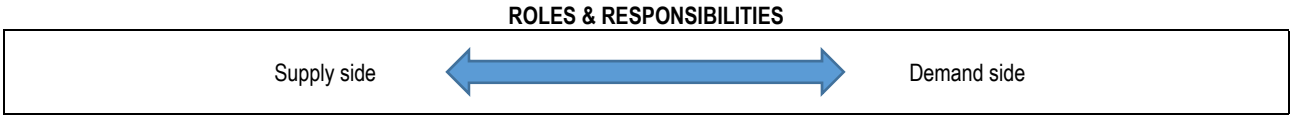

Figure 4-2. Supply-demand gradient of users' roles and responsibilities – elaboration of the author

4.3 Objectives and framework for analysis

The literature review has brought up a few figures under the broad umbrella definition of workplace users. Olsson et al. (2010) state the necessity to find more practical and nuanced categorizations of users, on a wider range of buildings in addition to the ones they propose, which are limited to building types other than the office. Haugbølle & Boyd (2013b) draft questions about roles and needs of clients and users. Moreover, several authors encourage toward a demand-driven approach to reset the perspective on the topic of building users (e.g. Vischer, 2008).

This phase of the research aims to receive these hints and set a framework of workplace users, by discussing about:

- Their needs and values; and
- Their roles and responsibilities.

The analysis focuses on the process of ‘workplace-making’ contextual to major office space changes, deliberately taking a demand-driven perspective.

The investigation is based on a thorough analysis of three case studies. Methods and findings of investigation will be presented in the following sections. Outcomes and major conclusions will be drawn after commenting on the results.

4.4 Methodology applied to Phase I

The methodology applied to elaborate office building users is based on a case study strategy, and the application of a multiple-case design, according to the definitions provided by Yin (2003).

Empirical observation and participatory methods were employed, as many researchers suggest (Niemi & Lindholm, 2010; Olsson, et al., 2010; Blakstad, et al., 2008; Vischer, 2008).

Three case studies have been selected to conduct the investigation. The project stages were distinguished in: initialization, planning, execution and normal operation, as in the framework proposed by Olsson, *et al.* (2010), which is inspired to the Project Management Institute 2008.

Description of the cases

The three companies identified for this purpose are afferent to different business sectors, with the aim to represent various organizational situations (**Table 4-4**). The selection was made out of a group of medium-large sized companies (more than 500 employees), headquartered in Italy. The sample was chosen among companies that have renewed their premises or have moved to new premises in recent times (less than 5 years), or are going to do it by the next 5 years. Within this range of time, companies should have undertaken a process of workplace change and faced all the related matters. The abovementioned rules have been adopted in order to:

- Assure a reasonable complexity of the organizational and managerial structure; and
- Select companies that are facing and embracing the new ways of working, therefore demonstrate a tendency toward the next-generation workplace.

Table 4-4. Schema of the case studies

Co. No.	Organization	Project Stage	Location
1	Telecommunications company	From Normal Operation	Milan, IT
2	Pharmaceutical company	From Planning	Parma, IT
3	Utility company	From Initialization	Milan, IT

The telecommunications company (Co. No. 1) was approached in the stage of normal operation after the move to a new premise that was recently built in the vicinities of their previous headquarters (HQ). Both the old and the new HQs are located in an industrial and business district that is sited in a peripheral area of Milan. Their old work setting consisted of a traditional open-plan layout, mainly based on cubicles, but affected by very low-density because of a misalignment between number of employees and availability of space. With the renovation, the goal was to increase density and contacts among employees, so that they switched to a hot-desking model.

The pharmaceutical company (Co. No. 2) was encountered in the phase of planning an expansion of their HQ in the industrial area of Parma, a middle-size Italian town one hour south of Milan. The company has been growing fast since the completion of the headquarters' premises in 2011, hence they are going to realize a second building in a proximal area, where to move all the administrative and corporate departments. If the 2011 HQ proposed a traditional layout, predominantly made of single or double enclosed offices connected through corridors, in the new building they are seeking to implement a much more open and collaborative environment. In order to obtain that, the new office is going to be based on an open-plan layout organized according to team work and functional units' necessities.

The utility company (Co. No. 3) is going to relocate its HQ within the next 4 years to a brand-new building. Its design has been assigned to an architecture firm that was chosen after a competition. The company's

HQ is currently situated in the very city center of Milan, but the new one will be developed in the south of the city, on a piece of land where a urban renewal process promises to create a new business district within a few years from now. Also in this case, the physical work environment is arranged with enclosed offices for small groups of people, that open their doors on long, narrow and empty corridors. On the contrary, the company wants the new work setting to be based on a desk sharing approach, to foster contacts and interactions among people. In order to gradually accompany this change, there are developing a pilot-project to be operating in-between now and the future move.

Literature review supports the proposition of a main theory, which is based on the idea that the generic 'user' is made of multiple groups. Each group differs from the others because it is involved to different extents in subsequent phases of the workplace-making process, as Olsson, et al. (2010) suggest, therefore it takes different roles and responsibilities in the process of workplace-making. Moreover, different groups seem to emerge also concerning the ways of using the building in the normal operation. This entails that each theoretical group of users might attribute different values to the building, and express different needs, requirements and satisfaction levels.

To sum up, the theoretical propositions to be tested in this study are:

1) *There is no generic user of the office environment, but there are multiple users to be considered; and*
2) *Workplace users can be distinguished in different categories, by roles and responsibilities, and by values and needs.*

4.4.1 Methods

The three case studies have been examined through multiple methods, taking into account the importance of triangulating data from multiple sources of evidence in order to increase construct validity (Yin, 2003), and of approaching the research from both a quantitative and a qualitative perspective (Jick, 1979). Thus, the research approach encompasses involving multiple stakeholders, merging several disciplines and applying different techniques toward a full understanding of the observed situation, as recommended by Costa (2014).

1.a Investigation about roles and responsibilities

Investigation about roles and responsibilities was mainly undertaken by critically observing the people who get involved in the workplace-making process from a demand-driven perspective. Track of the activities they took part to was kept throughout different life-cycle phases, following up on the approach assumed by Olsson, et al. (2010). This reflection was completed by semi-structured interviews, as explained below.

1.b Investigation about values and needs

Niemi and Lindholm (2010) list several different methods and tools for identifying and analyzing office occupiers' needs. These range from more unstructured to very sophisticated, and may focus both on the office occupier organization or the office end-user. The authors then rank the usability and development potential of nine of the most common methods, from the most valid and reliable to the least valid and reliable, as follows:

- Future working environment barometer;
- Satisfaction surveys and benchmarking;
- Participatory design;
- Rental barometer;
- Discussion with the clients;
- Small surveys/questionnaires carried out occasionally;
- Willingness to pay analyses;
- An interview-based method for analyzing the space demand; and
- Own experience-based knowledge.

The Future Workplace Environment Barometer, though, is a commercial tool specifically developed for occupier organizations in the Helsinki Metropolitan Area, therefore it was not applicable in the context of the present research. Also, rental barometer and willingness to pay analyses were excluded because they were not pertinent to the selected cases. Experience-based knowledge has been considered not sufficient to meet company goals. All the other methods have been applied according to each case's necessity and availability to carry out the investigation. Moreover, analysis of documents and archival records, and structured observations have been added to complete interview and questionnaires results.

1.c Steps of investigation

Both quantitative and qualitative methods have been applied for data collection to inspect the abovementioned theoretical statements. Due to the empirical stance and the participatory design of the research, each company was approached according to their specific necessities, so that an 'intervention research' strategy (Avenier & Nourry, 1999) was set in place in each company. Thus, the investigations have not been conducted homogenously the same across the three case studies, as **Table 4-5** shows.

Table 4-5. Methods applied roles and responsibilities

#	Organization	Surveys and benchmarking	Participatory design	Discussion with clients	Occasional questionnaires	Interviews for space demand	Observation	Docs and archival records
1	**Telecommunications**	Survey to all employees		Informal meetings	Questionnaire to a sample	Focus groups with a sample	Non-structured + Structured on space and activities	Plans, demographics + Access to the building and MR bookings
2	**Pharmaceutical**		Between workplace consultants and architects	Informal meetings + Semi-structured interviews	Questionnaire to a sample	Focus groups + Interviews to a sample	Non-structured	Plans, demographics and organigrams + Access to the building and MR bookings
3	**Utility**			Informal meetings + Semi-structured interviews	Questionnaire to a sample	Interviews to a sample	Non-structured + Space and activities	Plans, demographics and organigrams + Access to the building and MR bookings

Only discussion with the clients[12] through semi-structured interviews, semi-structured observation, and document examination went through the same process across the three cases. The other methods were slightly modified to suit each particular companies' situation (**Table 4-5**). Nevertheless, the main results converge, whereas this qualitative imprint has for sure enriched the knowledge gained.

Frist step

Semi-structured interviews were conducted with the business roles appointed to manage the workplace change phase representing the client interest. The goal has been to bring together impressions, willingness, and sentiment from the stakeholders responsible for fine-tuning real and perceived building performances. From these meetings it was also possible to start defining the key roles and responsibilities within the process.

Then, a large number of **documents** was examined, with the aim to analyze the characteristics of the buildings, on one hand, and the organizational structure, on the other. This exploratory phase was functional to understand business processes and current criticalities. This phase was completed by a **non-structured observation** with several walk-throughs, which allowed familiarization with the office spaces under examination. Thanks to document analysis and non-structured observation it was possible to: (a) cluster the spaces, following typological and functional criteria; (b) gain some insights into how the people behave in the space and their needs; and (c) plan on the following stages of investigation.

This first approach to the case studies helped translate the major research questions on the users into refined hypothesis to verify afterwards.

Second step

A campaign of **structured observation** was required in order to map and monitor the way people use the spaces, therefore better understand their needs and values. Those campaigns refer to the behavioral mapping approach typical of environmental psychology studies. The aim was to represent the maximum peaks of space occupancy. The observation took place on the most typical weekdays, given a firm's characteristics and different business units' habits. Four researchers,[13] in groups of two, walked through specific zones of the building, making sure to observe each space once per hour. Supported by a detailed checklist, the observers punctually registered the number of:

- Employees sitting at the desk;
- Personalized desks;
- Employees occupying the meeting rooms;
- Employees using concentration/phone booths (when applicable); and
- People using the break areas.

[12] Here the term 'client' is used with a general meaning as in Niemi & Lindholm (2010) thus includes all the users who interacted with the external supply side, i.e. the researchers' team.

[13] The author of the present study played a major role in planning the observation, and was also involved in first person during the walk throughs, while heading and guiding the other collaborators to the research.

In addition, qualitative considerations about where and how workers performed several activities were annotated for future consideration.

Subsequently, **focus groups and interviews** were organized to directly meet with the employees and listen to their thoughts about space demand. In total 166 participated in the focus groups and 32 were interviewed (see **Table 4-6, Table 4-7, Table 4-8**). The sample represented those business units inhabiting the building there were directly involved in the workplace change process. A **questionnaire** (see **Appendix 12.1**) was administered during the sessions. Since both focus groups and face-to-face interviews involved a large number of people, the questionnaire helped systematically collect some information and better organize the meetings. The questions enclosed several aspects, including workers' perceptions toward the way how they use the building they work in, and their satisfaction with it. The main topics regarded:

1. Their activities at work during a 'typical working day' (time spent in different activities); and
2. Work processes viable to affect interrelations among business functions or with externals.

The questionnaire was used as a template for open discussion. After answering one question, the participants were invited to talk about the same topic and elaborate on it. During conversation, the interviewers wrote down several annotations suitable for further comments.

Finally, **numerical archival records** about the access of employees to the building and meeting rooms' reservations were analyzed. These data are picked up on a daily basis, but they are left at a raw stage of elaboration, so that a careful work of cleaning and preparing was necessary before use. The numbers collected from those sources were used to calculate periodical trends in space usage by different groups of users.

Eventually, data received through all the methods have been matched together in order to properly weigh and interpret them. Some of the insights concern flex office, territoriality, need for proximity, and use of meeting rooms, phone booths, concentration rooms and break areas. These last topics have been developed in Tagliaro & Ciaramella (2016a, 2016b) with regard to the telecommunications company.

Other information obtained is applicable to refining the reference framework of workplace users currently available, which is object of the present part of the research.

4.5 Analysis

By reversing the supply chain approach, this study proposes a demand side perspective assuming services are required in the office building, and needs originate in the workplace. The methods applied within a demand-driven perspective lead to confirm that workplace users are not a uniform whole, but a multifaceted group. Its components deserve to emerge as separate user categories, which can be identified according to a few criteria. Users scouted across the case studies and life-cycle phases are matched with the users' categories and general project phases adopted by Olsson et al. (2010). Further comments will be provided in the Findings and Discussion.

4.5.1 Roles and responsibilities: Users categories by life-cycle phases

One of the goals of the study is to understand whether different users can be recognized by their roles and responsibilities in different life-cycle phases of the building. This topic is investigated through: (a) semi-structured interviews with the business roles appointed to manage the workplace change strategy; (b) direct observation of the researcher across the workplace-making process; and (c) examination of the respective organizational structures.

1 Telecommunications company

The telecommunications company (Company No 1) was approached six months after the move to a new premises. The goal of collaboration between the company and the researchers was to conduct a post-occupancy evaluation, in order to assess the new workplace performance and attune it at best with occupants' needs.

Table 4-6. Methods applied to case study 1

#	Organization	Surveys and benchmarking	Participatory design	Discussion with clients	Occasional questionnaires	Interviews for space demand	Observation	Docs and archival records
1	**Telecommunications**	Survey to all company employees		Informal meetings	Questionnaire to a sample	Focus groups with a sample	Non-structured + Structured on space and activities	Plans, demographics + Access to the building and MR bookings
	Details	830 people of which 432 respondents (52% response rate)		3 people: 1 HRM 1 FM 1 CREM	58 people (100% response rate)	3 groups: 1 of 20 people and 2 of 19	584 work stations, i.e. 62% of the total (945 work stations)	Of the previous 6 months

Decision to undertake this kind of study was endorsed by the CREM department. The researchers interacted initially with HRMs and FMs responsible for handling the evaluation through **informal meetings and non-structured observation of the spaces**. CREM managed the organization of the process, while HRM and FM provided the researchers with the required data. These two departments occupy the building as end-users. Information used to perform the evaluation was retrieved through documental analysis and elaboration on archival records, questionnaire administration, structured observations, and focus groups.

The HRs provided **data** about the organizational structure, and staff characteristics (e.g. demographic data), whereas the FMs supplied documentation about the physical characteristics of the building, accesses, and meeting room bookings.

The **satisfaction survey** has been prepared in collaboration with the FM and submitted to all the employees (830 people at that time).

Structured observation was performed on most of the building (except laboratories) on all the employees occupying those areas, including internees, collaborators and consultants supporting the company's primary process.

The **focus groups** took place in three large groups for an overall sample of 58 employees selected by the HRM from different departments and hierarchical levels. The meeting was facilitated by the submission of a brief **questionnaire**.

Even though visitors and customers were frequently accessing the building, they were not directly involved in the investigation, nor were included as objects of analysis. During the focus group, the role of different departments came up as very important to fine-tune different sorts of problems: IT for some issues

concerning video/conference call equipment, HR for behavioral problems, and FM for technical problems related to building functioning (e.g. heating/cooling, lighting).

2 Pharmaceutical company

The pharmaceutical company (Company No 2) was approached when the company was starting to plan and design its new headquarters. Researchers were involved in facilitating the interactions between the organization and the designers. Their role consisted of building up a systematic framework of the company's needs. On the basis of this framework, some **participatory activities** were organized between the researcher/consultants and the designers first, and together with employees' representatives, with the goal to draw a set of requirements and start matching them with the draft plans of the future building.

Table 4-7. Methods applied to case study 2

#	Organization	Surveys and benchmarking	Participatory design	Discussion with clients	Occasional questionnaires	Interviews for space demand	Observation	Docs and archival records
2	**Pharmaceutical**		Between researchers and architects	Informal meetings + Semi-structured interviews	Questionnaire to a sample	Focus groups + Interviews to a sample	Non-structured	Plans, demographics and organization charts + Access to the building and MR bookings
	Details		6 people: 3 architects 2 researchers 1 person from the company's Engineering	2 people: 1 Engineering 1 HRM + owner and CEO	34 employees + 15 interviewees (both 100% response rate)	4 groups: 2 of 9 people and 2 of 8 + 15 interviewees	Whole building	Of the previous 12 months

In this case, the owner of the company is also the owner of the building in operation and of the future headquarters. At the beginning of the planning stage, the owner participated most of all as an auditor of the workplace-making process that was being undertaken. Later, the owner acted as the key-decision maker in the crucial stages of planning and designing, together with the CEO. In addition, both owner and CEO occupy the building as end-users.

The whole process was coordinated by the HR team and the Engineering team, both of whom retain the key-data object of analysis, and interact with the architects from the designing studio, external to the company. The HRM was responsible for providing the researchers with the organization chart and information on staff characteristics. The Engineering department instead supplied documents on the building in use, and data on accesses to the premises. Both these departments are occupants of today's headquarters and will be moving to the new one.

First, **documents and archival records** analyses were carried out, on top of a **non-structured observation** of the existing spaces, guided by the Engineering and the designer team. Access records to the building in use were carefully examined to distinguish patterns of employees, from patterns of other building users such as consultants, internees, collaborators, operators, visitors, and customers.

Interviews and focus groups followed, both supported by 2 different brief **questionnaires** to systematically collect key information.

Interviews involved 15 executives of the departments that are interested in the future move to the new headquarters. Interviewers were asked information on the current ways of working of their people, and their perspectives on the future evolution of the ways of working in that company.

Focus groups took on board a sample of 34 employees, chosen by the HRM from both the strategic and operative level. Focus groups were useful for collecting information on the actual flaws of the building in use, and desirable or expected improvements for the future. Here aspects emerged regarding the interest of the IT for the connectivity infrastructure, the related equipment, and digitization process, HR for change management issues, and FM for how to manage new services and spaces.

Finally, **semi-structured interviews** with the owner and the CEO were functional to understand their prospective goals, and the company's mission and vision.

3 Utility company

The utility company (Company No 3) was approached in the very early stages of the initialization process, prior to decisions on realizing a new headquarters. Here the researchers started with helping the company figure out how their mission and vision was evolving, and their potential impacts on spatial organization. The follow up consisted of a building-in-use study in order to address the gaps between the current ways of working and building functioning, and the renewed mission and vision. Currently, the researchers are still supporting the planning/design phase.

Table 4-8. Methods applied to case study 3

#	Organization	Surveys and benchmarking	Participatory design	Discussion with clients	Occasional questionnaires	Interviews for space demand	Observation	Docs and archival records
3	**Utility**			Informal meetings + Semi-structured interviews	Questionnaire to a sample	Interviews to a sample	Non-structured + Structured on space and activities	Plans, demographics and organization charts + Access to the building and MR bookings
	Details			2 people: 1 Space Planning 1 HRM + President and CEO	17 interviewees (100% response rate) + 74 managers (55% response rate)	17 interviewees	714 work stations, i.e. 100% of the total	Corresponding to the 2 days of observation

Here the company is represented by the President and CEO, who defined the mission and vision together with the executive board. They gave **semi-structured interviews** to the researchers expressing their ideas about how the future headquarters should face the new ways of working. Moreover, they decided on the architects to invite to the competition for the planning and designing phase. They both use the current building and will use the new one as occupiers.

The Space Planning team was in charge of managing the initialization stage, with the support of the HR. Here sort of a pilot conceptual project was elaborated with university students for one floor of the premises. A **non-structured observation** of the premises was organized to support the project. Subsequently, brief meetings with employee representatives took place to catch feelings and comments on these first ideas.

Subsequently the CREM started to lead the process, collaborating with the HR and Space Planning departments for deepening the investigations. CREM, HR and Space Planning, started encountering the prospective designers. At the same time, HR provided the researches with **data** about demographics, organization charts, accesses and bookings, while Space Planning took care of the plans.

Direct **structured observation** was performed to characterize the actual use of the building, and to find out flaws to correct in the future and to avoid in the new headquarters.

In addition, **interviews** were performed with 17 executives, with the aim of systematizing information about the current and prospective ways of working. During these interviews, concerns about the involvement and role of the Office Financial Administration came up a few times, for validating the feasibility of the project. Results were refined by a **questionnaire** distributed among 74 top managers (55% response rate) in addition to spot interviews. Here several aspects emerged that require the involvement of ICT people in particular for supporting a massive digitization process.

During these investigations, company collaborators, consultants, and internees resulted being important users to take into consideration in the operation of the building, thus to account for especially in the new headquarters. Similarly, the company aims to devote particular attention to visitors and customers, as well. Even though they remained excluded from the initialization stage, the company plans on involving some samples of both visitors and customers in the future activities related to workplace-making.

4 Cross-case synthesis on roles and responsibilities

From the comparison of the three different experiences some comments can be drawn about the three different life-cycle phases under examination.

The **initialization phase** sees the intervention of the President and the CEO of the company. They define how the future building will face the new ways of working and take decisions about how to manage the process (e.g. prospect stakeholders, external suppliers, etc.). In this phase, HR managers and space planners set up the due interactions with the forthcoming supply side (e.g. designers, contractors/constructors, developers, financers, brokers, workplace consultants, and so on), while trying to detect the values and needs of the users at the demand side. Here the demand side is represented by the executive board, which is called to provide general information on its view of the potential evolution in the future.

In the **planning phase,** the Owner, represented by the President and CEO where appropriate, keeps himself updated with the development of the workplace change process. In the meantime, HR, Engineering, Space Planners, and CRE managers interact directly with the external supply side (e.g. designers, contractors/constructors, developers, financers, brokers, workplace consultants, and so on). They also perform punctual investigation upon the needs from the demand side by involving a number of executives in interview campaigns. The goal is to collect detailed information on the actual ways of working and desirables, and to translate these into specific requirements. Requirements are to be checked by the IT team and the CFO administration for technical and economic feasibility. In-depth details about the ways of working can be gathered through online questionnaires submitted to a larger range of selected managers.

In the **operation phase**, the Owner, the President and CEO inhabit the building, interacting with CREs, FMs, Engineering, Space Planning, IT, and HRs when needed. At the same time, Owner, President and CEO all take strategic decisions together with the executive board. CREs, FMs, Engineering, Space Planning, IT, and HRs typically collaborate to implement the workplace strategy and keep building performances under control. While inhabiting the building themselves, they are in charge of fine-tuning the actual building operation. This can be done by performing some building-in-use or post-occupancy studies, which generally

involve a panel of top managers. The building is also used by employees, who can interact with the building operation people. Also their collaborators, consultants and internees occupy a variable number of workstations and have the indirect responsibility of updating some building areas to these necessities. A variable number of visitors and customers come to tour the building and make use of specific areas, such as conference rooms, or exhibition areas. They are not recognized for any active role in workplace-making, while appearing as occasional 'workplace consumers', to use the expression proposed by Puybaraud and Kristensen (2015).

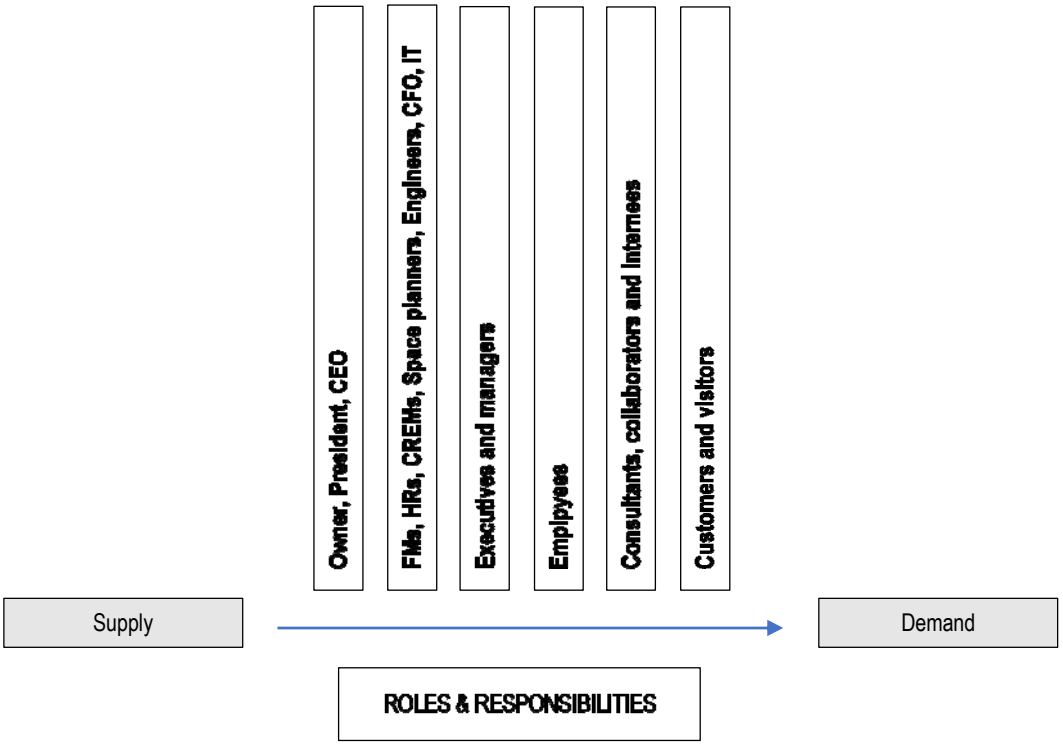

Figure 4-3. Workplace users by roles and responsibilities on a supply-demand gradient

To sum up, different users can be recognized in the workplace-making process by roles and responsibilities (see **Table 4-9**):

- **Owner, President and CEO** define objectives, take decisions on workplace strategies, and occupy space;
- **Facility managers, HR representatives, CRE managers, Space planners, Engineers, IT and Financial Administrators** set up interactions between the external supply side and the internal demand side, accommodate requirements during building operation, while making use of the space as occupiers. In all they can be defined as 'Building operation staff'. However, their roles differ from one another as follows:
    - **FM** takes care of building functioning, and manages the related information;
    - **HRM** takes care of people, and deals with the related data;
    - **CREM** combines elements related both to people and building into strategies;
    - **Financial Administrators** assures the feasibility of workplace strategies;
    - **Engineers and Space Planners** look at workplace layout and appearance; and
    - **IT** manages the connectivity of the people and of the building, and between people and building;

- **Managers and executives** provide information on the ways of working and their view of the future, while making use of the space as occupiers;
- **Employees** provide information on their ways of working with specific needs, and occupy the space with more or less regular patterns;
- **Collaborators, consultants, and internees**, use the workplace to support the organization, although only temporarily and in an irregular way; and
- **Customers or visitors** to whom the organization provides its services, just enter the office building periodically, but do not use the workplace as the other users do.

Once the major actors appearing in the workplace-making process have been identified, they were compared with the user categories proposed by Olsson, et al. (2010), based on the definitions that these authors give of user roles.

Results from this adaptation can be read in **Table 4-9**, which shows a cross-case synthesis. In the three cases, highlight is given to: which users enter the workplace-making process, and at which specific stage, by adopting the user framework as proposed by Olsson, et al. (2010).

Table 4-9. Cross-case synthesis: Different user categories by life-cycle phases

User categories by Olsson (2010)	Owner	Building operation	Management of organization	Service providers	(Direct) Service receivers	Indirect service receivers
INITIALIZATION						
Company No 1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Company No 2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Company No 3	President, CEO (defines how the future building will face the new ways of working and decides about suppliers)	Space planning, HR (understand needs and interact with supply side)	Executive board (provide information on their view of the future through interviews and comment on the concepts)	/	/	/
PLANNING						
Company No 1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Company No 2	Building and company owner, and CEO (is updated about the development of the project with the designers)	HR, Engineering, IT (understand needs and interact with supply side)	15 executives (interviews provide information on the current and prospective ways of working)	/	/	/
Company No 3	President, CEO (is updated about the development of the project with the designers)	Space planning, HR, CREM, IT, CFO (understand needs and interact with supply side)	20 executives (interviews provide information on the current and prospective ways of working)	80 managers (through online questionnaire provide information on their ways of working)	/	/
OPERATION						
Company No 1	N.A.	HR, FM, CREM (understand needs and interact with supply side, while inhabiting the building)	All executives (occupy the building and interact with Building Operation staff when needed) + Sample of them involved in POE focus groups	All employees (occupy the building and interact with Building Operation staff when needed) + All of them fill in a POE questionnaire + Sample of them involved in POE focus groups	Visitor, Customer (sometimes occupy specific areas of the building e.g. conference rooms or exhibition areas)	Consultant, Collaborator, Internee (occupy workstations on a temporary basis and might interact with Building Operation staff if needed)
Company No 2	Building and company owner, and CEO (occupy the building, interact with FM and take strategic decisions)	HR, Engineering (understand needs and interact with supply side, while inhabiting the building)	All executives and top managers (occupy the building and interact with Building Operation staff when needed)	All employees (occupy the building and interact with Building Operation staff when needed)	Visitor, Customer (sometimes occupy specific areas of the building e.g. conference rooms or exhibition areas)	Consultant, Collaborator, Internee (occupy workstations on a temporary basis and might interact with Building Operation staff if needed)
Company No 3	President, CEO (occupy the building, interact with FM and take strategic decisions)	Space planning, HR, CREM (understand needs and interact with supply side, while inhabiting the building)	All executives and top managers (occupy the building and interact with Building Operation staff when needed)	All employees (occupy the building and interact with Building Operation staff when needed)	Visitor, Customer (sometimes occupy specific areas of the building e.g. conference rooms or exhibition areas)	Consultant, Collaborator, Internee (occupy workstations on a temporary basis and might interact with Building Operation staff if needed)

4.5.2 Needs and values: Users categories by ways of working

Further considerations are required to understand if different user categories emerge by the values and the needs related to the activities these undertake in the workplace. Investigations were carried out by zooming in on the operation phase, when (a) needs come to light from the ways of working, and (b) values appear from the point of view of the users.

(a) The **ways of working** were pictured by analyzing different aspects of work processes, as emerged from Phase 0, across all the three case studies:

1. **Work patterns**, through analyzing the use of different type of spaces provided, i.e. reservation of meeting rooms (MR);
2. **Identity, status, and privacy** issues, through examining the use of workstation, i.e. personalization of desk, and confidentiality levels;
3. **Activities**, through depicting the nature of work, e.g. type of activity; and
4. **Degrees of interaction**, through recording the interaction with externals, i.e. accesses to the premises.[14]

Table 4-10. Investigations to define ways of working

#	Organization	Work patterns	Identity, status and privacy	Activities	Degrees of interaction
1	**Telecommunications**	MR reservations	Personalization of workstation		
2	**Pharmaceutical**	MR reservations		Type of activity by business unit	Accesses to the premises + Interaction with externals
3	**Utility**		Need for confidentiality	Type of activity by business unit	Interaction with externals

Results on user needs came out from triangulating data collected through structured observation of the spaces, information gathered through interviews and questionnaires, and quantitative records retained by the HR and FM departments.

(b) The **point of view** of the users, instead, was scrutinized through interviews and focus groups (FG), which involved:

- Owner, President, and CEO of the companies;
- Building operation staff;
- Executives and top managers; and
- Employees.

Table 4-11. Investigations to define points of view

		Discussion with clients		Interviews and focus groups	
#	Organization	Owner	Building operation	Executives/Managers	Employees
1	**Telecommunications**		✓	✓	✓
2	**Pharmaceutical**	✓	✓	✓	✓
3	**Utility**	✓	✓	✓	✓

[14] Those indicators are only some of the many indicators potentially suitable to describe the ways of working and work processes. In this particular study, the most convenient ones have been chosen according to the companies' needs and expectations. However, the choice of different indicators depends on a few factors, such as: objective of the investigation, availability of time and tools for data gathering, structure of the company, and so on.

These dialogues primarily aimed at discerning the projection on time of user values and needs related to the workplace. Investigations followed different templates in each company, but covered analogous aspects across which it is possible to recognize specific trends. Topics that were covered are:

1. Space usage, availability and flexibility;
2. Functionality, look and feel;
3. Filing, paper handling and clean desk;
4. Environmental quality; and
5. Equipment.

1 Telecommunications company

Two types of analysis performed at the telecommunications company were functional to identify different users by the expressed needs, namely reservation of meeting rooms and personalization of workstations. Values have been scouted through informal meetings and focus groups.

Table 4-12. Analyses performed on case study 1

		Ways of working				Viewpoint
#	**Organization**	**Work patterns**	**Identity, status and privacy**	**Activities**	**Degrees of interaction**	**Discussion and interviews/FG**
1	**Telecommunications**	MR reservations	Personalization of workstation			Informal meetings with active users, and focus groups with exec and employees

From the records of **meeting room bookings** several patterns of habits can be distinguished by different departments (see **Appendix 0**). Each business unit demonstrates its own necessities in terms of **work patterns**, so that some of them clearly show the need for intense collaboration (e.g. WT and Finance). On the contrary, some other business units reveal only a rare use of the meeting rooms, considering that the overall number of hours reserved by 21 business units just exceeds the hours reserved by WT.

Identity, status and privacy issues have been explored through **structured observation**. The use of workstation was detected by registering **personalized** desks (see **Appendix 0**). Here again quite various habits were recorded with regard to personalization of the workstation. The business units that are less mobile by nature (for example, Procurement, REGS, RDO), appear to manifest some sort of attachment to their desk, which is reflected in a more intensive style of personalization. On the contrary, the business units that are more mobile (for example, IP Routing and Transport, Presales, Repair) seem pretty detached from the necessity to mark or personalize their workstation, that probably they do not feel as 'proprietary' as their more stationary colleagues do. This again proves dissimilar trends in space occupancy and consequent differences in the way of approaching the workspace by different groups of users.

Informal meetings and focus groups clearly showed the respective sight different users have on the workplace (see **Appendix 12.6** – quotes; numbering 1V for values, and 1N for needs).

Employees [E] look at their own comfort in the very short-timeframe. Their comments during focus groups tend to refer to contextual and personal impressions. Expressions such as "I like it here, everything is much more efficient" [1V-E], "On some days there is not enough room for everybody" [1N-E], "Not all the meeting rooms are properly soundproofed, you can hear a lot from the outside" [1N-E] refer to both needs and values. However, they have in common an operative stance. These statements all comment on workplace aspects that impact on their operational and short-term objectives.

Executives [Ex] and managers [M] demonstrate a mid-term perspective on the evolution of work in the near future. They express opinions on values and needs based on comparisons between different solutions with advantages and disadvantages to the business. For example: "In the previous open-plan setting we were too dispersed and there was scarce contact with each other. Now the arrangement of the workstations allows for fruitful interactions" [1V-M]; "Switching to a clean desk policy is a cultural transformation we should undertake: until there is so much paper documents around of course, all the desks will seem proprietary" [1N-Ex].

Finally, HR, FM, CREM, look at mid/long-term values and needs for the company, for example: "We want to make sure that employees are satisfied with the new workplace" [1V-HRM]; "We are going to accommodate 200 more people after the merge, so we need to understand if they will fit in this spaces, or we should rent out external facilities. In terms of business effectiveness this is not recommendable" [1N-CREM]. In addition, they report some requirements that are strictly related to the actual operation, but in a strategic logic, such as: "We are taking care of communication problems related to flexibility. We will be soon switching to only mobile phones and devices, and get rid of fixed IT equipment." [1N-FM].

2 *Pharmaceutical company*

With regard to the investigations carried out at the pharmaceutical company, analysis useful to show different user needs are: reservation of meeting rooms, type of activities, accesses to the premises and interactions with externals. Values have been scouted through interviews and focus groups.

Table 4-13. Analyses performed on case study 2

		Ways of working				Viewpoint
#	**Organization**	**Work patterns**	**Identity, status and privacy**	**Activities**	**Degrees of interaction**	**Discussion and interviews/FG**
2	**Pharmaceutical**	MR reservations		Type of activity by business unit	Accesses to the premises + Interaction with externals	Informal meetings with owner and active users, and focus groups with exec and employees

From the records of **meeting room (MR) reservations** several patterns of habits could be distinguished by different departments (see **Appendix 0**). Each business unit demonstrated its own necessities in terms of **work patterns**. From Human Resources Corporate Functions, which regularly books rooms for meetings several times a day, to Corporate Marketing, where bookings on average account for one per day, to Corporate Production and Engineering, that barely use the meeting rooms.

Activities depicting the **nature of work** have been schematized through **interviews** with executives of each business unit supposed to move to the new premises (see **Appendix 12.4**). A brief questionnaire supported inquiries directed to grasp the ways of working typical of each business unit, and the extent to which the way of working of the executive could be assimilated with his subordinates. Much differentiated attitudes emerge when asking to define what kind of activities characterize daily work. Inter-function teams, intra-function teams, individual activities and operative/mobile activities often combine within the same business unit. Some trends are common to different business units, for instance Corporate Finance and Legal & Corporate Affairs show a similar effort split between individual and inter-function activities. Executives' typical activities are also variable and depend on their respective type of work.

Degrees of interaction were examined through analyzing both the accesses to the premises and the need for working with externals by business unit. **Records** of accesses to the premises reveal that more than 10% of the people entering the building every day are consultants and collaborators who do need a workstation for performing their activities throughout the day (see **Appendix 12.5**). These consultants and collaborators

though have preferred relationships with only some business units, as **interviews** revealed (see **Appendix 12.5**). For instance, Human Resources Corporate Functions attract collaborators much more often than Global Business Development and Licensing.

Semi-structured interviews with the owner, HR and Engineering, on one side, **and interviews with executives and focus groups with employees,** on the other, clearly showed the different sight these people have on the workplace (see **Appendix 12.6** – quotes; numbering 2V for values, and 2N for needs).

Only to cite one example, concerning space usage, availability and flexibility several quotes demonstrate different points of view. Employees [E] tend to show very particular interest that are projected in a short-timeframe, such as "I am happy about this office building because it is close to the train station and to the city center. However we are a bit isolated from the other company sites, which entails frequent travels back and forth" [2N-E]. On the same topic, executives [Ex] reveal a mid-term perspective on the evolution of the work in the near future. These are interested also in business-related impacts, in fact, as it is evident from the following statement: "Today we waste a lot of time just going back and forth our different sites. This leads to inefficiencies and inefficacies in everyday activities" [2N-Ex].

HR [HRM] and Engineering [En], instead, look at mid/long-term values and needs for the company, with an operative stance, in addition to reporting some requirements that are strictly related to the actual time, for instance: "Proximity between business functions must be planned accurately. Some functions would highly benefit from being closer to each other" [2N-En]; "A key issue regards security of both data and people" [2N-HRM]. The owner [O] and CEO have the longest-term view on the workplace and its prospective value, like: "For our company it is important to overcome the silos-like organizational structure, and move forth to integrating people and spaces, toward the maximization of communication, efficiency and creativity" [2V-O].

3 Utility company

For what concerns the utility company, differences among user needs emerge from: need for confidentiality, types of activities, and interactions with externals. Values have been scouted through interviews and focus groups.

Table 4-14. Analyses performed on case study 3

			Ways of working			Viewpoint
#	**Organization**	**Work patterns**	**Identity, status and privacy**	**Activities**	**Degrees of interaction**	**Discussion and interviews/FG**
3	**Utility**		Need for confidentiality	Type of activity by business unit	Interaction with externals	Informal meetings with owner and active users, and focus groups with exec and employees

Identity, status and privacy issues here have been addressed through a **questionnaire** devoted to qualifying and quantifying the need for confidentiality by business unit. Different business units showed dissimilar needs for confidentiality (see **Appendix 12.3**). On one hand, business units registered various reasons for this need, in case it occurs: meeting with suppliers, dealing with personal data, unbundling, and dealing with sensitive data. One the other hand, the proportion of teams internal to the respective business units which carry different confidentiality motives, varied a lot. For example, Customer Service had no need for confidentiality at all, whereas IT Generazione e Reti (Information-Technology Generation and Networks) needs to satisfy confidentiality for meeting with suppliers, dealing with personal data, unbundling, and dealing with sensitive data.

Activities depicting the **nature of work** have been schematized through **interviews** with executives of each business unit involved in the move to the new premise, and a **questionnaire** distributed to selected managers. These were directed to grasp the ways of working typical of each business unit, and the extent to which the way of working of the executive/manager could be assimilated with his subordinates. Much differentiated attitudes emerge when asking to define what kind of activities characterize daily work (see **Appendix 12.4**). Inter-function teams; intra-function teams; individual work or operative/mobile work often combine within the same business unit. Some trends are common to different business units, for instance Group Security, Internal Audit, and BU Mercato (Business Unit Market) show a similar effort split between individual work and intra-function teams. Activities characterizing executives and managers' work are also variable and depend on their respective type of work.

Degrees of interaction were examined through relations with externals by business unit that were investigated with a **questionnaire** to selected managers. Consultants and collaborators resulted having preferred relationships with some business units, rather than others (see **Appendix 12.5**). For instance, all the business units within the department of Amministrazione, Finanza e Controllo (Administration, Finance and Control) attract collaborators much more often than units of Affari Legali e Compliance (Legal Affairs and Compliance), or Affari Regolatori e Mercato (Regulatory Affairs and Martket).

Semi-structured interviews with the President and CEO covered also some aspects of work patterns. They confirmed that they often arrange meetings, and their daily work is characterized by many activities ranging between inter- and intra-function teams.

Semi-structured interviews with President, CEO, Space Planning, HR, and CREM, on one side, **and interviews with executives and focus groups with employees,** on the other, clearly showed the different sight these people have on the workplace (see **Appendix 12.6** – quotes; numbering 3V for values, and 3N for needs).

Only to cite the instance of Functionality, look and feel, significant variance in the approach of different users can be highlighted.

Employees [E] look at their own comfort, by referring to situations that do not have a direction in perspective, but are oriented to a personal interest, which sounds time-focused. For example, the statement "I would like more lively and stimulating workspaces" [3V-E], implies that the person evaluate stimulating workspaces because he likes them more.

Executives [Ex] demonstrate a mid-term perspective on the evolution of work in the near future, such as: "I like morning briefings with my team. I think stand-up areas would be appropriate to accommodate these brief exchanges" [3V-Ex]. This sentence reveals an interest which is more general than a time-specific situation, but reflects on business strategies and culture.

HRM, Space Planning and CREM instead, look at mid/long-term values and needs for the company, with a strategic approach, which is demonstrated by the following intentions: "We need to provide not only spaces to our people, but also services, such as a kinder garden, a laundry, a doctor" [3V-FM]. Building operation people, when thinking about a stimulating environment have a service-related sight which extends in time, even if its contents are in the end quite operative and concrete.

President [P] and CEO have the most general and longest-term view on the workplace and its prospective value. Their main interests in workplace functionality, look and feel refer to company culture with forward-looking intentions, for instance: "If open plan layout also for executives seems too extreme, transparency might be a good compromise, but a strong cultural message" [3V-P].

4 Cross-case synthesis on needs and values

Interpolating quantitative records and qualitative considerations produced valuable evidence to outlining a few common trends on the ways of working and on the points of view of workplace users. This leads to recognize different user categories by needs and values.

By examining the ways of working a few observations can be pointed out.

(1) With regard to **work patterns**, examined through the **use of different types of spaces**, i.e. meeting room reservations, different attitudes emerge across business units. However, no differences emerge across users with different roles and responsibilities, as they were identified in the previous part of the analysis. An exception must be made for visitor and customers, who have restricted access to spaces. Consultants, collaborators and internees as well are limited in the way they can use the available spaces, which is justified by the type of activity they are undertaking in the building.

Among the users who are able to book meeting rooms, dissimilarities depend on the type of work each business unit is called to do. In fact, while some business units use the meeting rooms quite often, some others rarely book them. This might suggest that some business functions require more collaborative activities, instead others tend to carry out a more individual kind of work. Alternatively, this could mean that some departments are more mobile than others are, and often work out of the office building, thus they do not need these spaces because they meet colleagues outside.[15] Independently from what causes this behavior, the attitude is likely to have a significant impact on the type of space and services (i.e. needs) required by business unit.

(2) Similar considerations can be derived about **identity, status, and privacy** issues through the **use of individual workstations.** Again, this varies depending on the type of work. Obviously, visitors and customers do not use any workstation. Consultants, collaborators, internees have temporary access to specific workstations. All other users use workstations in their daily work, to different extents.

First, analysis of territorial behaviors proves dissimilar trends in space occupancy and consequent differences in the way of approaching the workspace. Second, analysis of the necessity for confidentiality allows to distinguish separate groups even within the same department.

(3) By depicting the type of **activity** characterizing the **nature of work,** once more differences occur not much across the user categories that are recognizable by roles and responsibilities, rather across different business units, except for visitors and customers who do not perform any work in the building. Some variance can be observed at the business function level, but also at a more granular detail. Each business function, indeed, can be composed by many micro-units or clusters, deploying even substantially diverse jobs and work-styles. Moreover, some analogies in the ways of working can be found across clusters belonging to different business functions.

(4) Finally, **degrees of interaction** by capturing the need for **relations with externals** (i.e. consultants, and other collaborators) show diverse attitudes across business functions, depending on the type of work they have to perform. No clear distinction appears between user categories as defined by roles and responsibilities.

Once the major actors appearing in the operation phase by examining the ways of working, they have been compared with the user categories proposed by Olsson, et al. (2010). Results from this adaptation can be read in **Table 4-15**.

[15] Further analysis on the number of accesses can prove what cause is the most plausible.

Table 4-15. Cross-case synthesis: Different user categories by ways of working in the normal operation

User categories By Olsson (2010)	Owner	Building operation	Management of organization	Service providers	(Direct) Service receivers	Indirect service receivers
USE OF DIFFERENT TYPE OF SPACES PROVIDED						
Company No 1	N.A.	HR, FM, CREM *use different kind of spaces depending on the type of work*	*Executives and top managers use different kind of spaces depending on the type of work*	*Employees use different kind of spaces depending on the type of work*	*Visitor, Customer use the space they are assigned, have limited access*	*Consultant, Collaborator, Internee use different kind of spaces depending on the type of work*
Company No 2	*Building and company owner use different kind of spaces depending on the type of work*	HR, Engineering *use different kind of spaces depending on the type of work*	*Executives and top managers use different kind of spaces depending on the type of work*	*Employees use different kind of spaces depending on the type of work*	*Visitor, Customer have use the space they are assigned, have limited access*	*Consultant, Collaborator, Internee use different kind of spaces depending on the type of work*
Company No 3	*President, CEO use different kind of spaces depending on the type of work*	Space planning, HR, CREM *use different kind of spaces depending on the type of work*	*Executives and top managers use different kind of spaces depending on the type of work*	*Employees use different kind of spaces depending on the type of work*	*Visitor, Customer have use the space they are assigned, have limited access*	*Consultant, Collaborator, Internee use different kind of spaces depending on the type of work*
USE OF INDIVIDUAL WORKSTATION						
Company No 1	N.A.	HR, FM, CREM *use ws in many different ways depending on type of work*	*Executives and top managers use ws in many different ways depending on type of work*	*Employees use ws in many different ways depending on type of work*	*Visitor, Customer do not use workstations*	*Consultant, Collaborator, Internee use ws in many different ways depending on type of work*
Company No 2	*Building and company owner use ws in many different ways depending on type of work*	HR, Engineering *use ws in many different ways depending on type of work*	*Executives and top managers use ws in many different ways depending on type of work*	*Employees use ws in many different ways depending on type of work*	*Visitor, Customer do not use workstations*	*Consultant, Collaborator, Internee use ws in many different ways depending on type of work*
Company No 3	*President, CEO use ws in many different ways depending on type of work*	Space planning, HR, CREM *use ws in many different ways depending on type of work*	*Executives and top managers use ws in many different ways depending on type of work*	*Employees use ws in many different ways depending on type of work*	*Visitor, Customer do not use workstations*	*Consultant, Collaborator, Internee use ws in many different ways depending on type of work*
NATURE OF WORK						
Company No 1	N.A.	HR, FM, CREM *work differently depending on type of work*	*Executives and top managers work differently depending on type of work*	*Employees work differently depending on type of work*	*Visitor, Customer do not perform any work*	*Consultant, Collaborator, Internee work differently by type of work*
Company No 2	*Building and company owner work differently depending on type of work*	HR, Engineering *work differently depending on type of work*	*Executives and top managers work differently depending on type of work*	*Employees work differently depending on type of work*	*Visitor, Customer do not perform any work*	*Consultant, Collaborator, Internee work differently by type of work*
Company No 3	*President, CEO work differently depending on type of work*	Space planning, HR, CREM *work differently depending on type of work*	*Executives and top managers work differently depending on type of work*	*Employees work differently depending on type of work*	*Visitor, Customer do not perform any work*	*Consultant, Collaborator, Internee work differently by type of work*
INTERACTION WITH EXTERNALS						
Company No 1	N.A.	HR, FM, CREM *interact with externals depending on type of work*	*Executives and top managers interact with externals depending on type of work*	*Employees interact with externals according to their type of work*	*Visitor, Customer are externals themselves*	*Consultant, Collaborator, Internee can interact with each other if needed*
Company No 2	*Building and company owner often interact with externals for representative reasons*	HR, Engineering *interact with externals depending on type of work*	*Executives and top managers interact with externals depending on type of work*	*Employees interact with externals according to their type of work*	*Visitor, Customer are externals themselves*	*Consultant, Collaborator, Internee can interact with each other if needed*
Company No 3	*President, CEO often interact with externals for representative reasons*	Space planning, HR, CREM *interact with externals depending on type of work*	*Executives and top managers interact with externals depending on type of work*	*Employees interact with externals according to their type of work*	*Visitor, Customer are externals themselves*	*Consultant, Collaborator, Internee can interact with each other if needed*

By examining the points of view of workplace users, differences between long-term and strategic perspectives, and short-term and operative perspectives emerge.

Employees tend to express their considerations in the first person and talk about very contextual concerns entailing 'like', 'problems', and judgements such as 'excellent', 'nice', 'bad'.

Executives and managers show to be interested in the collective impact of the workplace, mainly referring to opportunities to improve business effectiveness. They utilize words such as 'useful', 'appropriate', 'to foresee'.

Users dealing with building operation look at medium-long term strategies to enhance the overall performance of the workplace, for general advantage, and for contributing to business development in perspective. The terms they often include in their discourses embrace characteristics of space, services, and business: 'flexibility', 'adaptability', 'efficiency', 'creativity', 'future'.

Eventually, Owners and his representatives look at very long-term strategies mainly referring to broad concepts and ideals like: 'development', 'culture', 'atmosphere', 'opportunities', 'innovation'.

In conclusion, needs and values expressed by each category of users differ in the time span (**Figure 4-4**):

- **Company owners, President and CEO** have reported to work in different ways. However, they are interested in long-term objectives and they express a strategic viewpoint for the whole organization. They look at the value the workplace is able to provide for the development of the whole company's business;
- **FMs, HRs, CREMs, Space planners, Engineers** work in different ways. They are interested in medium/long-term objectives, and they express a strategic/tactical viewpoint. They look at the value the workplace is able to provide for the daily work of each corporate department;
- **Executives and managers** show quite differentiated ways of working. They are interested in medium/long-term objectives, and they express a strategic/tactical viewpoint; they look at the value the workplace is able to provide for the daily work of their own department;
- **Employees** work in many different ways, and their needs are generally medium/short-term oriented. They express a tactical/operative viewpoint; they look at the value the workplace is able to provide to their own daily work or to that of their own team;
- **Consultants, collaborators and internees** manifest short-term needs, related to the operative tasks they are asked to perform. They look at the value the workplace can add to their own temporary activity; and
- **Customers or visitors**, display short-term needs, strictly related to the few activities they are performing in the building, which rarely require a workstation. They look at the value the building is able to provide only for the limited time of their experience in the building.

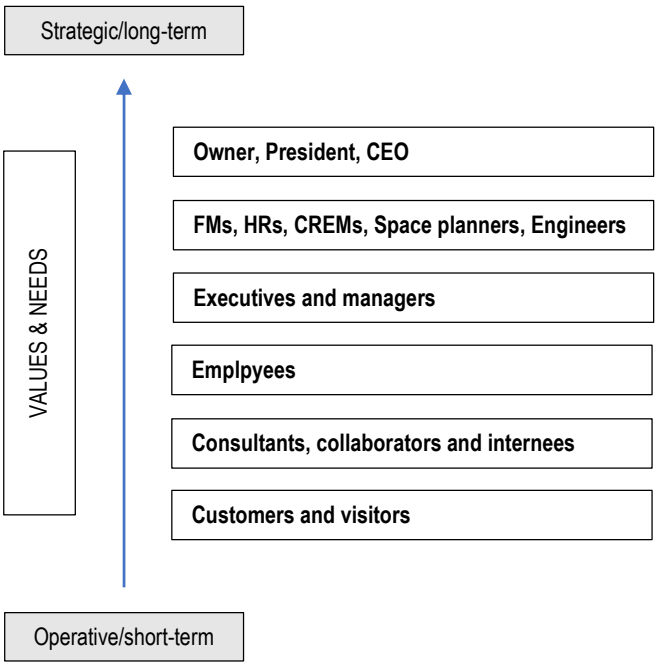

Figure 4-4. Workplace users by needs and values on a long-term vs. short-term gradient

4.5.3 Findings

Multiple investigations deliver a common finding, confirming the initial assumptions, namely that today's office user is actually a heterogeneous group. From a demand-driven perspective, multiple users can be appreciated (**Figure 4-5**). These users can be grouped according to two main criteria:

a. By different life-cycle phases when they enter the workplace-making process with different roles and responsibilities ('horizontal-x' perspective); and
b. By different ways of working and points of view over the operation phase, which define their needs and values ('vertical-y' perspective).

By different life-cycle phases, a supply side group and a demand side group can be distinguished, and placed on an **'x' axes (roles & responsibilities)**.

The supply side group entails those typically in charge of taking decisions and managing both the workplace strategy, and the building operation: CREM, FM, HR, Space Planning, Engineers, IT, Financial Administration and the Owner or who acts in his behalf (namely, President and CEO). In fact, they seem to have a two-fold role. To some extent, they just occupy the building as customers of external suppliers. At the same time though, they are entitled to negotiate between the demand side and the 'external' supply side (for example, designers, constructors, developers, financers, brokers, etc.). They typically participate to all the three life-cycle phases under analysis: initialization, planning and operation.

The demand side group comprehends company employees, both at the strategic/managerial level and at the operative level, together with consultants, collaborators, customers, and visitors. These make use of the building as pure customers, and are never responsible for controlling nor managing its performances. However different degrees of involvement in the workplace-making process distinguish them in four groups. Selected managers of the organization based in the building can be called to give some contribution

in the initialization and planning phases. Employees might participate in the planning, but usually join only the operational phase. Both managers and employees occupy the building on a regular basis. Collaborators differ from them because they do not appear in the initialization nor in the planning phase. In addition, they do not occupy the building regularly, but still need a workstation in specific time frames. Customers and visitors do not get involved in the initialization nor planning phase, frequent the premises more occasionally, and usually do not need a workstation.

By different ways of working and points of view over the operation phase, users can be placed on a **'y' axis (values & needs)**. In this perspective, the users previously mentioned can be accounted in a variable number of sub-categories, as many as their ways of working within the organization (no matter if they belong to the demand or the supply side). Moreover, these sub-categories are likely to correspond not directly to the number of business units derived from the organizational chart, nor to any hierarchical role. Rather, they can be considered as cross-category groups.

According to this vertical perspective, the same users show different values and needs they carry while using the workplace. Values and needs range from strategic and long-term, to operative and short-term. The ways of working reflect the needs people manifest while using the premises in the operation phase, whereas their point of view on the workplace expresses the value they attribute to the workplace. Differences and similarities across user categories emerge, as **Figure 4-5** shows.

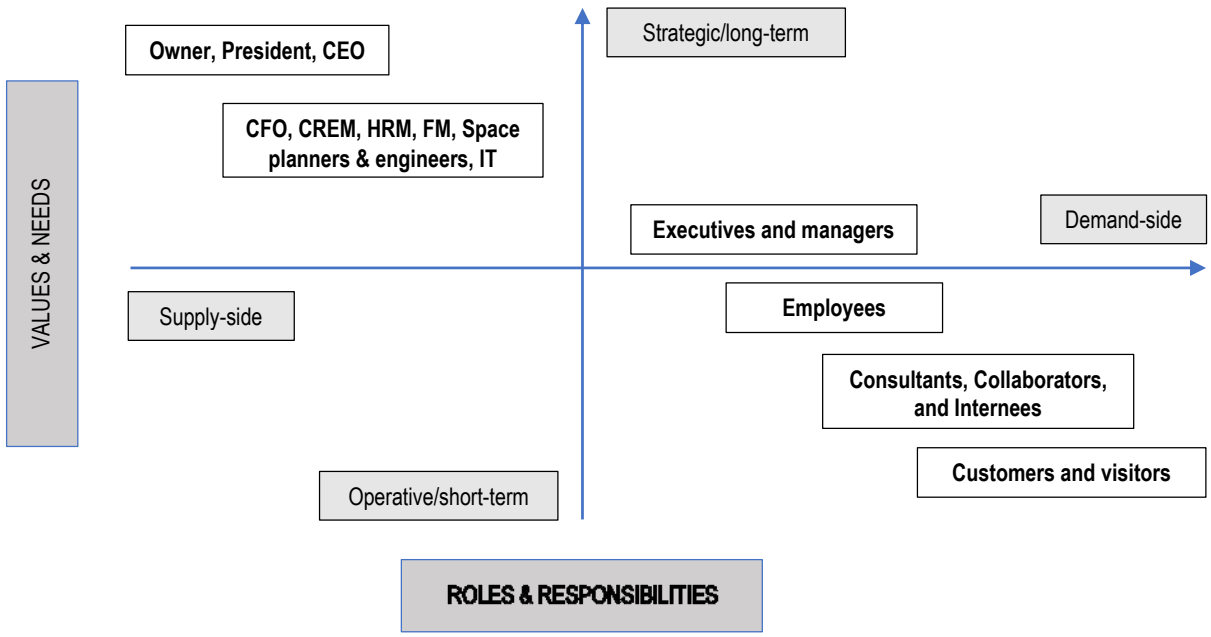

Figure 4-5. Workplace users on an x-y diagram

4.6 Discussion: Users categories for the office type

The results from Phase I of the research allow to systematize some of the hints on workplace users gained from literature review. Once different user categories have emerged from analysis of the case studies, these can be compared to the categories that Olsson, et al. (2010) outline for building types other than the office (**Table 4-16**).

Literature suggests examining the project/service delivery process from a demand-driven perspective. Therefore, the present study reversed the supply side point of view that is typically applied in the context of the built environment.

In a first attempt, office users appear as follows:

- **Owners** of the buildings are often also company owners, and in any case they are often represented by President and CEO;
- **Service providers operating the building** are not only Facility Managers, but also HR representatives, CRE managers, Space planners and Engineers, in addition to IT and Financial Administrators;
- **Service providing organization**, as customer of facilities management, can still be divided in two components: **Management** of the service providing organization, at the strategic level; and **Employees** providing the service, also defined as 'service providers';
- **Service receivers** might be customers or visitors to whom the organization provides its services, however they do not use the building as intensively as service receivers in other building types (e.g. pupils in schools); and
- **Indirect service receivers**, do not appear in the office environment with the same description, but can be broadly intended as people who support the service providing organization, although not being part of its organizational chart, such as collaborators, consultants, and internees.

Table 4-16. Update of user categories defined by a demand chain approach

	SUPPLY SIDE			*DEMAND SIDE*		
User categories definition by Olsson (2010)	**BUILDING OWNER**	**BUILDING OPERATION / FACILITIES MANAGEMENT**	**MANAGEMENT** of the organization based in the building	**SERVICE PROVIDERS**	**DIRECT SERVICE RECEIVERS**	**INDIRECT SERVICE RECEIVERS**
Description of the role	May not be directly involved in the operation that take place in the building	Acting on behalf of the users at the "supply side", but at the same time actual users of the building performing services to the other user groups	SERVICE PROVIDING ORGANIZATION (Customers of facilities management) Strategic level	EMPLOYEES of the service providing organization based in the building (Customers of facilities management) Operative level	Users benefitting from the services provided by the ORGANIZATION	With a relation to the direct service receivers
Example SCHOOL			Headmasters	Teachers	Pupils	Parents
Example HOSPITAL			Hospital management	Doctors and nurses	Patients	Relatives
Example BANK			Bank executives	Bank clerks	Customers	Business relations of the customers
Example OFFICE (added by the author)	*Owner* *President* *CEO*	*FM* *HRM* *CREM* *Space Planner and Engineers* *IT* *CFO*	*Executives* *Top managers*	*Employees*	*Visitors* *Customers*	*Consultants* *Collaborators* *Internees*

At this point, it should be noticed that the description of user roles provided by Olsson, et al. (2010) does not always fit with user identities in the workplace. For example, 'Indirect service receivers' seem to not find any correspondent user in the workplace, whereas consultants, collaborators, and internees do not find any appropriate place in the existing scheme. Consequently, some variation in the description of users' roles appears to be beneficial to better adapt user groups from the model to the office type.

Moreover, in Olsson, et al. (2010), these user categories follow a differentiation based solely on roles and responsibilities, rather than on needs and values. This latter perspective can be applied to workplace users in order to enrich the model.

Thus, a new framework of workplace users is proposed to fill these gaps (**Table 4-17**).

Table 4-17. Users of office buildings. Processing on different user categories defined by a supply chain approach (Olsson, et al., 2010)

Olsson, et al. **(2010)**	SUPPLY CHAIN					
	SUPPLY SIDE		*DEMAND SIDE*			
User categories	**Owner**	**Building operation/ Facilities management**	**Management of organization based in the building**	**Service providers**	**Indirect service receivers**	**(Direct) Service receivers**
Description of the roles	May not be directly involved in the operation that take place in the building	Acting on behalf of the users at the "supply side", but at the same time actual users of the building performing services to the other user groups	Service providing organization (Customers of facilities management) Strategic level	Employees of the organization based in the building (Customers of facilities management) Operative level	With a relation to the direct service receivers	Users benefitting from the services provided by the organization
New proposal	DEMAND-DRIVEN APPROACH					
	INTERNAL SUPPLY SIDE		DEMAND SIDE			
User categories	**OWNER**	**ACTIVE USERS**	**SERVICE PROVIDERS STRATEGIC LEVEL**	**SERVICE PROVIDERS OPERATIONAL LEVEL**	**INDIRECT SERVICE PROVIDERS**	**SERVICE RECEIVERS**
Figures	Owner, President, and CEO	Financial Adm. CREM HRM FM Designer IT	Executives and Managers	Employees	Consultants, Collaborators, and Internees	Customers and Visitors

On the supply side, two main categories can be distinguished, that can be respectively defined as 'owner' and 'active user'.

The **'owner'** in the office type must be intended not exclusively as the premises' owner, but more correctly as the owner of the company or those representing him, namely the President and CEO. Indeed, most offices are owned by investors/pension funds/etc. and leased by the company owner. In that case, the investor is often represented by a commercial real estate management firm who interacts with the company owner. Here, though, investor and commercial real estate firm correspond to the external supply side, whereas company owner with president and CEO hold the internal supply side. This internal supply side is actually shared with the company departments that make sure the building operates well.

When it comes to an office environment, what Olsson et al. (2010) call 'building operation/facilities management' expands to several departments. Beside the FM, also CRE, HR, Space Planning, Engineering, IT, and Financial Administration participate in managing the whole workplace-making process. These figures characterize the next-generation workplace, if compared to the traditional model team in charge of workplace design and change management as described by Bell & Anderson (1999). Bell & Anderson (1999) claim IT should be engaged throughout the whole process. However, in the case studies IT appeared only as a necessary figure to involve, but was not actually present in any of the phases the researchers observed. The same happened also for the Financial Administration function. Even if these two roles are well identifiable, their proactive intervention in workplace processes is still to come. This might be ascribed to the immaturity of the Italian corporate real estate sector, where many times key actors still need to emerge and assume a systematic role. However, it is true that all these 'building operation' people are on one hand 'service providers', and on the other hand actual users of the building, too. Thus, it can be suggested to call them all **'active users'**.

Owners and building operation management/active users represent the supply side of the workplace-making process, and mediate between the demand side and the external supply side. Such a characterization of different users within the 'client' group significantly advances the general definitions that can be scouted in literature. Indeed, these only mention on one hand 'paying clients' (e.g. Zeisel, 1995) and 'owners' (e.g. Lindholm and Nenonen, 2006; Blakstad, et al., 2008; Haugbølle & Boyd, 2013a), and on the other hand 'design and maintenance teams' (e.g. Leaman, 2003; Lindholm and Nenonen, 2006), 'facilities management' (e.g. Blakstad, et al., 2008; Tucker and Smith, 2008), and 'occupying organization' (e.g. Heywood and Kenley, 2013).

On the demand side, four main categories can be distinguished.

The 'service providing organization' shows two levels in the workplace, as well as the source suggests for the other building types. In the office case they are **managers**, at the strategic level, and **employees**, at the operative level, coherently with Niemi & Lindholm (2010).

'Service receivers', as named in the source, appear to be customers and visitors in the office environment.

'Indirect service receivers' do not exist in the workplace as they are described in the source. Though collaborators, consultants and internees can be renamed as **'Indirect service providers'** and take their place. Their role is similar to the other employees. However, their needs are usually peculiar for the type of activity they carry out, and the space and time they are required to spend in the premises. Thus, even if they use the building only sporadically, they might express very specific requirements. Consequently, collaborators deserve to be considered as important users to take into account in the workplace management and related processes.

Such a characterization of different users within the 'demand' group significantly advances the heterogeneous and dispersed definitions that can be scouted in literature. Indeed, these mention not systematically at times 'managers, staff, and customers, clients and visitors' (i.e. Lindholm and Nenonen, 2006), 'end-users, and visitors/society' (i.e. Blakstad, et al., 2008), or 'occupier organization, employee level, and other prospective individuals' (i.e. Niemi and Lindholm, 2010), etc.

In the end, eleven main users can be identified in the workplace-making process:

1. Owner, President, and CEO;
2. Financial admin.;
3. CREM;
4. HRM;
5. FM;
6. Engineering and space planning;
7. IT;
8. Executives and managers;
9. Employees;
10. Consultants, collaborators, and internees; and
11. Customers and visitors.

Questions arise whether all these user categories at the demand side should be involved throughout the whole process, as hinted by Tucker & Smith (2008). On the contrary, analysis of the case studies demonstrated that not all the users are taken into due account.

Finally, both users at the demand and the supply side need to be carefully observed because they are likely to be composed of numerous sub-groups due to their differentiated ways or working or work styles. Defining universal user profiles by ways of working is not possible and neither advisable. Conversely, careful monitoring is recommended from time-to-time to observe changes and detect needs at the organization, team and individual level.

4.7 Conclusions on workplace users

The main goal of this phase of the research is to define more concretely the identity of the users involved in the workplace-making process and their roles within it. The literature review, in fact, reveals a gap in defining office buildings' users, which might impact the next-generation workplaces. By adopting a demand-driven perspective, the investigative methods applied help advance the existing knowledge on the topic.

The theoretical propositions that have been verified in this study are:

1) *There is no generic user of the office environment, but there are multiple users to be considered; and*
2) *Workplace users can be distinguished in different categories, by roles and responsibilities, and by values and needs.*

Users involved in the workplace-making process are numerous. They can be categorized through two different criteria. A first criteria/perspective shows two macro-categories of users by their roles and responsibilities across the workplace building life-cycle: the demand side and the 'internal' supply side. Besides this, a second perspective shows their needs and values in the operative phase distinguishing between strategic/long-term and operative/short-term.

Six user categories can be distinguished, which appear as follows: owner, active users, strategic level service providers, operational level service providers, indirect service providers, and service receivers. This categorization happens to update the model proposed by Olsson, et al. (2010) for other building types, that had resulted as being the most comprehensive among all the user categorizations scouted in the literature. Among the six categories, that of active users include several groups, highly diverse for their roles and responsibilities, namely: Financial Administration, CREM, FM, HR, Engineering and Space planning, and IT.

In addition, a more refined granularity of these users is acknowledgeable, by analyzing their way of working, according to which all the abovementioned categories may be clustered into a number of subcategories, at least corresponding to the number of different ways of working that can be outlined.

This extreme fragmentation of user categories emerges particularly nowadays and will affect the workplace-making process in the next-generation office buildings. Indeed, new ways of working have been multiplying the variables traditionally characterizing knowledge workers. Moreover, office buildings have been evolving into complex systems made of different components: spatial, technological, human, and cultural. Managing their daily operation requires the interaction of several workplace users. Such level of detail can be appreciated only by taking a demand-driven perspective on the process of project/service delivery.

This piece of research sets a framework of the main workplace users. A better understanding of these users is valuable for advancements in both theory and practice. The categories herewith defined should be considered to be involved in the next-generation workplace-making processes. The framework can be applied while initializing, planning, and managing an office building from both the 'internal' and the 'external' supply side. It will help check whether all the relevant users have been taken into due account. The same framework makes users on the demand side aware of their roles and responsibilities during building operation. In all, this supports feed back and forward in the next-generation workplace-making process.

4.7.1 Limits and perspectives for progress in research

This study is limited to only three case studies, located in Italy. The small number of cases under examination, together with the immaturity of the Italian corporate real estate field, might affect the outputs of the investigations and reduce generalizability. Nevertheless, the cases show workplace users in at least one particular geographic context.

Moreover, the proposed scheme might appear rigid. In effect, the life-cycle phases of the project are not strictly enclosed into defined boundaries, but tend to blur and overlap. The same happens for corporate departments, which can slightly vary denomination and functional position from company to company. Therefore, roles and responsibilities should be interpreted as malleable competences, rather than precise job descriptions. Indeed, they might elastically extend over different life-cycle phases and different departments. The proposed scheme appears as a simplification of the process and aims at giving a general orientation to people who are approaching workplace-making to different extents.

At present, further questions emerge, worth to find an answer in future research.

1. Since the framework can be helpful for space design, as for workplace management and use, the next issue to be faced with regard to values and needs is: whether a higher variety of work settings and services should be provided according to job characteristics and work styles, as Becker & Steel (1990) advocate with the concept of *"functional diversity"*. In fact, the significant diversities that have been scouted in the case studies suggest that, within the same office building, some job function groups may be assigned to enclosed private offices, while others to an Activity-Based Working environment, and some others again to a 'radical collocation' setting (Hua, 2010). The same could happen with the application of clean-desk policies versus the allowance of keeping territorial signs on the desks, as it is warned to be fundamental for certain jobs (Brown, 2009).
2. Then, a strong multi-disciplinarity characterizes the workplace-making process, which requires a match of several points of view. These, at the state-of-the-art, are represented by the organizational functions being involved in the process as 'active users', working in a cohesive manner in order to achieve a common major objective. However, a lack of integration and many gaps in communication were observed across all the life-cycle phases (initialization, planning and operation). Solutions should be developed to prevent this phenomenon. Maybe a workplace consultant, as suggested by Bell & Anderson (1999), could facilitate the cohesion of different roles and competences. Anyway, even a data analyst might be helpful to gather and interpret proper data about users' behaviors and needs. Should one be hired within every company to inform the whole process of workplace-making? Could this have something to do with the so-called 'experience manager', entitled to handle coworking spaces?

These latter questions push this research forth to investigate how all the abovementioned workplace users can integrate their respective roles and responsibilities, and match their respective values and needs.

4.8 Remarks

Phase I of this research has identified different workplace users, thus answering some of the initial research questions (**Table 4-18**).

a. In all, user categories involved at the supply side of the workplace-making process are users from 1 to 7. Users involved at the demand side of the workplace-making process correspond to categories from 8 to 11.
b. In order to understand how negotiations between the two sides are handled, more investigations are needed. First, it is useful to scout existing methods to this end and select the most appropriate one. Second, it is necessary to acknowledge emerging perspectives different users might have on the chosen method. Lastly, it is important to integrate different perspectives into a unitary system suitable to assist designers, managers, and users of the NGW.

Table 4-18. Phase I: Action plan

Q-1A: Who are the users involved in the workplace-making process?	*Q-1B: How is the negotiation between the 'demand side' and the 'supply side' handled?*	
Users in workplace-making	**Necessity for action**	**Object of action**
1. Owner, President, and CEO 2. Financial admin. 3. CREM 4. FM 5. HRM 6. Engineering and space planning 7. IT 8. Executives and managers 9. Employees 10. Consultants, collaborators, and internees 11. Customers and visitors	Choose methods to handle negotiations (a)	Performance measurement and management
	Acknowledge different perspectives on methods (b)	KPIs
	Integrate perspectives (c)	Users and indicators

These intentions will be pursued in the subsequent Phase II of the research.

5 PHASE II: Workplace Data - Analysis

"ANALYSIS IS THE ADMITTEDLY INDISPENSABLE ROAD TO OUR DESTINATION, BUT IT IS NO MORE THE DESTINATION THAN IT IS THE INTENTION TO BEGIN THE VOYAGE."

—STANLEY ROSEN, PROFESSOR EMERITUS AT BOSTON UNIVERSITY

WHY (AIM). Chapters 5, along with Chapter 6, develops Phase II of the research, namely elaborating on the data-side of the workplace. This second phase of investigation is split in two separate but complementary parts, through which an analytic-synthetic process is shaped. The analytic part (Chapter 5) consists of an in-depth study (de-composition) of the existing knowledge on workplace data. The synthetic part (Chapter 6) elaborates on the results gained through the analytic approach and builds new knowledge by applying a synthetic reasoning (re-composition).

WHAT (CONTENT). Through a literature review, Chapter 5 proposes a critical analysis of the state-of-the-art and practice on key performance indicators (KPI) that are applied in different workplace-related fields.

The ***introduction*** reflects on why evaluating impacts, managing performance and monitoring indicators make sense, especially in the case of office buildings. A lack of information integration emerges due to the traditional separation of disciplines. Indeed, different users might reveal distinct stakes on the workplace, which is part of dealing with today's diversity and complexity in the workplace.

Issues and questions arise with respect to data and indicators, on one hand, and users and processes, on the other.

The ***literature review*** critically analyses ***several approaches and perspectives*** on performance indicators related to the workplace. These belong to the organization development sphere, the facility management area, and the corporate real estate management field. Thus, ***several strategies and methods*** exist to address workplace performance investigations.

Despite the efforts undertaken by several scholars, ***gaps in the literature and opportunities for development*** in the field are traced, which translate into the objectives of this research stage.

Several indicators for workplace monitoring are thoroughly examined before scouting also ***several tools for workplace evaluation and rating***.

5.1 Introduction to workplace data

Today, many organizations recognize that their development strongly depends on the building they occupy (Lavy, et al., 2010a). This because physical environments have proved to enhance efficiency of an organization (Amaratunga, et al., 2000), increase people productivity and wellbeing (Augustin, 2014), and enable employees' engagement (Steelcase, 2014) and happiness (Puybaraud, 2017), to which business success is strongly related. That is why the main question most executives look for answering to is: *"How does my building impact my people?"* (Alker, et al., 2014, p. 3). Despite intensions, however, it is still uncommon among companies to be fully aware of how their property assets impact the success of their business, and to implement strategies for keeping those impacts under control. On one hand, often corporate leaders do not recognize the strategic potential of their workplaces and their real estate assets (Duffy, 2000; Lindholm & Leväinen, 2006). On the other hand, the variety of fields herewith implicated complicates the spectrum, and has discouraged research from an interdisciplinary strand (Fleming, 2004) and practice from establishing collaborative relationships (Duffy, 2000). As Appel-Meulenbroek (2014) observes, ergonomics, environmental psychology, facility management, logistics, engineering, sustainability and indoor environments are ideally all integrated into the background knowledge of the expertise on corporate real estate. Indeed, research to date in the area of workplace management comes from a broad range of disciplines such as architecture, real estate, sociology, psychology, education, and others, that would benefit from being integrated as a whole, as Kämpf-Dern & Konkol (2017) highlight.

This research aims at bringing together these various perspectives of inquiry, in order to better understand the potential of workplaces in supporting organizations' needs, and to improve workplace management.

The goal of the following part of the work is to acknowledge what workplace factors mainly affect businesses, including the physical and human dimensions. This approach requires embracing a holistic viewpoint, as a few authors stress (e.g. Fleming, 2004; Lavy, et al., 2010; and Bahr, et al., 2016).

Literature taken into consideration in this review concerns key performance indicators (KPIs) from both business and workplace management, with the end of creating the basis for a transdisciplinary reasoning.

KPIs are first analyzed and systematized. Subsequently they are condensed through the application of a Delphi technique. Eventually, this methodology produces a short list of indicators shared by all workplace users, as they have been defined in Phase I of the research.

The benefit herewith pursued is to provide decision-making processes and workspace strategies with a set of transdisciplinary key-indicators cross relating businesses, physical environments and people, that all workplace users value.

5.1.1 Evaluating impacts, managing performance, and monitoring indicators

Evaluating impacts is common practice in many different fields. Gertler et al. (2011) speculate on impact evaluation in policy making, discussing that development programs and policies are typically designed to produce a change in outcomes. These changes might be, for example, a rise in incomes, an improvement in learning, or a reduction in illnesses. Whether or not those objectives are achieved is a crucial question that is not often addressed. Program managers and policy makers pay attention on the initial inputs and immediate outputs (for instance, how much money is spent, or how many textbooks are distributed), whereas the assessment of the intended outcome (for instance, improving wellbeing) is still uncommon. Nevertheless, Gertler et al. (2011) observe a global trend towards a shift in focus from inputs and outputs, to outcomes and results. This shift is actually influencing the workplace sphere, as well. Here researchers have been working to conceptualize the general process of Value Adding Management (VAM) in a

framework (Jensen, et al., 2012; Jensen & van der Voordt, 2017). According to their model, the process develops with the following sequence of cause-effect relations: *"Input → Throughput → Output → Outcome = Impact = Added Value"*. A more simplified version of this model translates into: *"Intervention → Management → Added Value"*, or *"What → How → Why"* (Jensen & van der Voordt, 2017, pp. 11-12).

Changes and interventions include both product-related (for example, changing the physical environment) and process-related actions (for example, changes in the FM or CREM supply chain, or changing the interface with core business). Management corresponds to the in-between stage, where interventions are accompanied toward impacts and added value, through outputs and outcomes. This stage has the potential to maximize both efficiency and effectiveness. Management entails strategic alignment of the results with initial objectives, stakeholder management, and relationship management.

Results and outcomes have been increasingly used to enhance accountability, inform budget allocations, and guide decisions, in the broader framework of '**evidence-based decision-making**'.

In fact, all decisions based on evidence are made through judgments (some founded in politics, some in expertise), and *"performance measurement is an important aid for making judgements and decisions"* (Jensen & van der Voordt, 2017, p. 56). Thus, giving more informed judgments is a general necessity, from the policy scale to the building scale. Information on which to base judgements often come from performance measurement. According to Kämpf-Dern & Konkol (2017, p. 217): *"[…] performance is defined as the degree to which stated objectives are being achieved".* That is why performance measurement relies on 'appraisal systems'.

Appraisal systems can be used to evaluate building impacts. At the same time, they can contribute to controlling and managing building performances. In both cases, these systems support more informed judgments, from the policy/strategic scale to the building/operative scale. Judgements in general pass through a number of questions. Becker (1990) speculates on a few fundamental questions to be answered at the building scale:

> "Which buildings being considered are acceptable? Which buildings being considered are the most effective? Am I paying for things I do not need? Am I paying for things I am not getting? What modifications should I ask for? Which organizational subgroup should occupy a particular building (or part of it)? What should the purchase price or rental rate be? Which leases should be renewed or be allowed to expire? Which buildings should we sell or retain but lease? What should the term of the lease be? Which buildings most need renovation? What renovations are more cost effective? If we want to lease or sell, what market should we target?" (Becker, 1990, p. 263)

From this list of questions, it is evident that building appraisal does not have to do only with existing buildings, but also with the planning stages, and embraces a broad range of themes, from costs and flexibility, to change and occupant satisfaction. Appraisals are valuable for organizations both when they are shrinking and when they are expanding, when they are refurbishing and when they are building new, when they are divesting and when they are merging (Becker, 1990; Douglas, 1996).

In fact, performance measurement systems not only deliver information, but also drive execution, and help decision-making link to customer expectations toward quality outcomes (Jordan, et al., 2009). To this extent, Amaratunga and Baldry (2003) stress the necessity for transitioning from performance measurement to **performance management**. Indeed, they describe performance measurement as:

> […] a process of assessing the progress towards achieving pre-determined goals, including information on the efficiency with which resources are transformed into goods and services, the quality of those outputs and outcomes, and the effectiveness of organizational operations in terms of their specific contributions to organizational objectives. (Amaratunga & Baldry, 2003, p. 174)

Complementarily, performance management encompasses:

> […] the use of performance measurement information to effect positive change in organizational cultures, systems and processes, by helping to set agreed performance goals, allocating and prioritizing resources, informing managers either to confirm or change current policy or directions to meet those goals, and sharing results of performance in pursuing goals, thus emphasizing the relationship between the strategy and the measurement system. (Amaratunga & Baldry, 2003, p. 174)

Consequently, performance management bridges organizational strategy and measurement system.

Performance management must be grounded on 'evidence-based decision-making', hence it lies on monitoring and evaluation. To accomplish monitoring and evaluation, a core set of tools and indicators are provided to stakeholders. Gertler et al. (2011) define **'monitoring'** as the continuous process that tracks what is happening and uses the data collected to inform implementation, with the result of supporting day-to-day management and decisions. Monitoring tracks performances against expected results, allows for comparisons across programs, and analyzes trends over time. **'Evaluations'**, instead, are periodic and objective assessments of a planned, ongoing, or completed project/program/policy. They are used to answer specific questions related to design, implementation and results. While monitoring is carried out on a regular basis, evaluations happen at a discrete point in time, and often look for an external perspective from technical experts. Design, methods and cost for performing evaluations may vary substantially in relation to the type of question to be answered. **Indicators** should be used both to monitor program implementation and to evaluate results.

In sum, monitoring indicators, managing performance and evaluating impacts offer several benefits for (Lebas, 1995; Parker, 2000; Sinclair & Zairi, 1995):

- Driving decision-making;
- Recognizing/adding value;
- Supporting strategies;
- Informing stakeholders; and
- Easing communication between the parties.

All these benefits reflect in the design, management, and use of buildings.

However, indicators, methods, tools and techniques to this purpose are still underdeveloped, thus remain unused to their full potential of supporting evidence-based decision-making. Becker (1990) and Alker (2014) both lament this issue 25 years apart from each other, at least for what concerns office environments. McGregor (2000) foresees the future of workspace management as being based on measurement as well as on implementation. In fact, McDougall, et al. (2002) notice the worth of the recent interest toward continuous improvement, which encompasses using performance measurement systematically as a means to understanding buildings. Adding value to the business will happen not only by evaluating workplace performance, but especially by matching the findings with appropriate business metrics on a regular basis with a view to monitoring.

5.1.2 The case of office buildings and Key Performance Indicators

In the case of office buildings, managing performance through indicator monitoring and impact evaluation is functional to understand the extent to which physical spaces affect workers, and ultimately businesses (Lavy, et al., 2014b), hence they are vital practices to organizations (Amaratunga, et al., 2000).

Lindholm and Nenonen (2006) cite Oscar Wilde's words to remark the importance of assessing values for organizations: *"A fool is a man who knows the price of everything, and the value of nothing"* (Lindholm & Nenonen, 2006, p. 108). They demonstrate that being aware of how an office building performs is necessary to the core business management that takes place in that building, as well as to drive corporate real estate and workplace management strategies. In other words: *"What gets measured gets done"* (Varcoe, 1996, p. 46). The same idea is reiterated by Kämpf-Dern and Konkol (2017) stating that: *"To assess the quality of the actual and future workspace configuration with respect to its purpose – helping the organization to meet these goals and fulfill its mission – performance criteria and metrics of the workspace are necessary"* (Kämpf-Dern & Konkol, 2017, p. 212). Kaplan and Aronoff (1996) confirm that informed judgement is required when deciding on the quality of the workplace.

Indeed, the quality of office facilities should be evaluated for the extent to which they support the organization in reaching its mission and goals (Lavy, et al., 2010a). Who is responsible for office quality then? Lavy, et al. (2010a) declare that facility management (FM) is responsible for dealing with built assets by gauging their effectiveness in supporting organizations. To do so, FM managers need to understand the current assets' conditions, therefore to control building performances. According to Kämpf-Dern & Konkol (2017), building performances related to the workplace can be defined as 'the relationship between forecasted and executed work'.

Facility performance measurement practices range from benchmarking, critical success factors (CSF), post-occupancy evaluations (POE), to balanced scorecard (BSC), business excellence model (BEM), and Key Performance Indicators (KPI). BSC, BEM and KPI are the most diffused practices both in facility management and in the construction sector (Meng & Minogue, 2011).

According to Lavy et al. (2014b), KPIs have the advantage of being comprehensive, offering the opportunity for selecting the performance metrics of interest from time-to-time, and eventually helping management make strategic decisions. The execution of this method assesses the overall performance toward an organization's mission. Thus, it addresses issues related to the premises or facilities owned by the company, their current conditions, new facilities or services required to achieve company's goals, matters to be handled, and the potential results of investment decisions.

In fact, interest and practice in systematically measuring building performances date back to the 1960s-1970s, and evolved together with the professionalization of corporate real estate management (Krumm, 2001) and facility management (RICS, 2013; Duffy, 2000). Several measurement practices do exist, but have not been commonly applied among companies, yet. This, partially, is because not many firms do formulate a proper corporate real estate strategy (Lindholm & Leväinen, 2006). In addition, even when a real estate strategy is set in place, this has only a weak link, or no link at all with the overall business strategy (Lindholm & Leväinen, 2006). Consequently, although facility performances get measured, they cannot be effectively used to manage real estate assets towards the goal to boost the whole organization's performance.

In a recent survey conducted by Jones Lang LaSalle (JLL), 52% of real estate executives is reported saying that *"the lack of data and analytics to measure value and generate insights holds them back from enhancing strategic value-add to their organizations."* (JLL, 2017a). The current state of the practice is affected by several other drawbacks: traditional real estate metrics are considered inadequate across a complex real estate portfolio; stakeholders are demanding, but often not familiar with metrics and results; and executives have to choose among a large variety of data points to gauge performance (JLL, 2017a).

In conclusion, it is evident that, even though a few practices exist and some data are collected with the aim to manage workplace environments and set corporate real estate strategies, these seem inefficient and ineffective. This because indicators frequently appear outdated, disconnected from stakeholders and dispersed. It follows that, if appropriately systematized, KPIs could better support organizations to driving asset, property and facility management strategies. Making the implementation of KPIs a common practice is considered useful for the full deployment of workplaces' potential.

Also, there is still a need for going beyond mere quantitative data, and identify value-adding elements for organizations. More reliable data can be obtained by developing corporate real estate management (CREM) in close connection with information and communication technologies (ICT) management, human resources (HR) and workplace managements, as Lindholm and Nenonen (2006) encourage.

5.1.3 A lack of integration

Kaplan and Aronoff (1996) highlight the increasing complexity of the work world. The difficulty of managing an overwhelming knowledge load progressively led to delegation and separation of the roles.

> When organizations were small, the head of the organization was able to know virtually all the information needed to run the business. As organizations grew and became more complex, a single individual could not carry the entire knowledge load. Managers and specialists were added to the organization […] (Kaplan & Aronoff, 1996, p. 9).

This dynamic have probably generated the dispersion affecting today's knowledge across different corporate departments. In addition, often this dispersion is difficult to manage because many buildings rely on weakly developed control and communication interfaces (Leaman & Bordass, 1993). Indeed, data are generally retained by different departments according to their respective stakes, and so kept separate. Each department has its own focus and lexicon (Jordan, et al., 2009). Chief Executive Officers (CEOs) look at growth and competitive advantage, checking for incremental revenue, speed-to-market, etc. Chief Financial Officers (CFOs) keep costs and financial impacts under control, observing Return On Investment (ROI), occupancy costs, lease flexibility, and so ever. Chief Operating Officers (COOs) are in change for the operational efficiency, therefore look at schedules, work order productivity, and space utilization. Facility Managers (FMs) deal with the building itself, with their physical features and related complaints. Human Resources Mangers (HRMs) take care of workers attitudes, retention and attraction, absenteeism, medical costs, and so on. All these data are rarely cross-checked among those responsible for data gathering, nor *"shared widely within organizations and almost certainly not evaluated against the kinds of spaces workers occupy"* (Alker, et al., 2014, p. 62). This attests that a more holistic approach is missing (Lavy, et al., 2010b).

Appel-Meulenbroek (2014) cites a survey from 2008 questioning 59 leading organizations about the relationship between CREM and other business functions (Bouri, et al., 2008). Results showed that only 40% of the respondents collaborated with HR, IT and finance on a regular basis.

On the contrary, performance measurement systems should boost integration between various areas of the business (Amaratunga & Baldry, 2003).

In the opinion of Amaratunga and Baldry (2003), key responsibility of FM is exactly to support the integration between core business needs and other departments within the core organization. Integration, indeed, depends on the quality of the information system, which can be addressed thanks to the adoption of an effective and efficient performance measurement framework. They state that *"choosing appropriate approaches to performance measurement for the needs of the organization, implementing them systematically, and evaluating their impacts are some of the processes that managers have to grapple with while being under increasing pressure to deliver optimum performance."* (Amaratunga & Baldry, 2003, p.

173). Most of all, performance measurement systems need to be dynamic, thus sensitive and flexible to changes in the organization. Indeed, McGregor (2000) warns that what strongly differentiates today's work and work processes from the past is the nature, extent and speed of change that is going to even increase in the future.

In all, workplace indicators tend to remain split under different domains, which slows down their ability to evolve in parallel with organizational changes. Simultaneously, there is a need for better aligning real estate and business strategies, especially in today's complex panorama, when new ways of working, new workers and new technologies are reshaping the workplace day-by-day (Ciaramella, 2016). Systematizing a list of valuable indicators represents a first step towards enhancing the usefulness of existing data and dovetailing real estate performances to business strategies.

5.1.4 Relevance of the research in the context of the new ways of working

Innovation in workplace design, together with globalization, the power of the service economy, and advancements in technology create threats and opportunities for companies to evaluate how their offices fit into their strategic plans (Lindholm & Leväinen, 2006).

Douglas (1996) recognizes that office buildings are complex physical environments, becoming more dynamic over time in both usage and character. If the complexity of office buildings was evident already 20 years ago at Douglas' times, today's workplaces are going through an even more disruptive complexification. As Kämpf-Dern & Konkol (2017) remind, organizations nowadays manage a much more complex work environment compared to decades ago. Indeed, contemporary work environments are made of several factors that need to be kept under control and properly managed, namely culture, spaces, people, and technology, that are broadly represented in Chapter 3.

Phase I of the present research highlights how **new ways of working** have risen rapidly in the past few years. On one hand, work changed in modality: work environments have become increasingly virtual (Lindholm & Nenonen, 2006) because people can do their job remotely (Mannheimer, 2011). People use offices on an as-needed basis (Slumbers, 2017), and 'location-independent' companies are becoming more and more numerous (Sias, 2017). On the other hand, work changed in nature: communicating, collaborating, contemplating and concentrating are the main activities keeping today's workers busy (Methodos, DEGW, & Partners4Innovation, 2015). Beside traditional individual tasks that are still required, collective and collaborative activities have gained importance (Kaplan & Aronoff, 1996). All forms of collaborative communication are nowadays encouraged in the office environment (Partners4Innovation, 2015b), with the goal to engage people and stimulate innovation. Offices are asked to host a variety of collaborative activities, each of them fitting different spaces. Formal collaboration searches for traditional bookable rooms; informal collaboration, when no privacy is indispensable, can happen in causal locations; remote collaboration, such as long-distance meetings, require the support of special ICT devices (Vertino, 2014).

In such a context, traditional office buildings cannot fully support the new ways of working anymore, which require much more agility. Virtualization and the social dimension of work have been affecting workplace strategies and the physical characteristics of the office space. That is why some of the indicators usually adopted by organizations might have different relevance today, and it may be worth to consider revising them, replacing them and/or introducing new ones.

In this respect, JLL (2017a) contends that **changing business environments and new trends in the workplace and workforce** lead to the need for innovative metrics. Traditional metrics still provide a

foundation to start. Though, indicators such as 'total portfolio size' or 'total operating cost' seem not enough anymore, and are worth to be combined with non-traditional metrics. JLL (2017a) suggests, for instance, 'user experience' or 'employee health and wellbeing' as emerging metrics to look at for an organization to evolve.

Also, Phase I of the present research confirms that today's workplaces are populated by a variety of **users**. The panel of stakeholders is more complex than the one characterizing traditional office buildings. Puybaraud (2017) emphasizes that an optimal user experience creates value for employees, colleagues, customers, visitors, other stakeholders, and the company's brand. Thus, indicators representing different user on the workplace are likely to help attune the facility with all their respective needs.

In addition, people in general are more sensitive to the physical environment they live in, and become more and more demanding with regard to the quality of spaces and services they use. Research undertaken by Morgan Lovell surveying 2,000 UK office workers attests that most employees believe the design of their workplace supports their physical wellbeing (MorganLovell, 2014). Both El-Zeiny (2012) and Lindholm et al. (2006) report a study carried out by the American Society of Interior Designers – ASID, which shows that the physical workplace is the third most important factor, after compensation and benefits, in the decision to accept or leave a job (American Society of Interior Designers, 1999). In the survey, 41% of US workers declare the office physical environment would influence their decision to accept or leave a job position. Especially Millennials, in comparison to the previous generations, have higher expectations about workplace quality, and how and where they work (Miller, et al., 2014, p. 101). Hence, taking care of user perceptions and satisfaction in the workplace is fundamental in today's context, since it has to do with attraction and retention of the knowledge workers' talents (Vertino, 2014).

Finally, yet importantly, comes the **technology** component. Kämpf-Dern & Konkol (2017) remind that the new work environment cannot find any 'best technological solution', rather it is built up as part of a specific corporate ICT strategy.

Technology has enabled the inception of the new ways of working. At the same time, technology is also an important facilitator in data collection and analysis, but it seems like this kind of application has not displayed its full potential in the built environment, yet. Fleming (2004) points out that information technology enhances the opportunity for selecting and collecting data on performance indicator variables. Nowadays, Big Data and the Internet of Things (IoT) are broadening the horizons of data production and interpretation. The potential aid of the information-communication technology is worth being taken into account in the workplace as well, since it might ease the data gathering process, by making it more affordable, and to produce advanced knowledge, by enabling innovative insights. However, a couple of threats are associated with the disruptive power to today's technology, as Jordan, et al. (2009) point out.

One pitfall concerns mistaking measurement for technology, given the contemporary availability of elaborate technological infrastructures. Performance measurement is sometimes interpreted as a mere technical matter, rather than a communication process. Instead, performance measurements serve the continuous dialogue that leads to better service delivery, by understanding what to measure in order to assess the related critical issues (Jordan, et al., 2009). Kaplan and Aronoff (1996) echo this idea when stating that simple access to greater volumes and higher speed of information does not necessarily increase the ability of comprehension, thinking and decision-making.

A second pitfall has to do with the extreme complexity of today's businesses that translates into an overwhelming number of variables to be tracked, analyzed and adjusted. Jordan, et al. (2009) warn that

more information can easily be confused with better information. This erroneous association of ideas leads executives to crowding a large amount of data onto a scorecard, which falls out in over-reporting. On the contrary, giving complex ideas the appearance of simplicity should be the result. That is why the simplicity of a performance measurement system is a fundamental requirement in order to manage today's complexity.

This confirms the central role of the human contribution, beside the rise of automation and robotics (JLL, 2017b). Artificial Intelligence and other forms of automated technology are likely to replace some jobs, while the role of humans will be elevated becoming more and more critical in managing automated systems.

To conclude, a key to simplify the complexity of today's work environments is advantageous.

5.1.5 What stake do users hold in workplaces?

Chapter 4 showed how workplaces interest multiple users. Their diverse perspectives can be recognized as it is briefly recapped in this paragraph.

On one hand, executives, employees, collaborators, and visitors represent the demand side, whereas owners and users in charge of building operation (also defined as active users) represent the supply side.

Top executives care about workplace impacts in terms of productivity and added value to their business. Kämpf-Dern and Konkol (2017) declare that corporate workspace initiatives aim at maximizing the business performance, which depends on employees' performance both at an individual and a team scale. They are well aware that 82% of business costs flow into salaries (Young, 2017), so that companies are interested in assuring that their workers can make their best out of their workplaces. They theoretically look for indicators that can explain to what extent office layout and design boosts or decreases productivity, for example by affecting concentration, collaboration, confidentiality, creativity, and engagement.

A large debate is dedicated to the employees. Alker, et al. (2014) indeed claim that offices influence not only employees' productivity, but also their health, and wellbeing. The office physical environment is made up of several factors, which are likely to affect primarily the health of its occupiers (MorganLovell, 2014). Health is an important element in defining wellbeing, summed up with other perceptual factors. Indeed, human wellbeing can be social, physical and psychological (Appel-Meulenbroek & Feijts, 2007). Health and the three components of wellbeing are together compounding elements of occupant's productivity, which is related to the financial implications for each organization.

It is also important to remark that visitors and collaborators, who occasionally use the workplace, concur to business performance. As Puybaraud (2017) suggests, the spaces impact the impression an organization gives not only to its employees, but also to visitors. At the same time, the spaces not only improve its own employees' quality of life, but also collaborators' efficiency. She emphasizes that an optimal user experience creates value for employees, colleagues, customers, visitors, other stakeholders and the company's brand.

Owners, Presidents and CEOs who own and/or manage the business are interested in assuring that the real estate asset concurs to maximize their wealth (Lindholm, et al., 2006).

Users in charge of building operation, also defined as active users, want the buildings they take care of to function at their best. Building performance is their primary mission and core business. By ensuring that the office building is aligned to business needs, they produce value added for the company (Lindholm & Leväinen, 2006).

5.1.6 The challenge of mastering diversity and complexity

Someone could contend that every building and every organization are different, especially nowadays, so that every assessment should be done on a case-by-case basis. For example, Kämpf-Dern & Konkol (2017) assert that relevant working performance measures should be defined by each individual company or business function, or in cross-corporate workshops. Lavy et al. (2014c) remark that key indicators are usually chosen according to different criteria: (a) the type of users (typically facility manager, executive level management, etc.); (b) the nature of the organization (private or public); (c) the focus of the assessment (e.g. financial, functional, physical); and (d) industry trends.

Conversely, Becker (1990) observes that, when buildings are constructed for particular purposes and at a certain time in history, they tend to have many similarities, or at least they apply similar design strategies. Hence, overall they are likely to look at and check for the same performance indicators. Organizations do change over time, and that is why it is important for assessment tools to be treating departments, divisions or other organizational units with a sufficient level of detail. The categorization of workplace users provided in the previous phase of the research allows the acknowledgement of them, to capture their needs and to relate them to the physical environment.

Hinks and McNay (1999) as well raise an issue concerning the supposed impracticability of creating a singular and comprehensive set of generally applicable performance indicators. That is why the same authors elaborate a set of key metrics that they define as *"a bespoke list of performance indicators (and definitions) for a bespoke application"* (Hinks & McNay, 1999, p. 36). However, the same authors emphasize the high weight of culture and contemporary themes in the definition of KPIs, which recalls Becker's (1990) observation. At the time of their research, for example, energy efficiency was a popular company-wide theme, so that in their model the corresponding KPI resulted in harmony with the company policy, but this is liable to change over time. Consequently, they point out that *"KPIs are contemporary by their very nature, and so need to be maintained and updated"* (Hinks & McNay, 1999, p. 36). That is why proposing a set of indicators that aims at addressing the matters of today's workplace users seems a valuable effort, since some deficiencies in existing performance measurement systems and metrics have been detected.

Moreover, Hinks and McNay (1999) comment on their own model criticizing the exclusion of a broader matter as the 'effectiveness of the environment as a whole', in favor of focusing exclusively on a particular environmental issue, namely the energy performance. Nowadays the importance of the physical environment as a whole is largely recognized, whose strong evidence is demonstrated through the abovementioned literature (e.g. Amaratunga, et al., 2000; Augustin, 2014; Steelcase, 2014; Puybaraud, 2017). Thus, within the present study the attempt is to address the workplace environment in a holistic perspective as a unitary system.

Finally, the same Hinks and McNay (1999) noticed the group of FM experts involved in the investigation being unable to reflect the high-level core business planning perspectives. They say the problem may be mitigated thanks to the involvement of a larger and more diverse group membership, which is the panel of users the present research aims at targeting. While contrasting with the approach applied by Hinks and McNay (1999), Alker, et al. (2014) assert that investigations should be carried out independently from the objective or drivers that differentiate each organization and make it a unique case of analysis. In general, these authors, within the World Green Building Council (WGBC), encourage the set in place of a process, which can lead to more data collection, by more businesses, in more common ways. By doing so, they propose a number of possible survey questions that each company can draw from. A similar strategy is undertaken also in the context of the present research.

5.2 Issues and questions

The literature suggests that organizations already accumulate a variety of data about their businesses, their workers and their buildings; though existing data and indicators often suffer from the following common problems:

- Information is dispersed in different departments (Jordan, et al., 2009);
- Different indicators tend to remain disconnected (Alker, et al., 2014);
- The number of performance metrics is very large, therefore suggesting that something is not working well in the current use of performance indicators (Lavy, et al., 2010a);
- Many of them are collected only occasionally or ad-hoc, and anyway not on a regular basis. For example, medical and physical complaints tend to be detected when POEs are carried out. In any case, organizations have a proclivity for measuring changes in health, wellbeing and productivity only when they plan a move/refurbishment or a major change (Alker, et al., 2014);
- They lack geo-positioning (Hua, et al., 2014), thus they cannot be related to the physical dimension of the workplace, which instead is crucial to the definition of their impacts on the organizations' business. Technology nowadays would be able to ease this refinement; and
- They are gathered with inappropriate tools, which incurs in lack of precision, inconsistency, wastefulness of time and resources, and so on (Zhou, Work in progress).

Even though a lack of systematic collection and matching makes the usefulness of existing indicators somehow limited, many data are already in the hands of companies. Becker (1990) confirms that *"The secret, if there is one, is analyzing and interpreting in an imaginative and purposeful way the data that are routinely collected, something that sadly is all too seldom done."* A different way of thinking and approaching these information would probably be enough to gain more knowledge, without any additional extra, expensive data capture. Becker (1990) endorses using existing measures, or slightly modifying them to fit their new purpose, is a good way to start a performance profile assessment. Jordan et al. (2009) reiterate this statement by arguing that *"reliable measurement can often stem from simple data collection tools, periodic sampling and anecdotal input."* (Jordan, et al., 2009, p. 110)

In light of these considerations, the main questions to be answered are the following, with respect both to:

Data/indicators:

- *Which indicators are relevant and must be monitored?*
- *How can relevant indicators be matched, in order to obtain useful insights for enhancing workplace performance?*

Users/process:

- *Who manages workplace performance indicators?*
- *What workplace users hold an interest in workplace performance and the related KPIs?*

The final goal is to provide all users who hold a stake on workplaces, as defined in Chapter 4, with a system of key performance indicators that can support them in designing, managing and using their workplaces, with a holistic approach.

This goal is addressed through subsequent steps of analysis, as listed below:

1. Literature review on the main disciplinary areas providing key performance indicators for workplace management (i.e. organization management, facility management, and corporate real estate management);
2. Literature review on the strategies and methods therewith applied to investigating indicators for workplace management;
3. Critical analysis of the gaps in the literature and opportunities for advancements in the field;
4. In-depth examination of several lists of indicators for workplace monitoring;
5. In-depth examination of several tools for workplace evaluation and rating;
6. A proposal for organizing indicators by classes of impact;
7. Selection of a short list of indicators important to all workplace users (as defined in Phase I), through a Delphi method; and
8. Construction of a system of indicators based on their relevance to different workplace users with a holistic perspective.

It is important to point out that the system of performance indicators being outlined in the present work is not intended to substitute the other management scorecards, dashboards and tools, which are being widely applied in the professional sector. Those will remain extremely valuable to the different disciplines involved in the process of workplace-making. In fact, whereas real estate, facilities, human resources, office administration teams, etc. may have their own internal achievements and programs for operations and self-management – goals that require their own monitoring – only metrics tied to common objectives trigger access and interest to the strategy table, as Jordan et al. (2009) suggest.

The KPI system proposed in this research is meant to allow all the different workplace users to better communicate with each other through the design, management and use of their spaces for work.

5.3 Literature review: Several approaches and perspectives

Data gathering and performance assessment can be undertaken by different stakeholders/users and therefore reflect different perspectives. Consequently, different types of performance indicators exist, which relate to the workplace to different extents.

The author suggests that two main perspectives to performance management can be recognized. A supply side and a demand side emerge, based on the categorization of workplace users proposed in the previous phase of the research (**Chapter 4**). Each side carries its own interests in the premises and in its functioning. Therefore, different points of view are worth to be compared and, if possible, matched. This match would allow for better communication between the parties, along with the set in place of a common strategy toward shared objectives.

5.3.1 The demand side perspective: organizations

Organizations' interest in the workplace is most of the time represented by senior executives. Executives stand at the demand side of the workplace-making process because they run the business occupying office buildings, thus make use of premises and services provided by the supply side.

Kaplan and Aronoff (1996) talk about work settings for knowledge work and conclude that it is left to senior executives to believe in the benefits of improved productivity through upgrading office quality, especially when measurable business value of the work environment is missing. Kaplan and Norton (1996) deeply look at the problem of current performance measurement systems from the point of view of organizations and their senior executives.

Kaplan and Norton (1992) believe company's executives are aware that measurement systems can strongly affect the behavior of managers and employees. They note that companies master skills and competencies, which require the adoption of a different approach, namely to balance financial and operational measures. That is why in the 1990s Kaplan and Norton elaborated the so-called *"Balanced Scorecard (BSC)".* The BSC offers a set of measures to give top managers a synthetic and comprehensive snapshot of their business, including both financial and operational measures. This approach translates the company's strategy into specific measurable objectives, useful to both guiding current performance, and pursuing prospective strategic goals (Kaplan & Norton, 1996). Rather than a simplistic measurement system, the Scorecard is presented as a management system. The Scorecard looks at the business from four perspectives: customer, internal, learning and growth, and financial. Each perspective comprehends a number of main goals. Each of those goals correspond to a few critical 'measures' that can be defined as indicators of performance.

Kaplan and Norton's approach is still well known and widely diffused as a performance measurement practice. It was innovative at that time because it sought to represent different points of view, each of which has the same weight on the overall organization's performance. Indeed, the involvement of senior managers, besides financial controllers and finance presidents or vice-presidents, was found to be necessary in the implementation of the Scorecard. Moreover, the BSC constitutes an important milestone in switching companies' culture from focusing on control to focusing on vision and strategy, and from measurement to management. Kaplan and Norton (1996) then recognize that an information system including financial and nonfinancial measures is useful to senior executives for setting long-term drivers, on one hand, and to front-line employees for understanding the consequences of their actions, on the other. Finally, Kaplan and Norton's Balanced Scorecard approach hints at the importance of user perceptions, both external and internal, respectively tied to the 'customer' and the 'internal business process' dimensions.

Anyway, the scorecard approach reveals several shortcomings, especially if applied in the modern corporate environment (Khomba, 2015). Meng and Minogue (2011) mention the insufficiency of four perspectives that led future BSC-related models to expand them. In particular, the BSC does not take into any account the physical environment where the business takes place.

Miller, et al. (2014) report an interview with Mabel Casey, vice-president at Haworth,[16] who laments that business leaders are not prepared to consider work environments:

> No program, school, or magazine has prepared business leaders to handle the decisions that need to be made regarding employee work environments. And certainly, there is little discussion on how to manage employee feedback about the decisions that are made. In that void, financial measures have become the only tool to make decisions regarding space. Using just financial lens to make decisions regarding where your valuable personnel spend so much of their time is a narrow, underdeveloped thought process. (Miller, et al., 2014, p. 107)

Brackertz and Kenley (2002) try to overcome this deficiency through the development of a Service Balanced Scorecard (SBS) that is deliberately applied to property. In their SBS, facilities' performances are evaluated based on four perspectives: services, community, building, and financial. However, this model has been applied only on the properties of local government authorities, even though the authors foresee its potential to be implemented also in the corporate environment. In any case, in this model the overall evaluation of how well a facility performs depends strongly on a weighting that needs to be attributed to each of the four perspectives composing the SBS. This weighting is demanded to the senior management of the authority, which can theoretically attach a low weight to the building component, if it does not perceive its strategic relevance.

Alker et al. (2014), within the World Green Building Council (WGBC), propose an innovative approach to performance assessment from a demand-driven perspective, which focuses on the impacts of the physical environment on business. They provide a framework for building owners, occupiers and their advisors to start tracking the impacts of buildings on employee health, wellbeing and productivity, in order to use that information in financial decision-making. Their framework is comprehensive of three main types of metrics: financial/organizational, physical, and perceptual.

Chwalbińska-Kusek & Olszewska (2015) acknowledge the framework proposed by the WGBC and try to adapt it in the peculiar context of the Polish market. Their analysis makes it evident how geographical context matters. Context, indeed, can significantly affect the feasibility of this kind of processes, and influence the collection of the related metrics and indicators.

All these authors identify the organizations goals for their own business, and they look for the right workplace to reach these goals. At the same time, also who provides the premises and services to them carries some stakes in the same workplace. How does the organization's perspective combine with the supply side of workplace-making?

Interestingly, Lavy et al. (2010a) contend that KPIs most of the time are ranked differently from a business perspective (i.e. the demand side) and from a facility management perspective (i.e. the supply side). Nevertheless, they report that at the Facility Management Association Ideaction 2001 Conference in Melbourne, Australia, it came out how the two perspectives match each other in ranking customer satisfaction indicators on top of the list. This result emphasizes the possibility and opportunity to join the

[16] Haworth is a company (located in Michigan, USA) that designs and manufactures adaptable workspaces.

demand-driven and the supply-driven approaches toward a unified performance measurement system, suitable to make the two perspectives converge.

5.3.2 The supply side perspective: FM

Most commonly workplace performance assessment is in the charge of the property and facility management area. Not without reason, Haynes (2007) remarks that Duffy attributes to facilities managers the responsibility for creating office environments that meet organizational requirements. Based on the first definition of FM provided by the European standard, this discipline consists of *"the integration of processes […] to maintain and develop […] services which support and improve the effectiveness of its primary activities"* (CEN, 2006). This is totally coherent with Duffy's beliefs. Thus, the main FM focus is *"on supporting workplaces, the development of working environments, and the delivery of services such as reception, catering, cleaning and ICT"* (Jensen & van der Voordt, 2017, p. 15).

Lavy, et al. (2014c) remind FM operators that the process of facilities performance measurement encompasses the review of previous and current building performances, and the comparison of those within the same organization and across similar ones. The first step in this process should consist in identifying Key Performance Indicators (KPIs). The same authors point out that, even if a reference list of KPIs already exists to evaluate building performances, this must be improved for at least three main reasons (Lavy, et al., 2010a). First, the list is too extensive and many indicators are not relevant, measurable, quantifiable or broadly applicable. Secondly, a lack of proper categorization is hampering frequent and widespread application of performance metrics. Third, a holistic overture on facility performance measurement is still sadly missing.

The prevalent attitude towards only a partial point of view is lamented already by Fleming (2004), who reports that common methods adopt a number of only technical performance indicators. The same author states that methods adopted in this field tend to rely on a positivist approach, most of the time employing parametric measures (Fleming, 2004).

Amaratunga and Baldry (2003) highlight that performance measurement, *per se*, shows what happened, but does not give enough information on why it happened, and neither how the organization should react to that happening. Hence, they claim the need to transition from performance measurement to performance management, as also Kaplan and Norton (1996) claim from the organizational side. In effect, facilities measures are typically based on costs per unit, being it area or occupants within the building. Cost measures anyway have an intrinsic deficiency, namely they do not explain the reason underneath the measure's behavior. For instance, an increase in the occupancy density is likely to generate an increase in the unit area cost measure. This can be mistakenly interpreted as a fall in performance achievements, if not accurately balanced with the overall improvements in efficiency (Varcoe, 1996).

This lesson teaches that cost measurements must be contextualized and balanced thanks to different metrics and different contributions. In order to do so, Varcoe (1996) emphasizes the technique of *"a moment of truth"* (Varcoe, 1996, p. 50), which consists of interfacing the facilities function with the organization's external customers.

In the words of Varcoe (1996)**,** there are three fundamental facilities performance criteria all measures must relate to: customer satisfaction, flexibility and productivity. The corresponding measures, at an

operational level, have to do with factors such as quality, delivery, cycle time and waste. Thus they embrace multiple aspects.

Core performance indicators should indeed represent not only financial aspects, but also business and organization goals, job satisfaction, work environment, environmental issues, and other non-financial qualitative aspects (Lavy, et al., 2010a). Therefore, Lavy et al. (2010, 2014a, 2014b) propose a new framework for categorization of significant Key Performance Indicators, while stressing the necessity for further research. The goal should be to narrow down a list of valid, applicable and easily measurable indicators, suitable to support facility management practitioners.

Lavy et al. (2010a) initially cluster facility management performance indicators according to criteria of scope and intent. The aim is to show their interrelationships, and to facilitate the analysis of the reciprocal impacts they may have on one another. The study is conducted through a questionnaire, which results in a list of major indicators (35) tied to four categories: financial, functional, physical and survey-based.

The so-called ‘financial’ category collects all cost-related metrics, including operation and maintenance, energy, building functions, real estate, plants, etc. These represent performance in terms of currency expenses per unit (being it area, person, output/product). Indicators reporting operational performance of a facility or organization are grouped as 'functional’ or ‘physical’. ‘Functional’ metrics express the way the building functions through space utilization and adequacy, occupants productivity, parking, etc. ‘Physical’ indicators describe the physical conditions of the facility, such as how well the building supports the actual function, the quality of the space, its accessibility, and resource consumption. This latter category comprehends both quantitative and qualitative metrics. Some other measures resulted being qualitative in nature, unquantifiable, or based on subjective opinions. Those latter indicators are defined as ‘survey-based’, as they are usually gathered through the submission of questionnaires.

Except for the inclusion of a wide variety of aspects in the final list, it is remarkable that Lavy et al. (2010a) involve a wide range of building users among questionnaire respondents: occupants, full- and part-time employees, transient occupants like customers or visitors, and/or any other potential respondents, as required by the survey purpose.

In subsequent studies (Lavy et al., 2014a, 2014b), the authors end up summarizing the initial 35 indicators into six core KPIs. Four of them are quantifiable: Condition Index, Replacement Efficiency Indicator, Maintenance Efficiency Indicator, and Functional Index. The additional two qualitative indicators capture indoor/outdoor environmental quality and user perceptions.

Speaking of user perceptions, in the context of a behavioral approach to facilities management, Fleming (2004) declares that the perceptions of the participants in an environment are more relevant than the observations of non-participant observers. In line with this statement, Becker (1990) declares that involving end-users within the workplace design and briefing phases is likely to enhance their overall perceptions afterwards. In fact, among other outcomes, their involvement will influence directly the amount and quality of information based on which the workplace project is going to be developed (by non-participant observers).

Tucker and Smith (2008) explore the fundamental importance of user perceptions when applied within facilities management. They affirm that, to some extent, perception may be more significant than reality. Hence, user perceptions have an important role as a dimension to contemporary FM performance measurement systems, both for stimulating reaction to changes, and for learning and growth (Tucker & Smith, 2008). In particular, Tucker and Smith (2008) argue that user perceptions can be used for a twofold

scope: (a) deriving inputs to be applied in the workplace environment, toward the achievement of workplace functionality and productivity; and (b) extracting feedbacks to drive strategic FM delivery, toward the enhancement of customer satisfaction.

With regard to the first scope, i.e. informing the workplace environment, the authors remind how satisfaction with the working environment has a positive effect on complaints, absenteeism, productivity, job satisfaction, and people's psychology. User perceptions of the workplace is affected by different elements, such as personal control, privacy, interior planting (positive distractions), personalization, color, and windows and lighting (Tucker & Smith, 2008).

With regard to the second scope, i.e. driving FM delivery process, Tucker and Smith (2008) emphasize that perception data are a valuable complementary source to measuring FM performances. First, involving users might diffuse a better understanding of the function of FM, and how it can strategically add value. Then, user inputs are useful to align the actual quality of service delivery with customer expectations. Finally, the authors propose a "*Logical Customer Performance Ladder – LCPL*" that maps the theoretical process to achieve successful FM delivery and collimate it with the organization's goals (**Figure 5-1**).

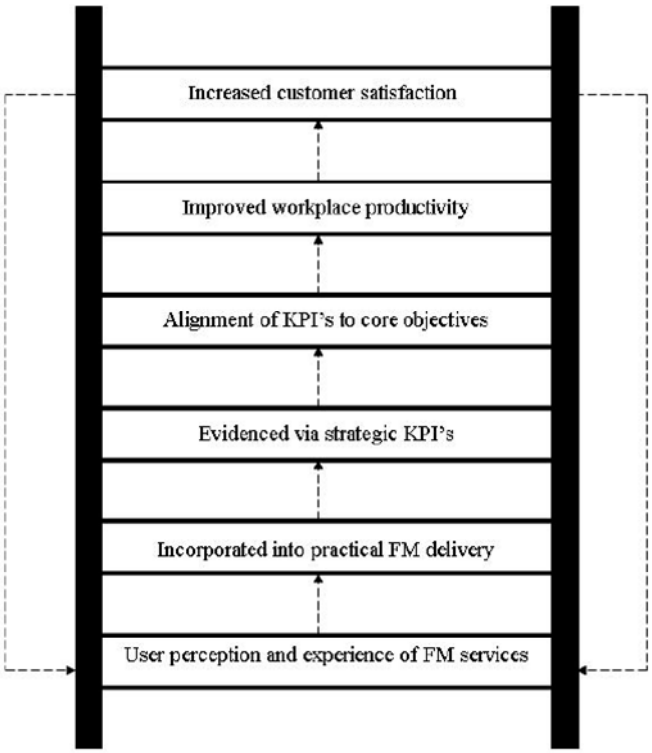

Figure 5-1. Logical Customer Performance Ladder – LCPL [Figure 7] (Tucker & Smith, 2008)

Facilities management, to this extent, functions as an *"interface between the physical workplace environment and the occupiers or participants of that workplace"* (Fleming, 2004, p. 38).

Fleming (2004) asserts that occupiers' perceptions are required to be considered as key performance indicators, in order to encourage a holistic approach to FM performance assessment. Studies show that perceptions of the performance and importance of FM services differ between the employees (FM team)

and the customers (users), bolstering the importance of establishing a shared set of performance indicators where possible misalignments can be noticed.

Hinks and McNay (1999) pursue exactly the objective of harmonizing FM operational efficiency with customer's performance priorities. Towards this goal, they realize the need for a bespoke set of KPIs suitable to overcome the main flaw of FM performance measurement, which is in their words *"the lack of generalized sets of data or industry-wide sets of KPIs"* (Hinks & McNay, 1999, p. 32).

5.3.3 The supply side perspective: CREM

Corporate real estate management (CREM) consists of aligning real estate portfolios to the corporation's (or public authority's) core business objectives (Dewulf, et al., 2000). Rather than taking care exclusively of the best possible return on investment in the short and long term, which is typical of real estate management from an investor's point of view, CREM looks at the interests of shareholders and stakeholders at a strategic, tactical and operational level (Jensen, et al., 2013). The real estate in these terms is intended to provide added value for the business and to contribute to the same organization's overall performance. Thus, CREM deals with *"acquisition, the development of real estate and the management of buildings-in-use"* (Jensen & van der Voordt, 2017, p. 15).

As such, the Corporate Real Estate function manages on average 10% of the business' overall cost base, so that CREM has been entitled to developing performance measures suitable to communicate the real estate performance to business executives (Calder & McPherson, 2007). Calder and PcPherson (2007) explicitly point out a few drawbacks of these indicators: (a) they typically express financial metrics; (b) they are strictly limited to the interest of the sector (i.e. CRE), rather than focusing on a business approach; (c) they refer to local or international benchmarks for 'CRE sector best practices', which are not related to business goals; and (d) they generally lag business need by at least a decade.

According to Krumm (2001), CREM departments should be those paying attention to matters of real estate from a business perspective. Krumm (2001) declares that often these departments suffer from a limited perspective, only focusing on operational efficiency. He proposes for CREM to embrace a four perspective approach on managing corporate real estate. This encompasses: general management, asset management, facility management, and cost control. He foresees the role of a 'corporate knowledge center', being that of coordinating external contributions of service providers with internal alignment of resources and capabilities.

Lindholm and Nenonen (2006) discuss a conceptual framework of performance measurement tools from the point of view of Corporate Real Estate Management. They report the BSC as the most widely diffused approach also in corporate real estate management. Here, it can be used in two ways: either individual CREM measures are part of a company-wide BSC, or CREM has its own BSC system. Anyway, they agree with Krumm (2001) by thinking that, traditionally, CREM's approach to performances stands from an operational efficiency perspective.

To some extent, CREM's focus overlaps with the facilities management approach. Indeed, corporate real estate managers and facilities planners/managers are both interested in factors such as operating costs, costs per square foot/meter and maintenance cost. Whereas FM is supposed to cover more operative aspects, CREM is expected to take a strategic sight. However, the abovementioned factors express the cost of doing business, rather than the related value adding opportunities, as Lindholm and Nenonen (2006)

remark. That is to say, they do not convey the impacts of buildings and workplaces on productivity, processes, customer satisfaction and organizational learning.

On the contrary, the greatest potential for value creation arises when real estate leaders focus on those key areas of the supply chain where their teams can make the difference, as stated by Jordan et al. (2009). Therefore, good performance measurement systems must create a direct link between CRE goals and stakeholder interest (Jordan, et al., 2009). Accordingly, CEO's strategic objectives find a direct line of sight with real estate expectations (**Figure 5-2**). For example, incremental revenue generation corresponds to store openings, business continuity depends on facilities' reliability, time to market is supported by process cycle times, and cost management is attained through performance to benchmarks. Jordan et al. (2009) propose a six-step performance measurement process, to help keep this link alive by focusing priorities and communicating missions. Their attempt ends up in a narrow set of relevant metrics that capture and communicate the strategic significance of real estate activities to business.

Industry	Business objective	Real estate implication	Metric
Retail	Speed to market	Rapid store construction	Cycle time
Healthcare	Superior patient care	Matching exam room supply to patient demand	Exam room utilization
High tech	Access to strong engineering labor	Site locations in favorable labor markets	Percentage of sites with favorable demographics
Pharmaceutical/ biotechnology	Product development cycle times	Workplace to improve team collaboration	Space flexibility

Figure 5-2. Scorecard example [Table II] (Jordan, et al., 2009, p. 111)

Similarly, Lindholm & Leväinen (2006) propose a set of corporate real estate management components, which are suitable to create added value to the organizations' core business. The framework they finally establish is supposed to help CREM better identify the ways property supports the core business performance, as well as better communicate this value to corporate decision makers (**Figure 5-3**).

The underlying assumption indicates that CREM deserves to be involved in a broader corporate strategy, by demonstrating how the property addresses organization's objectives, i.e. efficiency, productivity, customer satisfaction, and so on.

> Workplaces are the "last mile" of the real estate space market and CRE executives want practical research tools that ultimately help them demonstrate how to manage CRE as a strategic resource (Brown, 2008, p. 24).

Unfortunately, the impact of a workplace that increases morale, satisfaction and productivity remains often unmeasured or anyway unattributed to real estate decisions. Thus, from that broader framework, Lindholm & Leväinen (2006) derive a performance measurement system suitable to assessing the value each strategy adds to the firm (**Figure 5-3**).[17] The system aims at balancing financial and non-financial measures, with

[17] The first model of relationship of corporate real estate strategies to core business strategy (Figure 5-3) has been slightly revised in a more recent contribution by Gibler & Lindholm. In the latter model, seven levels (instead of the previous six) define the real estate strategy level: increasing the value of organization's real estate assets; promoting

measures that express the stakeholders' needs. In the end, the authors list a few potential measures to evaluate the effectiveness of the real estate strategies in corporate strategic processes. 'Percentage of CREM employees indicating strong understanding of how their jobs fit into attaining corporate objectives', 'CREM communication with top executives', and 'CREM involved in corporate strategic planning' are some of the suggested measures. Among them, 'CREM integrated with other functional strategies (HR, IT, etc.)' seems to be particularly relevant to the present dissertation, since it highlights the importance of matching the corporate real estate contribution with other areas of the business.

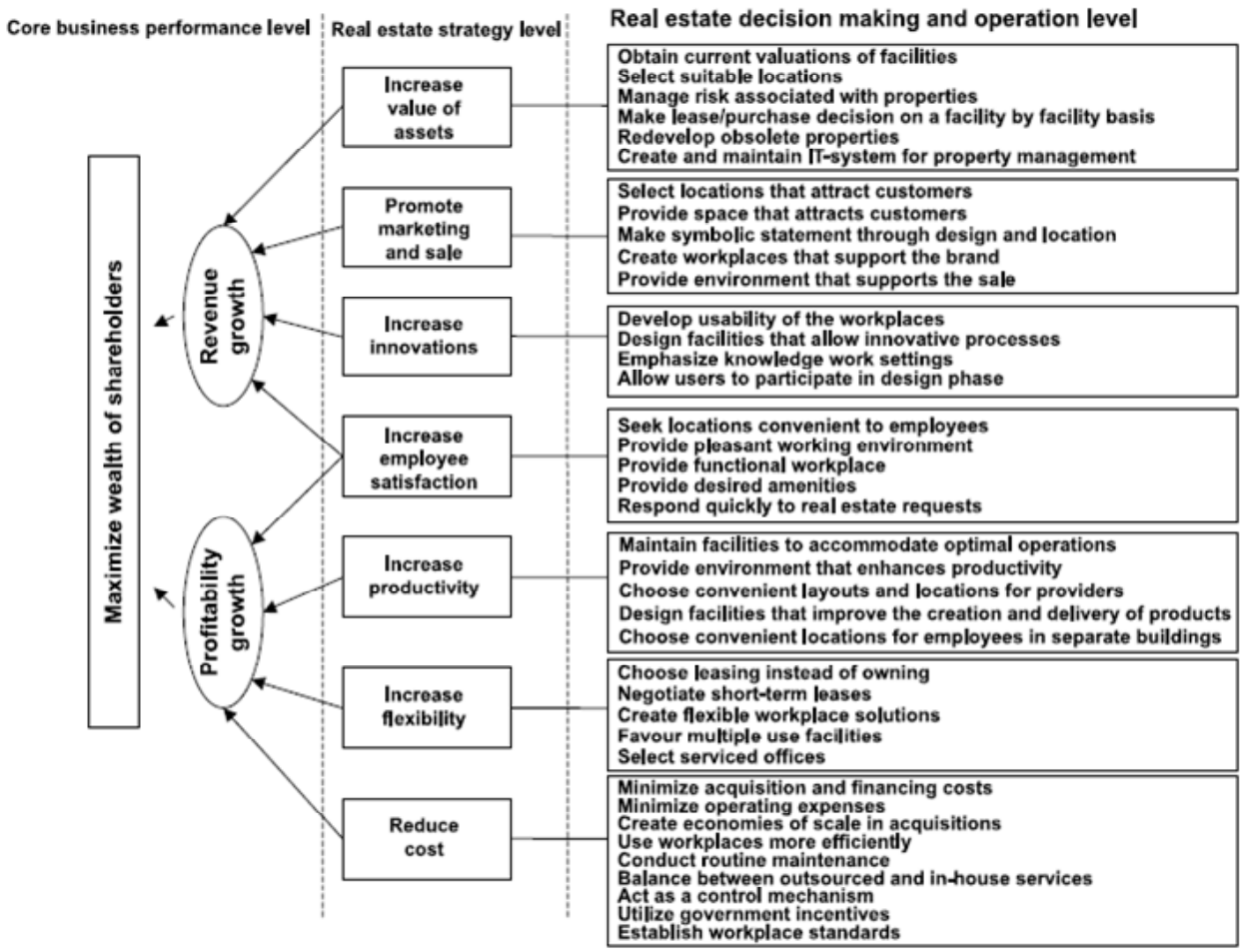

Figure 5-3. How real estate decisions support strategies and core objectives [Figure 2] (Lindholm & Leväinen, 2006, p. 42)

In effect, nowadays CREM is asked to demonstrate how property decisions impact on companies' core business and how the workplace can better support it (Lindholm & Nenonen, 2006). From this perspective, performance can be defined as the ability of CREM to support business success. Therefore, performance measures should derive directly from every organization's goals and strategies. That is one of the reasons why CREM performance measures appear so fragmented and there is no one right measure or method that fits all the organizations. What Lindholm and Nenonen (2006) try to do is then to draw a toolbox of

marketing, sales and organizational brand; encouraging and supporting employee innovation and creativity; supporting environmental sustainability (not existing in the first model); enhancing employee wellbeing and satisfaction ; increasing employee efficiency and productivity; enabling flexibility; and reducing real estate related costs.

different CREM performance measurement methods. From that framework, corporate real estate and workplace managers should be able to pick the tools/techniques/practices that best suit their individual needs.

Lindholm and Nenonen's investigation (2006) describes a context where organizations do make use of strategic performance management. In most cases, this strategic management system seems to be based on a balanced scorecard approach, as the one proposed by Kaplan and Norton (1996), (see Chapter 5.3.1).

Anyway, firms tend to adopt a number of individual measures, rather than a proper, comprehensive measurement system. Typically, those individual measures represent only one aspect of CREM, being it financial, technical, or organizational, and are spread in multiple indicators. On the contrary, the strategic level of the organization would benefit from a synthetic set of effective indicators.

Then, most firms focus on indicators like space efficiency (space per employee), cost reduction (cost per square meter) and capital minimization to measure profitability, and from those drive decisions on property management (Lindholm & Leväinen, 2006). Nevertheless, real estate management can contribute also to enhance revenues and other soft, qualitative factors that underpin organizations' success.

5.3.4 Comments on the different perspectives

As it emerges from the introductory section of this chapter, contributions on the topic of performance management come from different disciplines, which can span from policy making, business management, and organizational ecology, to corporate real estate management and facility management.

Within the workplace domain, two perspectives are currently predominant, reflecting respectively the demand side and the supply side of the workplace-making process. On the demand side, the organization, represented by its senior executives, is looking for maximizing the effectiveness of its business through the positive outcomes of the physical environment. On the supply side, two complementary forces devote their efforts to gaining this result: facility management deals with maintenance and development of the properties and services that are necessary to boost the business; corporate real estate management takes care of the alignments of properties and services with business objectives.

In the end, the shared goal of these three different actors consists of producing added value and managing the overall organization's performance. All these disciplines have applied strategies and methods in order to enhance performance management, which commonly encompass the identification of a number of relevant performance indicators to be controlled over time.

These findings from the literature support the idea of involving the demand side in the workplace-making process not only as a passive receiver/user of premises and services, but as an active stakeholder able to express its own values and performance priorities. A 'democratization' of workplace-making can start from outlining a list of performance measures agreed by all the stakeholders involved in the workplace-making process. These include owners, financial administration, corporate real estate managers, facility managers, engineering and space planners, IT operators, top managers, employees, collaborators, and visitors, as defined in the previous chapter of the dissertation.

5.4 Literature review: Several strategies and methods

Academic contributions on the topic of performance management and indicators come from different disciplines. This thesis specifically focuses on business management, corporate real estate management, and facility management. Scouting of the methods and techniques generally applied for undertaking research in this field supports:

- The selection of the most appropriate methods and techniques for developing the present investigation; and
- The definition of the characteristics and number of the metrics to be identified by the system proposed with this research.

5.4.1 Literature review: Methodologies

Across all the disciplines, common research methods adopted in the field initially encompass broad searches of current literature, namely papers from peer-reviewed journals, conference proceedings, books, and other relevant sources. From the collection and systematization of this corpus of information it is then possible to create new knowledge, as stated by Lavy et al. (2010a) and by Swanson (1986).

Subsequent to the literature review and collection of long lists of metrics, authors try to narrow down the lists, usually through the submission of questionnaires, interviews or focus groups to selected stakeholders.

Before performing questionnaires or interviews, it might be important to check for the comprehensibility of the investigative instrument that is going to be applied. For instance, the Center of the Built Environment at the University of California, Berkley tested their IEQ survey prior to submission, by carrying out a 'cognitive interviewing method'. The method verifies how well the respondents can understand and report answers to survey questions (Zagreus, et al., 2004).[18] The researchers combine two different techniques: 'concurrent think aloud' and paraphrasing. By the first technique, interviewee are asked to comment out loud on anything crossing their mind while filling out the questionnaire. By the second technique, the same respondents have to explain in their own words the survey questions. Overall, 7 people are involved in their survey testing.

After verifying the efficacy of the investigative instrument, submission can be performed according to different methods.

Kaplan and Norton (1996) recommend performing interviews with executives and workshops with top and middle managers, in order to build each company's scorecard. The first has the purpose of receiving inputs on the company's objectives and proposals for measures, the second aims at verifying the first hints and developing an implementation program.

Lindholm and Nenonen (2006) review a number of published works on performance measurements and models before conducting a series of interviews with corporate real estate executives to examine their approach to measuring performance. They involve 26 executives from a variety of industries and in different countries, which is important to balance the final results of their dissertation.

[18] See: Eisenhower, D. (2000) Documentation of the Results of the Cognitive Testing for the CBE Post Occupancy Evaluation Survey, Report to the Center for the Built Environment, Survey, Research Center, Berkeley, CA, University of California.

Similarly, Lavy et al. (2010a) administer a brief survey (two open questions) to eleven representatives from the facility management industry, in order to verify the validity of the categorization they propose. In a subsequent phase of their study, they further discuss their findings with industry representatives, in order to check for: (a) redundancy; (b) availability of data; (c) ease of data collection; (d) ease of interpretation; (e) relevance to K-12 school facilities; and (f) issues that can be controlled by a facility manager.[19] The process led to narrowing down the list of indicators to a reasonable number of key measures (Lavy, et al., 2014b).

Within their process for developing a framework of potential metrics, Alker, et al. (2014) conduct interviews and focus groups with numerous professionals. Thanks to this first phase they list around 40 possible health, wellbeing and productivity outcome metrics. Some narrowing down is undertaken in order to: (a) reduce the number of metrics, (b) ease feasibility, and (c) allow for applicability to as many types of businesses as possible. In the end, they compile a list of seven outcome metrics, which are relatively easy to measure and have a significant impact on business (Alker, et al., 2014, p. 61). Their work constitutes the basis for Chwalbińska-Kusek and Olszewska's (2015) white paper, which proposes a new framework for measuring organizational outcomes to be applied in the Polish market. In order to adapt Alker, et al.'s (2014) framework, Chwalbińska-Kusek and Olszewska's (2015) organize some workshops with a panel of professional experts from different areas, including human resources, marketing, building services engineering, architecture, acoustics, BREEAM and LEED certification.

Some authors employ a Delphi method (Linstone & Turoff, 1975). For example, a Delphi is used by Becker and his collaborators in the development of the ORBIT[20] rating process (Becker, 1990). Hinks and McNay (1999) adopt the same type of study to extrapolate a bespoke set of KPIs for facilities management performance assessment. They describe the method as a consultative research technique, designed to merge different opinions where there is a lack of agreed knowledge. This approach is considered particularly suitable to involving a range of viewpoints, in order to identify the consensus view (Linstone & Turoff, 1975; Hinks & McNay, 1999). Helmer (1987) confirms that convergence of opinions should be expected through the application of a Delphi approach.

Hinks & McNay (1999) recount the application of the Delphi method in sufficient detail to make it possible to replicate it for extracting different sets of bespoke performance indicators. They involve eight experts, who represent members of the premises FM department (in-house), and their internal customers in equal number. Questionnaires, scenario workshops and group discussions are used in combination, making sure to first collect individual opinions anonymously and then to open the group discussion to establish consensus. The investigative process addresses three complimentary goals:

1. Ranking. The group is submitted a questionnaire to rank and weight a list of key performance indicators. The initial list is populated by the researchers from a range of academic and other sources. Then, the group discusses as a whole and agrees on a shortlist of KPIs;
2. Prioritization. Again using a questionnaire, followed by a group discussion session; and
3. Populating the model. The FM performance of the premises departments is assessed against the new list of KPIs.

The process consists of subsequent phases of analysis:

[19] Particularly (e) and (f) are not relevant to the present study.

[20] The Office Buildings and Information Technology (ORBIT) studies were carried out in two separate stages, in the 1983 and the 1985. Led by DEGW, the aim of the studies was to identify the impact of the new technologies on office design.

a. Structured group interviews to familiarize with the organizational culture and the FM operating environment;
b. 1:1 structured interviews with each senior manager to understand their current performance assessment techniques and understand their level of satisfaction with them;
c. Literature review to identify whether existing sets of performance indicators or performance assessment tools could be adapted;
d. List of 172 indicators assembled from literature in a deliberately arbitrary manner in order to avoid leading the group. The list contains also several similar indicators to choose from. It is also possible to add indicators in case the list is omitting some. The questionnaire asks for each proposed indicator if it is essential, only desirable, or of tertiary level importance. Only the essential ones are taken forward. The requirement for selection is also that the indicators should be of mutual interest. The ones considered of local interest should be discarded (and then potentially treated internally by separate departments);
e. Two draft short lists are created for discussion, based on the number of 'essential' status votes they receive:
    - A list of 59 indicators, with all those indicators which attracted four (out of eight) or more 'essential' votes; and
    - A list of 30 indicators, with all those which attracted five (out of eight) or more 'essential' votes;
f. The list of 59 items is considered too long for a manageable tool. Further work is carried out on the shorter list, then. Through discussion, any KPI can be removed by group agreement or imported from the longest list if deemed sufficiently important;
g. Finally, a list of 23 KPIs is considered comprehensive and ready to be put into practice as a tool;
h. The group is asked to prioritize the 23 KPIs. Each individual anonymously gives a grade from 0 to 10 to each KPI. This prioritization indicates a drift from strategic policy issues at the top, to operational/detailed matters at the bottom; and
i. The last phase consists in rating the FM actual performance.

Hinks & McNay (1999) report this consultation indicating that the definition of KPIs tends to be particularized to the own business context the participants belong to.

This comment strengthens the importance of involving all the stakeholders to assure a holistic approach. Also, with the objective of obtaining a set of KPIs that can be useful for external benchmarking purposes, it seems useful to get together organizations belonging to different business industries.

In the end, researches aim at testing the final list of performance indicators.

Strategies widely applied for testing performance metrics encompass either laboratory-based studies, or office-based studies (Alker, et al., 2014). To date, new opportunities are offered by portable and wearable technologies, which are likely to allow for real-time field-studies.

Hinks & McNay (1999) engage the same group involved throughout the whole Delphi study in rating the FM actual performance using the short list of KPIs just obtained.

Jones Lang LaSalle (JLL, 2017a) suggests that, after shortlisting a few KPIs, real estate executives may want to check on their impact on the organization. This can be done both by assessing them within the internal management team, and outside the company's leadership team, for example against best practices across their same industry or even a different industry. JLL (2017a) remarks that impacts can regard corporate social responsibility programs and community impacts, as well as sustainability programs related to energy use.

Alker, et al. (2014) test their framework with HR professionals. This way they verify that many organizations already do collect some data, and those that are not collecting them yet are inclined to engage in the gathering soon.

This attitude confirms that a framework to draw from is likely to be the right tool for organizations. Those willing to understand more about the impact of their premises on their occupants and businesses will be able to manage it appropriately, thanks to the appropriate users appointed to manage it.

5.4.2 Characteristics of performance indicators

Literature suggests a number of requirements any good set of indicators must satisfy (**Table 5-1**).

JLL (2017a) recommends the articulation of metrics according to the theory of *"simplexity"*, a concept corresponding to the combination of things that are simple and complex at the same time. This will assure that metrics are impactful, comprehensible and easy to communicate.

Varcoe (1996) reminds that buildings, like occupiers, are rarely alike. Each organization is likely to use a building in its peculiar way. Consequently, performance measures/indicators should be sufficiently representative of *"common measures of buildings"*, in order to allow for inter-organization and market sector comparisons. Moreover, he states that, as a general principle, executives must keep in mind that only those measures that are of importance are worthwhile analyzing. Importance and, thus, attention are given merely to measures demonstrated to be convenient and easy to obtain.

Becker (1990) lists a number of characteristics that any good performance system is expected to satisfy. In particular, these measures should:

- Have meaning for the organization and the decision makers;
- Be accessible, reliable, valid and easy to analyze;
- Represent a broad range of the type of performance, including cost, maintenance, employee satisfaction, ease of relocations, and security;
- Be comparable with different buildings and different time frames; and
- Linkable to the organization's other databases.

Lindholm & Leväinen (2006) state that individual measures should be:

- Valid (represent what is intended to be measured);
- Reliable (provide consistent results);
- Practical (economical, convenient and interpretable); and
- Relevant (valuable and useful).

Gertler et al. (2011) remark that it is useful to engage program stakeholders in selecting the key indicators, and suggest the *"SMART"* rule of thumb to ensure that indicators are:

- Specific, to measure the information as closely as possible;
- Measurable, to ensure that the information can be readily obtained;
- Attributable, to assure that each measure is linked to some specific project efforts;
- Realistic, to make sure data are obtained in a timely fashion, with the appropriate frequency and at a reasonable cost; and
- Targeted, to the objective population.

Table 5-1. Literature review on the characteristics of performance indicators

Characteristic	Definition	Source
Meaningful	For the organization and the decision makers	(Becker, 1990)
Properly categorized	According to its practical meaning to the industry	(Douglas, 1996) (Lavy, et al., 2014b)
Relevant	Valuable and useful	(Lindholm & Leväinen, 2006)
Targeted	To the objective population	(Gertler, et al., 2011)
Reliable	Provide consistent results	(Becker, 1990) (Lindholm & Leväinen, 2006)
Realistic	To make sure data are obtained in a timely fashion, with the appropriate frequency and at a reasonable cost	(Gertler, et al., 2011)
Valid	Represents what is intended to be measured	(Becker, 1990) (Lindholm & Leväinen, 2006)
Measurable	To ensure that the information can be readily obtained Feasible under current industry practice	(Gertler, et al., 2011) (Lavy, et al., 2014b) (Chwalbińska-Kusek & Olszewska, 2015)
Practical	Accessible, easy to measure and analyze	(Becker, 1990) (Lindholm & Leväinen, 2006) (Alker, et al., 2014) (JLL, 2017a)
Convenient	Economic, Low cost of measure Seldom requires additional cost or resources	(Alker, et al., 2014) (Chwalbińska-Kusek & Olszewska, 2015)
Specific	Measure the information as closely as possible	(Gertler, et al., 2011)
Attributable	To assure that each measure is linked to some specific project efforts, and corresponds to decisions on facility performance	(Gertler, et al., 2011)
Suitable for internal benchmarking	Comparable with different buildings, different time frames (within the same company/corporation)	(Becker, 1990)
Suitable for external benchmarking	Applicable in a broad range of buildings/projects and across business/industry types	(Lavy, et al., 2014b) (Alker, et al., 2014) (JLL, 2017a)
Holistic	Suitable to cover overall performance, including organizational goals, cost, maintenance, job/employee satisfaction, work environment, environmental issues, ease of relocation, security, and non-financial qualitative aspects	(Becker, 1990) (Lavy, et al., 2014b)
Minimized	A list of a few indicators that express more aspects of performance assessment A streamlined number of key metrics	(Hinks & McNay, 1999) (Jordan, et al., 2009) (Lavy, et al., 2014b) (JLL, 2017a)
Timely *	Have a short manifestation time	(Alker, et al., 2014)
Interoperable *	Linkable to the organization's other databases	(Becker, 1990)
Self-performable *	Possibility to be carried out by building occupants Without the aid of external experts	(Alker, et al., 2014)
Financially impactful	Direct financial impact to business *	(Alker, et al., 2014)
Socially impactful *	Direct social impact to represent the corporate social responsibility, or community impact	(JLL, 2017a)
Environmentally impactful *	Direct return on company's sustainability programs and energy use	(JLL, 2017a)
Transparent *	Immediately graspable/understandable by all the stakeholders * The way it is written, verbalized and visualized makes it easily comprehensible	(JLL, 2017a)
Certifiable *	Allows for certifications (LEED, The Great Place to Work, etc.) *	

** Items or definitions added by the author*

Referring to Lavy et al. (2010a; 2014b), improved performance metrics, which researchers have been trying to sum up, should respect the following criteria:

- Applicability in a broad range of buildings/projects, with only slight modifications;
- Measurability, that is to say that KPIs should be directly interpretable toward decision-making and quantitatively measure the impacts of the corresponding decisions on facility performance;
- Holistic approach, suitable to cover facilities overall performance, including organizational goals, job satisfaction, work environment, environmental issues, and non-financial qualitative aspects;

- Proper categorization, based on practicality, which reflects meaning to the industry and encourages their use; and
- Minimization, which consists in a condensed list of a few key indicators that express more aspects of performance assessment.

According to Alker, et al. (2014, p. 60) the data that will be selected in the end must be verified, at least, against the following characteristics:

- Applicability across business types;
- Ease of measurement;
- Ease of relation to building features;
- Cost to measure;
- Financial impact to business;
- Possibility to be carried out by building occupants;
- Manifestation time – i.e. how long it takes for the metric to appear.

The latter, i.e. 'manifestation time', is a point of major interest in today's context of the big-data stream (IBM, 2012). Research mentions biases that occur due to 'availability heuristic' (Tversky & Kahneman, 1973), which embraces two ideas. First, individuals have been found to assess probabilities based on their familiarity with a certain task, idea, or environment (Hardin, 1999). Second, their perception is influenced by specific memorable situations (Folkes, 1988). To some extent, those two concepts raise doubts about the reliability of traditional survey instruments, such as questionnaires and interviews, as methods to collect soft performance measurement data (Hinks & McNay, 1999), i.e. perceptions. The weakness here lies upon the fact that a consistent time gap occurs between the moment when events happen and the moment when questions are asked about those events. This time gap leaves room for elaboration, distortion of memories, and evaluations around probabilities. Nowadays a slightly different kind of data could be gathered thanks to apps (the hospitality sector might teach something to real estate) or sensors (face-recognition, etc.) in real-time, thus trying to get rid of some of the bias.

This suggests to verify if KPIs fit with the data framework proposed in **Phase 0**.

Also, 'comparability with benchmarks' would be convenient to give organizations a sense of where they are placed among companies from the same business industry, the same geographical area, etc. as Becker (1990) asserts. This would allow them to set strategies for talent attraction and retention.

This encourages the establishment of a set that is not bespoke, but applicable cross-sector and cross-company.

In addition, the possibility for measurements to be carried out by building occupants might enhance involvement and engagement. To this extent, it is important for these metrics to be immediately understandable by all the stakeholders. This would help keep them informed and updated, by allowing all the parties to better communicate to each other. Thus, a more self-controlled behavior by the end-users, being aware of the impacts of their attitudes, could be enabled. Indeed, it has been proved that building occupants are inclined to be more tolerant when they understand the intentions behind green design (Leaman & Bordass, 2007).

This supports the opportunity for involving a broad panel of workplace users in KPI selection and management.

In the end, with regard to the number of KPIs, different opinions emerge. Hinks and McNay (1999) try to respect some parameters as suggested by literature, thus state that the ideal number of KPIs should be kept around 10 measures, within a range between seven and 12. Other references affirm that there must be not more than four to six indicators, tied to maximum five or six business objectives (Jordan, et al., 2009). In any case, authors generally agree on the fact that a few metrics are better than too many, for clarity and impact (Jordan, et al., 2009).

This warning leads to the necessity for further reducing existing KPIs into a short list of just the most appropriate ones.

On the whole, the characteristics required for good performance indicators are more than a few. It is possible grouping some of them under the same definition, as in the **Table 5-1**. Some characteristics are more practical, referring to the 'feasibility' of the metric, such as those referring to practicality, convenience, interoperability. Others are more theoretical, referring to the meaning and significance of the metric, such as those addressing categorization, and relevance.

It is clear that not all these characteristics can be verified at the same time. On the contrary, when seeking for developing a system of performance indicators, it is necessary to proceed in a step-by-step manner. One way to extrapolate some key characteristics may be to start from the more general/theoretical issues to the more practical/operative ones. However, the aim of the present research is not to go through all these characteristics for the mere goal of comprehensiveness, rather to address the most significant ones linked to its specific objectives. Thus, only a limited number of these characteristics is worth to be taken into consideration in the following steps.

According to the abovementioned issues and goals (**Chapter 5.2**), the present work proceeds with the aim to:

- Organizing indicators by classes of impact;
- Selecting a short list of indicators important to all workplace users; and
- Constructing a system of indicators based on their relevance to different workplace users with a holistic perspective.

Consequently, the KPI characteristics that can be considered as coherent and feasible when liked to these aims appear as follows:

a. Holistic approach;
b. Minimization;
c. Transparency;
d. Meaningfulness;
e. Proper categorization;
f. Social, environmental, and financial impact;
g. Measurability; and
h. Suitability for internal and external benchmarking.

5.5 Gaps in literature and opportunities for development

Despite the long lists of characteristics that are required for good performance indicators, authors elaborating on the topic of workplace performance assessment find many shortages affecting existing approaches to performance measurement.

Common deficiencies, pinpointed by either the demand side or the supply side, can be summarized as follows:

- Lists of indicators are generally too extensive (Hinks & McNay, 1999; Jordan, 2009; Lavy, 2010a);
- Indicators lack of proper categorization (Lavy, et al., 2014c);
- Indicators often reflect a partial point of view, for instance they focus on only technical performances (Fleming, 2004), they are based on cost per unit (Amaratunga & Baldry, 2003; Fleming, 2004; Lavy, et al., 2014), or they are unbalanced toward financial metrics (Brackertz & Kenley, 2002; Calder & McPherson, 2007; Miller, et al., 2014);
- Performance measurement suffers from a positivist approach leading to the collection of only parametric indicators (Fleming, 2004), or individual measures rather than a comprehensive measurement system (Lindholm & Nenonen, 2006);
- Common metrics tend to be purely descriptive, focusing on inputs/outputs and documenting starts and completions, rather than assessing intermediate stages (Jordan, et al., 2009);
- Indicators do not privilege user perceptions as an important dimension (Becker, 1990; Tucker & Smith, 2008);
- Indicators are seldom of qualitative/soft nature, whereas the tendency is to convert them in quantifiable data, thus generating more complexities (Lavy, et al., 2010a);
- Indicators tend not to express value adding opportunities (Lindholm & Nenonen, 2006); and
- There is a need for a holistic overture (Lavy, 2014b; Fleming, 2004; Varcoe, 1996; Hinks & McNay, 1999).

These shortcomings in the literature are reported by several authors, who make important efforts to bridge these gaps. In particular some of them, by the application of the abovementioned strategies and methods, propose specific lists of metrics or indicators to apply for performance management. However, their dissertations still leave some room for improvement, which corresponds to opportunities for the present research.

- Becker (1990):
    - His perspective is predominantly supply side driven. Indeed, among the individuals who should be involved to help identify the FM performance profile, he lists: senior management, user group managers and facility management.
    - According to Hinks and McNay (1999), Becker's tool lacks of: ranking, weighting, and prioritizing the indicators; comparing customers and suppliers viewpoints; multi-method measurements (only a single semi-quantitative scale is outlined in the source); and a dynamic, long-lasting approach, whereas proposing only a *"summative or snapshot application"* (Hinks & McNay, 1999, p. 34).
- Kaplan and Norton (1996):
    - Describe several of tailor-made scorecards for different companies, and list a number of recurring indicators which brings all of them together; however, these lack the internal business perspective.
    - Integrate multiple perspectives, but do not acknowledge a specific role for the workplace or physical environment in their system of indicators.
- Hinks and McNay (1999):

    - Stick to the facility management area, which might be not directly linked with the corporate strategic planning process, as the same authors admit (Hinks & McNay, 1999). This gap is caused by participant's selection that included only representatives from the premises department, who are not directly involved in corporate strategies. By words of the same authors *"This should be improved by the use of a larger and more hierarchically-diverse group membership"* (Hinks & McNay, 1999, p. 39).
    - Provide a bespoke set of indicators derived from and developed for a particular application.
- Lindholm and Nenonen (2006), and Lindholm and Levainen (2006) rely on the same extensive research:
    - Focus on CREM performance measurement methods and their impact on firm's strategy, by elaborating a list of BSC components specifically for corporate real estate management. As the same authors suggest, it would be important to put together reliable data for connecting CREM with HR and ICT management.
    - Interviewees are all real estate corporate executives, which is coherent with their research goals, but of course do not allow for an interdisciplinary overview.
    - Despite the large number of companies involved (26 firms interviewed), they are concentrated in Anglo-Saxon countries (USA and UK) and Northern European countries (The Netherlands and Finland), whereas the southern European context might show some peculiarities, and different results.
- Jordan, et al. (2009):
    - Adopt a supply-chain perspective from CREM to customers, even if in the proposed operational dashboard mention transaction management, facility management, project management, account management, occupancy planning, and lease administration.
    - Do not clarify in practice who the 'customer' of CREM service is. The authors include in a broad customer audience *"all important stakeholder groups"* (Jordan, et al., 2009, p. 108) without adding further detail.
- Lavy et al. (2010, 2014a, 2014b):
    - Stress the importance of a holistic approach, but their categorization purposely reflects the demand of the facility management industry providing the service, thus a supply side approach.
    - Declare to discuss performance evaluation from the point of view of the user/client, but do not specify what this means in practice. Especially, they underline the difference between customer-related metrics, focused on outputs, and provider-related metrics, focused on the process. However, they do not develop this argument further.
    - Aim at listing key indicators that are applicable to a broad range of buildings and facilities, thus they lack in specificity about the office environment. In particular, they talk about educational buildings (K-12 schools).
- Alker et al. (2014):
    - Do not give much information on which users at the supply and the demand side are involved in the first place in gathering specific indicators, but stick to a general overview.
    - Is particularly detailed for what concerns financial/organizational metrics and physical metrics, whereas it reserves a broader look at perceptual metrics.
- Chwalbińska-Kusek & Olszewska (2015):
    - Is intended for use of the business community to manage the relations with investors, business leaders, tenants and real estate agents. However considerations of users remain at a general level.
    - Verify the applicability of global solution to the local Polish market, thus show the peculiarities of that context.

- Focus on green buildings thus privileging the physical metrics, and financial/organizational metrics, over the perceptual ones.

In conclusion, many authors elaborate on performance assessment offering several viewpoints with their analyses.

Indicators, metrics and measurements presented by different authors tend to overlap toward the same goal of incorporating building performance. Several of them exist to evaluate various aspects of buildings, which mainly regard CREM, FM, and business. Most of the time, though, these authors propose an in-depth analysis of just one aspect of the expected outcomes, while missing integration.

Also, many of them tend to focus on financial aspects, which is often taken as a proxy for the overall organization's performance, rather than incorporating business goals and people satisfaction.

Then, none of these studies come from a southern European country, which might reflect a peculiar angle on workplace performance.

Finally, users are taken into consideration in various ways, not always with the due scrupulousness and awareness. A predominantly supply-driven perspective reveals, in the sense that the demand side of the workplace tends to be flattened into one macro-category. This is a common approach affecting the contemporary real estate and construction market in general. Anyways, the type of users involved in the studies influences the selection of the most adequate performance measures. In fact, providers and customers of services/facilities choose metrics that reflect their respective objectives and expectations. The formers are more focused on outputs, whereas the latter tend to look at the process. That is why it is important that all users agree upon a few selected measures to control for.

Consequently, this study proposes to:

a. Verify to what extent approaches from different authors overlap on one another, which will be sought in-depth examination of indicators and tools in the literature;
b. Understand what is the best balance between different aspects of the workplace, with a holistic approach, which will come out of a qualitative research approach;
c. Offer a southern European angle on the topic which will emerge after analysis; and
d. Acknowledge and involve all the different users that hold an interest in the workplace that is based on the premises constructed in Phase I of the research.

5.5.1 Objectives & framework for analysis

The abovementioned proposals for this study, concretize into a few of the characteristics that are recommended by authors. Thus, while developing a novel system of workplace performance indicators, this research seeks for:

a. Holistic approach – through collecting indicators from different sources in the literature (literature review) and practice (interviews);
b. Transparency – by involving all workplace users in a Delphi group;
c. Minimization – by asking workplace users to extract only essential KPIs;
d. Proper categorization – by asking workplace users to agree with a few proposed KPI categories;
e. Social, environmental, and financial impact – by asking workplace users to agree with some proposed classes of impact/value;

f. Meaningfulness – by asking workplace users to prioritize KPIs;
g. Measurability – by asking workplace users if KPIs in the system are already under control; and
h. Suitability for internal and external benchmarking – by merging KPIs' meaningfulness and measurability, which reflects the possibility of comparing performances both internally and externally.

5.6 Several indicators for workplace monitoring

After focusing on different perspectives, it is worth putting together all the metrics that have been found across the literature review, and thoroughly analyze them.

In effect, many of the above-mentioned authors come up with different lists of key performance indicators. These are worthy of deeper investigation in order to establish a common ground on which to develop the next stages of the research. To this end, the method for reviewing literature lines up with the concept of 'discovery through literature', as theorized by Swanson (1986). This method considers the creation of new knowledge by collecting and analyzing bibliographic sources in the form of peer-reviewed papers, conference proceedings, and others.

With the aim to embrace a holistic perspective, the present review gathers numerous metrics, by taking into consideration multiple approaches, and involving diverse disciplines. The investigation goes through the following stages:

1. Collection and description of all the KPIs listed in the abovementioned sources;
2. Analysis of the metrics based on the aspects being evaluated;
3. Cleaning of the long list; and
4. Discussion pointing out gaps and problems to be solved.

Finally, a shorter list of KPIs is extracted. This constitutes a starting point for taking the investigation forth.

5.6.1 Description of the sources

Reference to performance indicators have been found in several contributions ranging from books and scientific papers, to grey literature such as white papers, and online articles (**Table 5-2**), as happens also in Lavy, et al. (2010a). All of them have been considered relevant to the end of this research, whose aim is to include many disciplines with contributions from various scientific and professional fields, with a bottom-up stance. The sources have been put together mostly through a 'roll-your-snowball' approach (Haugbølle & Boyd, 2013). More research groups approaching the same topic were progressively scouted through bibliographies, references to authors, authors' affiliations, information on different articles downloaded by the readers, together with web searches per keywords. Among the publications authored by those groups, the ones focusing in detail on performance measures have been selected and deeply reviewed, as follows.

Review of the literature revealed a sizable body of indicators referring to 'workplace performance' to some extent. Altogether 278 of them have been gathered, deliberately including several perspectives. These are represented (a) by different time spans when the performance indicators were summarized by different authors, and (b) by different disciplines/fields of application where they come from.

The time span ranges from the beginning of the 1990s up to date. The disciplines involved belong to business management, facility management (FM) and corporate real estate management (CREM). Out of 11 papers, authored by 10 different teams of researchers (21 different authors in total), 3 represent the business perspective, 4 represent the FM perspective and 4 the CREM point of view. In all, 18% of the indicators reflect the demand side, that is to say organizations, companies and businesses asking for services; 82% of the indicators, instead, come from the supply side, namely facility management and corporate real estate management sectors (**Figure 5-4**). On average, each source collects around 25 indicators, from a minimum of 7 to a maximum of 70, where the median and mode correspond to 21 metrics (**Table 5-3**).

Table 5-2. Description of the sources

Year	Authors	Title of the publication	Type of source	Reference to other authors	Cited by other authors	Keywords *Keywords from journals are in italics*
2017	JLL	Choosing metrics that matter	Online article		Alker, J., Malanca, M., Pottage, C. and O'Brien, R.	Metrics, KPIs, real estate measures, performance
2015	Katarzyna Chwalbińska-Kusek, Małgorzata Olszewska	Health and productivity in sustainable buildings	White paper	Alker, J., Malanca, M., Pottage, C. and O'Brien, R.		Measuring outcomes, impact, metric, evaluations, sustainable building, workplace performance
2014	John Alker, Michelle Malanca, Chris Pottage, Rachael O'Brien	Health, Wellbeing & Productivity in Offices	Report	JLL		Green building, tracking impacts, measuring organizational outcomes, performance-related metrics, measurement
2014	Sarel Lavy, John A. Garcia, Manish K. Dixit	KPIs for facility's performance assessment, Part I: identification and categorization of core indicators	Research paper	Hinks, J. and McNay, P. Lavy, S., Garcia, J.A. and Dixit, M.K.		*Assessment, identification, Asset management, Quantitative techniques, Performance indicators*
2010	Sarel Lavy, John A. Garcia, Manish K. Dixit	Establishment of KPIs for facility performance measurement: review of literature	Research paper	Hinks, J. and McNay, P.		*Performance measurement (quality), quality indicators, critical success factors, facilities*
2009	Michael Jordan, Thomas McCarty, Brian Velo	Performance measurement in corporate real estate	Conceptual paper	Jordan, M.	JLL	*Performance monitoring, Performance measures, Real estate*
2006	AnnaLiisa Lindholm and Kari I. Leväinen	A framework for identifying and measuring value added by corporate real estate	Research paper	Kaplan, R.S. and Norton, D.P.	Lindholm, A.L. and Nenonen, S.	V*alue added, Real estate, Corporate strategy, Performance monitoring*
2006	Anna-Liisa Lindholm, Suvi Nenonen	A conceptual framework of CREM performance measurement tools	Research paper	Lindholm, A.L. and Leväinen, K.I. Kaplan, R.S. and Norton, D.P.		*Real estate, Performance measurement (quality), Management techniques*
1999	John Hinks and Peter McNay	The creation of a management-by-variance tool for facilities management performance assessment	Scientific paper	Becker, F.	Lavy, S., Garcia, J.A. and Dixit, M.K.	*Benchmarking, Facilities management, Performance indicators, Performance measurement*
1996	Robert S. Kaplan David P. Norton	The Balanced Scorecard: Translating strategy into action	Book		Lindholm, A.L. and Leväinen, K.I.	Performance measurement, value creation, management systems, strategy
1990	Franklin Becker	The total workplace: facilities management and the elastic organization	Book		Hinks, J. and McNay, P.	Facility management, Impacts, Organizational ecology, Building performance measurement

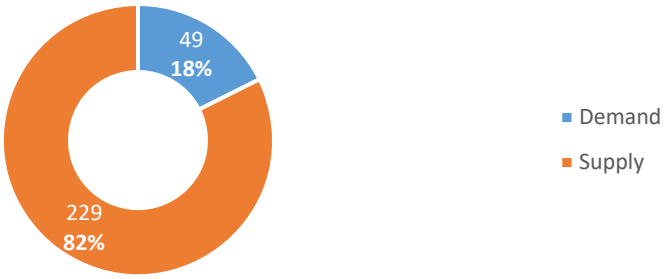

Figure 5-4. Proportion and number of indicators belonging to a demand or a supply perspective

Table 5-3. Statistics on the sources

	Source	Perspective - Side	Number of indicators/metrics
1	JLL, 2017	CREM - Supply	14
2	Chwalbińska-Kusek & Olszewska, 2015	Business - Demand	16
3	Alker, et al., 2014	Business - Demand	21
4	Lavy, et al., 2014a, 2014b	FM - Supply	7
5	Lavy, et al., 2010	FM - Supply	34
6	Jordan, et al., 2009	CREM - Supply	21
7	Lindholm & Leväinen, 2006	CREM - Supply	70
8	Lindholm & Nenonen, 2006	CREM - Supply	30
9	Hinks & McNay, 1999	FM - Supply	23
10	Kaplan & Norton, 1996	Business - Demand	12
11	Becker, 1990	FM - Supply	30
	Total sum		**278**
	Min		7
	Max		70
	Mean		25.8
	Median		21
	Mode		21

With regard to the characteristics of the indicators, a few considerations can be brought up. Indicators prove to be significantly varied in nature throughout all the sources. Namely, even within the same source, they can differ by detail, type, level, and novelty.

- Detail: a single list can contain at the same time **indicators** (e.g. *Cost-quality ratio*), **measures** (e.g. *Occupancy cost*), and **metrics** (e.g. *Square feet per employee*).
- Type: the same sources can collect either **quantitative** (e.g. *Utility costs*) **or qualitative** (e.g. *Employee satisfaction*) indicators.
- Level: in the context of the same source, indicators can be related to **strategic** issues (e.g. *Suitability of premises and functional environment*, *Productivity*), as well as to **operational/technical** matters (e.g. *Persons per seat*, *Standards of cleaning*). This variety is actually

quite common throughout all the sources, even when indicators appertain to one single discipline. However, variety is not to be considered defective. On the contrary, some authors intentionally choose to include metrics of both strategic and operational status in their list. This remark is consistent, for example, with the strategy adopted by Hinks and McNay (1999).

- Novelty: **traditional** metrics (e.g. *Operating costs*) and **nontraditional** metrics (e.g. *User experience* or *Employee health and wellbeing*) can be found in the same lists. A balanced mix of metrics with different degrees of novelty is seen as beneficial to guarantee both short and long term management (JLL, 2017a).

5.6.2 Analysis of KPI lists

Most of the sources cluster indicators according to some criteria, including: the impacts that the indicator is supposed to bring, the area that it is expected to affect, the major outcome related to the metric, the performance dimension, the goal for applying that specific metric, or their relation to specific business objectives. Most of the time, three to eight categories are identified (see **Appendix 12.7**).

Becker (1990) organized relevant indicators for facility management into five classes: financial issues, organizational issues, Information Technology, space use efficiency, and performance/productivity. Kaplan and Norton (1996) recognize four perspectives for organizational KPIs: financial, internal business, innovation and learning, and customer. However they state that common trends across different companies can be recognized only in the financial, innovation and learning, and customer areas. Thus, these three have been maintained in the present dissertation, coherently with the goal of reaching a list that can be shared across different business sectors.

Hinks and McNay (1999) compile a long list of KPIs for facilities management as a basis to develop their research. They initially classify them into eight categories: business benefits, equipment, space, environment, change, maintenance/service, consultancy, and general. In their final shortlist, only seven categories are confirmed and appear renamed as follows: business, equipment, space, environment, change management, maintenance, and general.

Metrics listed by Lindholm & Leväinen (2006) are categorized according to the real estate strategies they outline. Each strategy is defined by real estate objectives and operations: reduce cost, increase the value of assets, increase flexibility, increase innovations, promote marketing and sale, increase productivity, and increase employee/internal client satisfaction. Lindholm and Nenonen (2006) reiterate Kaplan and Norton's scheme, mentioning a financial perspective, a learning & growth perspective, a business process perspective, and a customer perspective.

Jordan, et al. (2009) look at different areas of interest for real estate management: transaction management, lease administration, facility management, project management, occupancy planning, and account management.

Lavy et al.'s (2010a) work is deliberately focused on extrapolating categories for facility performance indicators. According to the nature of the metrics therein included, their investigation confirms the validity of four categories: 'Financial metrics' are mainly cost-related; 'functional metrics' and 'physical metrics' incorporate the performance of buildings and facilities; 'survey-based metrics' are typically unquantifiable or based on subjective opinions. Anyway, they argue that the latter category contains indicators that may fall into one of the other three categories, thus it is liable to be erased or slightly modified (Lavy, et al., 2010b). In fact, in their work (Lavy, et al., 2014b), categories completely disappear in favor of a short list of only a handful of indicators.

Alker et al. (2014) analyze organizational performance metrics distinguishing three areas: ‘financial/organizational metrics’, physical metrics including ‘direct measures or evaluation/assessment’, and perceptual metrics, which involve ‘self-reported attitudes’. Studies by Chwalbińska-Kusek and Olszewska (2015) confirm the same three categories as identified by Alker et al. (2014).

Jones Lang LaSalle (JLL, 2017a) articulates the objectives corporate real estate managers should pursue into six sets: ‘provide long-term value for stakeholders’, ‘shed low margin business units’, ‘acquire emerging companies that extend product offering’, ‘help customers’, ‘drive growth’, and ‘drive innovation’.

Once putting together indicators coming from the abovementioned sources (see **Appendix 12.7**), categories multiply and do not match with each other. Categorization is useful at this stage of the research in order to better compare the indicators and prepare them for further analysis. Homogenizing categories is possible by identifying some common thematic areas the indicators refer to. This initial scrutiny has been performed through two subsequent steps:

- Word counting and thematic analysis; and
- New categorization.

1 Word counting and thematic areas

Word counting was performed on the initial list of 278 indicators. Around 900 words express 278 indicators, excluding prepositions (for instance, to, of, etc.). Here a few recurring words clearly emerged (**Figure 5-5**). From these words, a list of key thematic areas can be drawn.

Words recurring in 5% of indicators or more (i.e. more than 10 times), are considered to reveal important themes (**Figure 5-6**). Consequently, recurring words have been further analyzed in order to create thematic areas useful for categorization later on. Indeed, after word counting, some main considerations can be pointed out.

Figure 5-5. Word cloud (elaborated on www.wordclouds.com)

127 indicators out of 278 contain at least one frequent word, which recurs more than 10 times. Indicators often contain more than one recurring word, thus they may be relevant to different themes. These indicators need to be interpreted in a more qualitative manner in order to understand which theme prevails over the others and, according to that, allocate it in the proper category. The remaining 151 indicators that do not contain any recurring word, in most cases, can be assimilated to the same recurring themes by their meaning. In the following part of the chapter, reasoning that has been followed to draw new categories of KPIs is described.

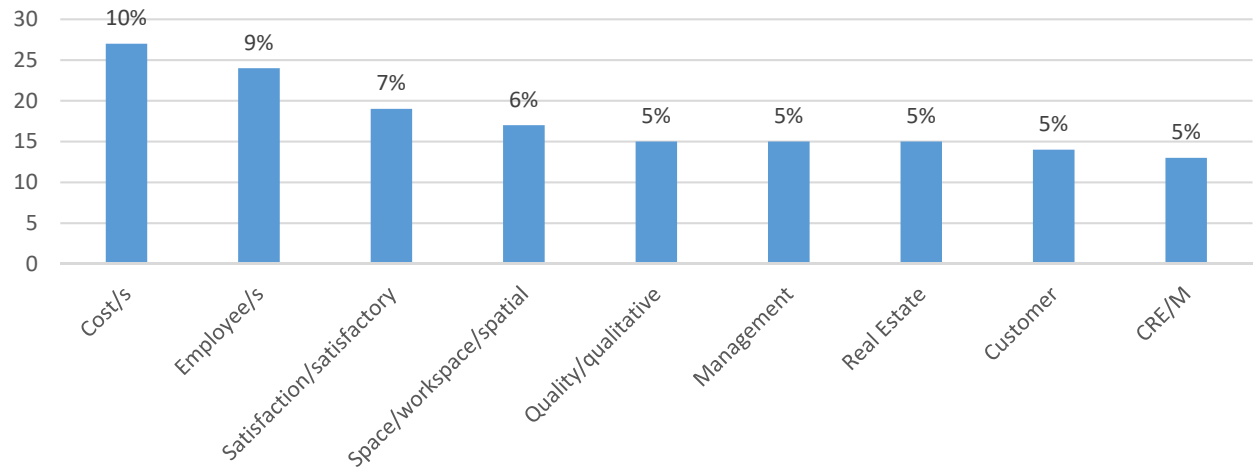

Figure 5-6. Frequency of recurring words (% KPIs containing the word on the total number of 278 indicators)

The word 'cost' seems to be much more common than all the others, summing 27 records, and being present in the 10% of the indicators. Indicators about costs include also other recurring words: 'real estate', 'quality', 'CRE/CREM', 'employee', 'management', and 'space'. A category **'Costs'** seems appropriate to collecting all cost-related items. Indicators expressing budget, expenditures, spending, and money are also related to the same thematic area, hence they can be included here. The category 'cost' is populated predominantly by quantitative metrics, even though a couple of times the word 'quality' is associated to costs, aiming at expressing cost-quality ratios (e.g. *Cost-quality ratio*, *Cost-quality ratio of facilities services*).

'Employee' or 'employees' recur 24 times, covering 9% of the indicators. Employees are associated with different thematic areas, involving other recurring words such as 'satisfaction', 'CRE/CREM', 'space', 'cost', 'customer', and 'real estate'. Most of the time, indicators incorporating the term have a quantitative meaning, e.g. *Number of employees*, *Space per employee*, *Costs per employee*, etc. A few times, instead, a qualitative stance emerges. This is the case of indicators representing employees' opinions and satisfaction (e.g. *Employee satisfaction with work environment*). Overall, indicators incorporating 'employees' predominantly identify staff characteristics (e.g. turnover, distance to commute or to other places). Consequently, a category named **'Staff characteristics'** sums up most of them. However, ways of working, productivity, space usage, and people attitude partially manifest through indicators related to employees.

'Satisfaction' seems an important aspect to take into consideration while measuring building performance, indeed it is present 19 times, i.e. 7% of the indicators. It expresses the human component of the workplace, and attributes importance to qualitative data. It mostly describes user satisfaction with spaces, services or products, all themes that can go under a general **'User attitude'**. Not only employees, but also other

internal and external stakeholders can express satisfaction, either individually or in groups (e.g. customers, community, business units). In addition, customer satisfaction is considered a parameter against which to evaluate productivity (e.g. *Completion of projects to customer satisfaction*).

The word 'space' can be counted overall 18 times (one indicator contains it two times), being present in 6% of the indicators. Indicators here tend to relate to availability and utilization of space, therefore one category has been dedicated to express **'Space usage'**. However, not only the physical dimension of space is taken into consideration, but also space qualities, such as space appropriateness in relation to the ways of working (e.g. *Adequacy of space*). Predominantly quantitative indicators appear here, except a couple of survey-based measures. Indicators related to a spatial theme can be detected in other areas, for instance those expressing staff characteristics, and costs.

'Customer' recurs 15 times (one indicator contains it two times), covering 5% of indicators. This word is frequently associated with 'satisfaction'. Indicators here express the quality of the customer experience with the business or the services, thus a few are of a qualitative nature. Indeed, customers are either internal to the company, corresponding to building occupants, or external, who can be identified with market customers. A few purely quantitative indicators regard physical distance to customers. In general, all these indicators attempt to measure the effectiveness of strategies or activities, thus they can be interpreted as matters regarding **'Ways of working' or 'Productivity'**.

The term 'real estate' exists as a whole locution 15 times, which means that 5% of indicators contain it. Occasionally it appears together with other recurring words, i.e. 'cost', 'CRE/CREM', 'employee'. Economic and financial measures refer to real estate, involving costs, productivity, and value/return/yield. In fact, value, return, and yield seem strictly associated to the locution 'real estate'. That is why a category has been specifically entitled for indicators belonging to **'Value, return, yield'**. Among these, three records, out of 15, have been considered as barely understandable, thus difficult to measure, and, however, of sectorial interest, with a connotation which leans definitely toward management rather than workplace. Thus, they have been erased from the long list, namely: *Ability for business leadership to leverage real estate data to make decisions*, *Property and real estate*, *Amount of real estate advice given to other business units*.

'Management' appears 15 times in the long list, comprehending 5% of indicators. It is associated with different management sectors: facility, project, account, talent, risk, and energy. Management-related indicators are transversal across thematic areas. Management is evaluated against building operation, costs, value, staff characteristics, user attitude. In the end, most of the indicators mentioning 'management' aim at measuring business success. Therefore, a category called **'Business effectiveness'** was created, suitable to include a broad group of indicators related to different extents to managerial issues. However, due to unspecified measures and very sector-specific meaning, some indicators containing this word have been cleared out, such as *Effective risk management*, and *Management information*. Indeed, they are non-specific to the point, which makes it difficult imagining how to measure them.

'Quality' or 'qualitative' appear 15 times, including the two items regarding cost-quality ratios, thus regard 5% of indicators. Indicators containing these words represent mostly physical parameters, such as those related to environmental conditions (air, light, acoustics, and so on). This class of metrics has been

associated with a thematic category for **'Environmental quality'**. Nonetheless, quality has to do also with space-related issues such as maintenance (i.e. *Number of building quality audits*, *Quality of end product*). Also, the term 'quality' is involved to describe the ways of working (*Quality of work*). On the whole, quality is represented more by quantitative data than by qualitative considerations. Sometimes 'quality' is associated with generic or abstract information that seems difficult to be measured in a concrete manner and, however, that would be of interest only as sectorial knowledge. Generic metrics of that sort, with particular interest only to sectorial knowledge, have been eventually erased from the list (i.e. *Transaction quality score*, *Quality of portfolio analysis and impact on decision making*).

Corporate real estate and corporate real estate management ('CRE' and 'CREM') were detected additional 13 times, which means that about 5% of indicators regard this themes. These have to do with people attitude, staff characteristics, and costs, thus including both quantitative and qualitative metrics. In this case, the locutions represent one of the business functions appointed to take care of workplace strategy and operation. According to this meaning, which is shared by most of the indicators incorporating CRE/CREM, a category describing the **'Building management'** was made up, and revealed it was broad enough to include also other indicators.

In conclusion, word counting has helped infer recurring themes for indicators. These themes, in turn, supported the creation of major categories where to assign all indicators. The table below (**Table 5-4**) shows the process that has been followed to progressively translate recurring words into major themes, and eventually categories.

This step of elaboration is followed by categorization first, and cleaning afterwards.

Table 5-4. Word frequency on 278 indicators (common words recurring more than 10 times)

#	Source	Indicator as in the source	Other recurring words in the same indicators	Major themes	Resulting category
	Cost/s (27)				
35	(Alker, et al., 2014)	Medical costs	Real estate Quality CRE/CREM Employee/s Management Space/Spatial	Cost Building operation and management (facility, real estate)	Costs
59	(Lavy, et al., 2010)	Operating costs			
60	(Lavy, et al., 2010)	Occupancy costs			
61	(Lavy, et al., 2010)	Utility costs			
62	(Lavy, et al., 2010)	Capital costs			
63	(Lavy, et al., 2010)	Maintenance costs			
64	(Lavy, et al., 2010)	Groundskeeping cost			
65	(Lavy, et al., 2010)	Custodial and janitorial cost			
72	(Lavy, et al., 2010)	Churn costs			
101	(Jordan, et al., 2009)	Cost savings tracking in facility management			
109	(Jordan, et al., 2009)	Churn costs			
122	(Lindholm & Nenonen, 2006)	Occupancy costs			
123	(Lindholm & Nenonen, 2006)	Operative costs (maintenance, energy, etc.)			
124	(Lindholm & Nenonen, 2006)	Transaction costs			
142	(Lindholm & Nenonen, 2006)	Cost-quality ratio			
143	(Lindholm & Nenonen, 2006)	Cost-quality ratio of facilities services			
144	(Lindholm & Leväinen, 2006)	Occupancy costs			
152	(Lindholm & Leväinen, 2006)	Cost of underutilized space			
153	(Lindholm & Leväinen, 2006)	Real estate cost per CRE employee			
155	(Lindholm & Leväinen, 2006)	Real estate cost of acquisition vs. returns/IRR			
156	(Lindholm & Leväinen, 2006)	Lease vs. construction or ownership cost			
158	(Lindholm & Leväinen, 2006)	Real estate holding costs			
168	(Lindholm & Leväinen, 2006)	Cost of disposal of property vs. savings			
240	(Kaplan & Norton, 1996)	Cost reduction productivity			
252	(Becker, 1990)	Construction costs			
253	(Becker, 1990)	Energy costs			
254	(Becker, 1990)	Maintenance costs			

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Table 5-4. (Continued)

#	Source	Indicator as in the source	Other recurring words in the same indicators	Major themes	Resulting category
	Employee/s (24)				
9	(JLL, 2017)	Employee productivity	Satisfaction/-tory CRE/CREM Space/Spatial Cost Customer/s Real estate	Staff characteristics Ways of working Productivity Space usage People attitude	Staff characteristics
13	(JLL, 2017)	Employee engagement scores			
76	(Lavy, et al., 2010)	Employee or occupant's turnover rate			
121	(Lindholm & Nenonen, 2006)	Square feet per employee			
145	(Lindholm & Leväinen, 2006)	Space per employee			
153	(Lindholm & Leväinen, 2006)	Real estate cost per CRE employee			
176	(Lindholm & Leväinen, 2006)	Number of workstations per employee			
184	(Lindholm & Leväinen, 2006)	Employees' opinions on how well the workplace supports their productivity			
185	(Lindholm & Leväinen, 2006)	Distance employees commute			
197	(Lindholm & Leväinen, 2006)	Full time equivalent (FTE) employee			
198	(Lindholm & Leväinen, 2006)	CRE employee qualifications			
199	(Lindholm & Leväinen, 2006)	Employee turnover			
202	(Lindholm & Leväinen, 2006)	Distance to required transportation modes for employees			
203	(Lindholm & Leväinen, 2006)	Employee satisfaction with work environment			
206	(Lindholm & Leväinen, 2006)	Amount of nearby amenities for employees			
208	(Lindholm & Leväinen, 2006)	Employee/internal customer satisfaction with responsiveness of CREM			
209	(Lindholm & Leväinen, 2006)	Employee satisfaction with CREM staff skills			
210	(Lindholm & Leväinen, 2006)	Employee satisfaction with CREM information sharing			
213	(Lindholm & Leväinen, 2006)	Investment in training per CREM employee			
241	(Kaplan & Norton, 1996)	Employee satisfaction			
242	(Kaplan & Norton, 1996)	Employee retention			
243	(Kaplan & Norton, 1996)	Employee productivity			
256	(Becker, 1990)	Need to relocate employees			
268	(Becker, 1990)	Space/employee			

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Table 5-4. (Continued)

#	Source	Indicator as in the source	Other recurring words in the same indicators	Major themes	Resulting category
	Satisfaction/satisfactory (19)				
29	(ChwalbińskaKusek & Olszewska, 2015)	Overall satisfaction	Customer/s CRE/CREM Employee/s Management	User attitude Productivity Building operation and management (facility, real estate)	User attitude
73	(Lavy, et al., 2010)	Productivity (turnover, absenteeism, occupants' satisfaction)			
89	(Lavy, et al., 2010)	Customer/building occupants' satisfaction with products or services			
90	(Lavy, et al., 2010)	Community satisfaction and participation			
103	(Jordan, et al., 2009)	End user satisfaction			
111	(Jordan, et al., 2009)	Key stakeholder satisfaction in account management			
128	(Lindholm & Nenonen, 2006)	Business units' satisfaction with CREM performance			
139	(Lindholm & Nenonen, 2006)	Customer satisfaction (with workplace and facilities among internal and external customers)			
140	(Lindholm & Nenonen, 2006)	Customer satisfaction with services			
141	(Lindholm & Nenonen, 2006)	Customer satisfaction with CREM department (hospitality, quick reactions, results, information)			
203	(Lindholm & Leväinen, 2006)	Employee satisfaction with work environment			
208	(Lindholm & Leväinen, 2006)	Employee/internal customer satisfaction with responsiveness of CREM			
209	(Lindholm & Leväinen, 2006)	Employee satisfaction with CREM staff skills			
210	(Lindholm & Leväinen, 2006)	Employee satisfaction with CREM information sharing			
220	(Hinks & McNay, 1999)	Satisfactory physical working conditions			
231	(Hinks & McNay, 1999)	Completion of projects to customer satisfaction			
233	(Hinks & McNay, 1999)	Customer satisfaction			
241	(Kaplan & Norton, 1996)	Employee satisfaction			
248	(Kaplan & Norton, 1996)	Customer satisfaction			
	Space/workspace/spatial (17)				
23	(ChwalbińskaKusek & Olszewska, 2015)	Spatial configuration	Employee/s Cost/s	Space usage Real Estate Building operation and management (facility, real estate)	Space usage
55	(Lavy, et al., 2014a, 2014b)	Functional index – FI, i.e. space utilization			
75	(Lavy, et al., 2010)	Space utilization (survey based data)			
78	(Lavy, et al., 2010)	Adequacy of space (survey based data)			
108	(Jordan, et al., 2009)	Space utilization			
145	(Lindholm & Leväinen, 2006)	Space per employee			
147	(Lindholm & Leväinen, 2006)	Percentage of space occupied			
148	(Lindholm & Leväinen, 2006)	Operational space vs. nonoperational space			
149	(Lindholm & Leväinen, 2006)	Owned and leased space			
152	(Lindholm & Leväinen, 2006)	Cost of underutilized space			
164	(Lindholm & Leväinen, 2006)	Space (square feet/meter) per unit of revenue			
172	(Lindholm & Leväinen, 2006)	Percentage leased vs. total space			
187	(Lindholm & Leväinen, 2006)	Time wasted with interruptions (due to open space layout)			
205	(Lindholm & Leväinen, 2006)	Workspace (size, shape)			
219	(Hinks & McNay, 1999)	Effective utilization of space			
268	(Becker, 1990)	Space/employee			
269	(Becker, 1990)	Space/unit of income			

Table 5-4. (Continued)

#	Source	Indicator as in the source	Other recurring words in the same indicators	Major themes	Resulting category
	Customer (14)				
12	(JLL, 2017)	Customer experience	Satisfaction/-tory CRE/CREM Employee/s	Ways of working Productivity Business effectiveness Real estate	Ways of working/ Productivity
89	(Lavy, et al., 2010)	Customer/building occupants' satisfaction with products or services			
139	(Lindholm & Nenonen, 2006)	Customer satisfaction (with workplace and facilities among internal and external customers)			
140	(Lindholm & Nenonen, 2006)	Customer satisfaction with services			
141	(Lindholm & Nenonen, 2006)	Customer satisfaction with CREM department (hospitality, quick reactions, results, information)			
177	(Lindholm & Leväinen, 2006)	Distance to required transportation modes for customers			
178	(Lindholm & Leväinen, 2006)	Distance to customers			
208	(Lindholm & Leväinen, 2006)	Employee/internal customer satisfaction with responsiveness of CREM			
231	(Hinks & McNay, 1999)	Completion of projects to customer satisfaction			
233	(Hinks & McNay, 1999)	Customer satisfaction			
245	(Kaplan & Norton, 1996)	Customer acquisition			
246	(Kaplan & Norton, 1996)	Customer retention			
247	(Kaplan & Norton, 1996)	Customer profitability			
248	(Kaplan & Norton, 1996)	Customer satisfaction			
	Real Estate (15)				
1	(JLL, 2017)	Ability for business leadership to leverage real estate data to make decisions	Cost/s CRE/CREM Employee/s	Value/return/yield Cost Productivity	Value/return/yield
81	(Lavy, et al., 2010)	Property and real estate			
153	(Lindholm & Leväinen, 2006)	Real estate cost per CRE employee			
155	(Lindholm & Leväinen, 2006)	Real estate cost of acquisition vs. returns/IRR			
158	(Lindholm & Leväinen, 2006)	Real estate holding costs			
160	(Lindholm & Leväinen, 2006)	Real estate return on investment			
161	(Lindholm & Leväinen, 2006)	Real estate return on equity			
162	(Lindholm & Leväinen, 2006)	Business return on real estate assets			
189	(Lindholm & Leväinen, 2006)	No loss of business due to real estate service failure			
190	(Lindholm & Leväinen, 2006)	Real estate spending as percent of gross margin			
191	(Lindholm & Leväinen, 2006)	Real estate spending as percent of total operating expenses			
194	(Lindholm & Leväinen, 2006)	Amount of real estate advice given to other business units			
200	(Lindholm & Leväinen, 2006)	Number of steps/time for real estate approval process			
249	(Becker, 1990)	Asset value of real estate portfolio			
251	(Becker, 1990)	Expenses of real estate occupancy			

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Table 5-4. (Continued)

#	Source	Indicator as in the source	Other recurring words in the same indicators	Major themes	Resulting category
	Management (15)				
3	(JLL, 2017)	Effective risk management	Cost/s Satisfaction/-tory	Building operation and management (facility, real estate) Costs Value/return/yield Staff characteristics User attitude	Business effectiveness
94	(Jordan, et al., 2009)	Critical date management			
100	(Jordan, et al., 2009)	Work order completion in facility management			
101	(Jordan, et al., 2009)	Cost savings tracking in facility management			
102	(Jordan, et al., 2009)	Energy management			
104	(Jordan, et al., 2009)	Schedule adherence in project management			
105	(Jordan, et al., 2009)	Budget management			
106	(Jordan, et al., 2009)	Change order activity in project management			
107	(Jordan, et al., 2009)	Capital plan attainment in project management			
111	(Jordan, et al., 2009)	Key stakeholder satisfaction in account management			
112	(Jordan, et al., 2009)	Budget adherence in account management			
113	(Jordan, et al., 2009)	Talent management			
171	(Lindholm & Leväinen, 2006)	Status of risk management activity (contaminated sites)			
223	(Hinks & McNay, 1999)	Management of maintenance			
234	(Hinks & McNay, 1999)	Management information			
	Quality/Qualitative (15)				
6	(JLL, 2017)	Quality of portfolio analysis and impact on decision making	Cost/s	Environmental quality Building operation and management (facility, real estate) Ways of working	Environmental quality
20	(ChwalbińskaKusek & Olszewska, 2015)	Indoor air quality			
21	(ChwalbińskaKusek & Olszewska, 2015)	Light quality			
22	(ChwalbińskaKusek & Olszewska, 2015)	Acoustic quality			
39	(Alker, et al., 2014)	Indoor air quality and ventilation			
57	(Lavy, et al., 2014a, 2014b)	Indoor/outdoor environmental quality			
80	(Lavy, et al., 2010)	Building physical condition (qualitative)			
84	(Lavy, et al., 2010)	Indoor Environmental Quality (IEQ)			
93	(Jordan, et al., 2009)	Transaction quality score			
142	(Lindholm & Nenonen, 2006)	Cost-quality ratio			
143	(Lindholm & Nenonen, 2006)	Cost-quality ratio of facilities services			
159	(Lindholm & Leväinen, 2006)	Number of building quality audits			
204	(Lindholm & Leväinen, 2006)	Quality of indoor environment (lightning, temperature, noise)			
228	(Hinks & McNay, 1999)	Quality of end product			
275	(Becker, 1990)	Quality of work			

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Table 5-4. (Continued)

#	Source	Indicator as in the source	Other recurring words in the same indicators	Major themes	Resulting category
	CRE/CREM (13)				
128	(Lindholm & Nenonen, 2006)	Business units' satisfaction with CREM performance	Employee/s Satisfaction/-tory Customer/s Cost/s Real estate	Building operation and management (facility, real estate) People attitude Staff characteristics Costs	Building operation and management
129	(Lindholm & Nenonen, 2006)	Professionalism and expertise of CREM staff			
141	(Lindholm & Nenonen, 2006)	Customer satisfaction with CREM department (hospitality, quick reactions, results, information,)			
153	(Lindholm & Leväinen, 2006)	Real estate cost per CRE employee			
154	(Lindholm & Leväinen, 2006)	Total CREM operating expenditures vs. budget			
198	(Lindholm & Leväinen, 2006)	CRE employee qualifications			
207	(Lindholm & Leväinen, 2006)	Range of services offered by CREM			
208	(Lindholm & Leväinen, 2006)	Employee/internal customer satisfaction with responsiveness of CREM			
209	(Lindholm & Leväinen, 2006)	Employee satisfaction with CREM staff skills			
210	(Lindholm & Leväinen, 2006)	Employee satisfaction with CREM information sharing			
211	(Lindholm & Leväinen, 2006)	CREM response time to requests			
212	(Lindholm & Leväinen, 2006)	Competence of CREM staff			
213	(Lindholm & Leväinen, 2006)	Investment in training per CREM employee			

2 Categorization

Lavy, et al. (2010b) claim that proper categorization of performance metrics is important in order for them to be meaningful to the industry. Categories emerging from the sources that have been brought together are heterogeneous, also due to the fact that they come from different disciplines (see **Chapter 5.3**). The goal for this research is to make all these disciplines flow together, which comes through creating common categories of indicators. Since some recurring themes have emerged, based on the most frequent words, they have been used to create meaningful cross-source categories.

These categories reflect some macro-areas of interest that indicators refer to or, in other words, some aspects being evaluated by the indicator. Hence, 9 thematic areas inferred from previous analysis built up just as many categories. These 9 categories are composed of several indicators, as described below.

1. Building operation and management: contains metrics related to maintenance, security and safety, energy and resource management, and data related to the premises' daily functioning.
2. Business effectiveness: expresses the efficiency and effectiveness of the business activity.
3. Costs: collects all cost-related data.
4. Environmental Quality: has to do with physical parameters, both quantitative and qualitative, identifying environmental conditions.
5. Productivity and ways of working: describes how people carry out their daily activities, their workstyles, and the adequacy of the spatial environment to their needs.
6. Space usage: takes into consideration physical parameters of the space as well as the way it is utilized.
7. Staff characteristics: embraces demographics and other objective/quantitative information related to company's personnel.
8. User attitude: includes subjective/qualitative measures about internal employees' and external customers' impressions, feelings, and engagement with respect to their daily work, the company more in general, the location of the office building and its image.
9. Value/Return/Yield: embraces indicators involving financial results of the company.

This number of classes may appear large, if compared to literature, where typically three to eight categories can be detected. Though, putting together indicators from different sources necessarily results in involving more areas of interest. Hence, a slightly larger number of categories seems reasonable in this case.

The 278 indicators flowed into the most appropriate category for them. Most of those indicators explicitly revealed a particular nature, based on which it was possible to lead them into one of the predetermined 9 categories. Some indicators (23), on the contrary, appeared very generic and their meaning seemed difficult to include in neither of the categories. These have been put together into a Non Defined (N.D.) category, and have been accordingly erased in the next step of elaboration, i.e. cleaning.

5.6.3 Cleaning

Together with categorization, unclear or vague indicators have been isolated in a separate class. As outlined above, 23 metrics revealed to be somewhat problematic (see **Chapter 12.8**). They were either unclear or too generic. Also, some of them were recognized as too strictly related to a specific sector and therefore would not be suitable to represent a holistic perspective. Hence, they have all been removed from the long list. This sifting allowed to reduce the overall number of metrics from 278 to 255.

However, some more cleaning was still necessary in order to:

- Detect and eliminate duplicates (i.e. when wording is identical or very similar); and
- Avoid redundancy by:
    - Joining overlapping or complementary indicators (i.e. when wording is similar but not exactly alike); and
    - Combining metrics related to the same issue, though representing separately quantitative and qualitative data, or slightly different points of view.

1 Duplicates

Across all the 11 sources, some metrics are in effect present more than one time with identical or very similar wording (**Table 5-5**). Seven of them are cited by only a couple of sources, but six indicators have been tracked in three to six sources. In particular, more than half of the sources cite *'Turnover'*, and more than one third mention *'Absenteeism'*, *'Revenue breakdown'*, and *'Occupancy costs'*. Around one third of the sources list *'Productivity'* and *'Space per employee'*. It is noticeable that sources reporting *Turnover*, *Absenteeism*, and *Revenue breakdown* come from both the demand and the supply side. *Customer satisfaction* recurs two times, and it is as well cited by both the demand and the supply side. However, in this case it seems appropriate keeping the distinction between the two indicators, since the demand side refers to external customers (i.e. customers of the good produced by the business), while the supply side refers to internal customers (i.e. customers of the services).

Table 5-5. Duplicates

Indicator/metric	# of indicator	Category of the indicator	# of sources	% of sources	Perspective of the source	
					Demand	Supply
Turnover	16, 33, 76, 137, 199, 257	Staff characteristics	6	55%	•	•
Absenteeism	15, 31, 56, 136, 277	Staff characteristics	5	45%	•	•
Revenue breakdown	17, 34, 163, 164	Staff characteristics	4	36%	•	•
Occupancy costs	60, 122, 144, 251	Costs	4	36%		•
Productivity	9, 49, 73	Productivity/WoW	3	27%	•	•
Space per employee	121, 145, 268	Space usage	3	27%		•
Medical complaints	18, 36	User attitude	2	18%	•	
Churn costs	72, 109	Costs	2	18%		•
Maintenance costs	63, 254	Costs	2	18%		•
Physical complaints	19, 37	User attitude	2	18%	•	
Return on assets	115, 125	Value/Return/Yield	2	18%		•
Security	87, 258	Security/Safety	2	18%		•
Competence of staff	130, 236	Staff characteristics	2	18%		•
Customer satisfaction	233, 248	User attitude Productivity/WoW	2	18%	•	•

2 Redundancy

Overlapping or complementary metrics have been detected throughout the long list of indicators, especially in the areas of staff characteristics, user attitude, and space usage.

In a few cases, two or more distinct metrics aim at representing the same data in a slightly different way. Sometimes differences are only a matter of viewpoint; some other times they depend on the instruments or tools employed/employable to perform the measurement. For instance, *Space utilization* can be expressed in different ways, such as *Functional index – FI, Percentage of space occupied*, *Operational space vs. non-operational space*, and *Effective utilization of space*. All these multiple perspectives deserve to be considered. They must be taken as different interpretations or ways to read the same data. Consequently,

it is worth putting them together into a more complex indicator, which includes also metrics and measures, while aiming to express a holistic viewpoint.

Hence, similar indicators have been unified, trying to match them into one comprehensive record. This allows an indicator to be complete and fully representative of one aspect of the building functioning. Moreover, this process reduces the overall number of indicators, which eases the following phases of investigation. In fact, collecting too many indicators is inefficient, and reduces comprehensibility and applicability, as Hinks and McNay (1999), Jordan (2009) and Lavy (2010b) claim.

By combining similar metrics, the number of indicators significantly decreased, as **Table 5-6** shows. Also, the incidence of the number of indicators in the respective categories slightly changes, as the comparison between **Figure 5-7** and **Figure 5-8** well represents.

Table 5-6. Number of indicators by category, before and after cleaning

Category of indicators	Number before cleaning	Percentage before cleaning	Number after cleaning	Percentage after cleaning	Δ
N.D.	23	8%	0	0%	23
Building operation and management	47	17%	33	20%	14
Productivity/Ways of Working	46	17%	32	20%	14
Costs	33	12%	24	15%	9
Staff characteristics	31	11%	12	7%	19
User attitude	30	11%	14	9%	16
Space usage	21	8%	10	6%	11
Business effectiveness	18	6%	18	11%	0
Environmental Quality	15	5%	9	6%	6
Value/Return/Yield	14	5%	10	6%	4
Total sum	*278*	*100%*	*162*	*100%*	*116*

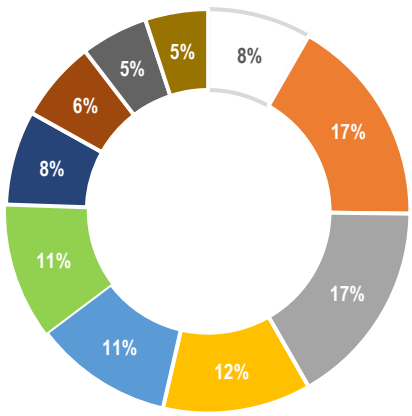

Figure 5-7. Incidence (% before cleaning)

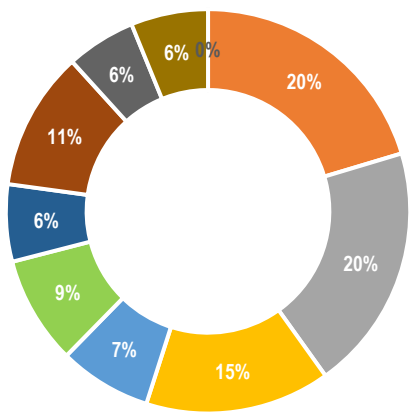

Figure 5-8. Incidence (% after cleaning)

N.D. | Building operation and management | Productivity/Ways of Working | Costs | Staff characteristics | User attitude | Space usage | Business effectiveness | Environmental Quality | Value/Return/Yield

42% of the long list of 278 records, i.e. 116, could be reduced. Of those 116, 23 were dropped and the remaining 93 were absorbed into other indicators or somehow unified. 162 indicators remain at the end of the process, clustered into 9 categories, as listed below (**Table 5-7**)

.

Table 5-7. Final list of indicators by category

#	Indicators before cleaning	#	Indicators after cleaning
	Building operation and management		
2	Ethics, health and safety practices	**85**	1. Accessibility for disabled
52	Condition index	**157, 173**	2. Aging reports for leases, Length of lease terms
53	Replacement efficiency indicator – REI	**79**	3. Building Performance Index (BPI – quantitative)
54	Maintenance efficiency indicator – MEI	**263**	4. Changing location of cables
67	Deferred maintenance, and deferred maintenance backlog	**236**	5. Competence of staff
69	Maintenance efficiency indicators	**218**	6. Correction of faults
70	Facility condition index	**211**	7. CREM response time to requests
79	Building Performance Index (BPI – quantitative)	**67**	8. Deferred maintenance, and deferred maintenance backlog
82	Waste	**225, 232, 273**	9. Effectiveness of help desk service, Response time, Responsiveness to problems
83	Health and safety		
85	Accessibility for disabled	**265**	10. Electrical power capacity
86	Resource consumption – energy, water, materials	**102, 181, 182, 222**	11. Energy management, Energy consumption, Energy performance, Number of energy audits
87	Security		
100	Work order completion in facility management	**2, 83, 221**	12. Ethics, health and safety practices (Health and safety, Provision of safe environment)
102	Energy management		
126	Sustainability objectives (waste, energy consumption, etc.)	**52, 70**	13. Facility Condition Index
157	Aging reports for leases	**54, 69, 223**	14. Maintenance efficiency indicators (MEI)
159	Number of building quality audits	**262**	15. Networking IT
167	Time to dispose of properties vs. plan	**159**	16. Number of building quality audits
169	Time to clear buildings vs. plan	**170**	17. Number of development projects for obsolete properties
170	Number of development projects for obsolete properties	**195**	18. Number of service providers/service level agreements
173	Length of lease terms	**200**	19. Number of steps/time for real estate approval process
181	Energy consumption	**196**	20. Number of transactions/projects/leases
182	Number of energy audits	**264**	21. Protecting equipment
183	Environmental sustainability of buildings	**224**	22. Reliability
192	Time used on RE project vs. time budgeted for projects	**53**	23. Replacement efficiency indicator – REI
195	Number of service providers/service level agreements	**86, 126, 183**	24. Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings
196	Number of transactions/projects/leases		
200	Number of steps/time for real estate approval process		
201	Use of audits for service providers	**87, 258**	25. Security
211	CREM response time to requests	**226**	26. Standards of cleaning
218	Correction of faults	**266**	27. Telecommunications
221	Provision of safe environment	**169**	28. Time to clear buildings vs. plan
222	Energy performance	**167**	29. Time to dispose of properties vs. plan
223	Management of maintenance	**192**	30. Time used on RE project vs. time budgeted for projects
224	Reliability	**201**	31. Use of audits for service providers
225	Effectiveness of help desk service	**82**	32. Waste
226	Standards of cleaning	**100**	33. Work order completion in facility management
232	Responsiveness to problems		

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Table 5-7. (Continued)

#	Indicators before cleaning
236	Competence of staff
258	Security
262	Networking IT
263	Changing location of cables
264	Protecting equipment
265	Electrical power capacity
266	Telecommunications
273	Response time

Continue on next page

Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	Business effectiveness		
7	Speed and agility to rebrand, co-locate or dispose of duplicative assets	**230**	1. Achievement of completion deadlines
11	Speed to market of store openings	**112**	2. Budget adherence in account management
38	Task efficiency and deadlines met	**105**	3. Budget management
94	Critical date management	**107**	4. Capital plan attainment in project management
97	Schedule adherence in lease administration	**94**	5. Critical date management
99	Critical date reporting in lease administration	**99**	6. Critical date reporting in lease administration
104	Schedule adherence in project management	**127**	7. Effectiveness of projects/investments (budgeting, scheduling, targets)
105	Budget management	**111**	8. Key stakeholder satisfaction in account management
107	Capital plan attainment in project management	**144**	9. Market share
111	Key stakeholder satisfaction in account management	**189**	10. No loss of business due to real estate service failure
112	Budget adherence in account management	**138**	11. Profitability
127	Effectiveness of projects/investments (budgeting, scheduling, targets)	**139**	12. Revenue growth/mix
230	Achievement of completion deadlines	**97**	13. Schedule adherence in lease administration
238	Profitability	**104**	14. Schedule adherence in project management
244	Market share	**7**	15. Speed and agility to rebrand, co-locate or dispose of duplicative assets
271	Turnaround time	**11**	16. Speed to market of store openings
189	No loss of business due to real estate service failure	**38**	17. Task efficiency and deadlines met
239	Revenue growth/mix	**271**	18. Turnaround time

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Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	Costs		
35	Medical costs	**62**	1. Capital costs
59	Operating costs	**72, 109**	2. Churn costs
60	Occupancy costs	**252**	3. Construction costs
61	Utility costs	**168**	4. Cost of disposal of property vs. savings
62	Capital costs	**152**	5. Cost of underutilized space
63	Maintenance costs	**101**	6. Cost savings tracking in facility management
64	Groundskeeping cost	**142**	7. Cost-quality ratio
65	Custodial and janitorial cost	**143**	8. Cost-quality ratio of facilities services
72	Churn costs	**65**	9. Custodial and janitorial cost
95	Savings tracker	**64**	10. Groundskeeping cost
96	Rent processing	**213**	11. Investment in training per CREM employee
101	Cost savings tracking in facility management	**156**	12. Lease vs. construction or ownership cost
109	Churn costs	**35**	13. Medical costs
122	Occupancy costs	**193**	14. Money used on RE project vs. money budgeted for projects
123	Operative costs (maintenance, energy, etc.)		15. Occupancy costs, * Occupancy cost/person, * Occupancy cost/sqft, * Occupancy cost/total revenues
124	Transaction costs		
142	Cost-quality ratio	**60, 122, 144, 251**	16. Operating costs (maintenance, utility, energy)
143	Cost-quality ratio of facilities services		
144	Occupancy costs	**59, 61, 63, 123, 253,**	17. Real estate cost per CRE employee
152	Cost of underutilized space	**254**	18. Real estate holding costs
153	Real estate cost per CRE employee	**153**	19. Real estate spending as percent of gross margin
154	Total CREM operating expenditures vs. budget	**158**	20. Real estate spending as percent of total operating expenses
156	Lease vs. construction or ownership cost	**190**	21. Rent processing
158	Real estate holding costs	**191**	22. Savings tracker
168	Cost of disposal of property vs. savings	**96**	23. Total CREM operating expenditures vs. budget
190	Real estate spending as percent of gross margin	**95**	24. Transaction costs
191	Real estate spending as percent of total operating expenses	**154**	
193	Money used on RE project vs. money budgeted for projects	**124**	
213	Investment in training per CREM employee		
251	Expenses of real estate occupancy		
252	Construction costs		
253	Energy costs		
254	Maintenance costs		

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Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	Environmental Quality		
20	Indoor air quality	**22, 42**	1. Acoustic quality, noise and acoustics
21	Light quality	**27**	2. Acoustics comfort
22	Acoustic quality	**25**	3. Indoor air climate
25	Indoor air climate	**20, 39**	4. Indoor air quality and ventilation
26	Light comfort	**57, 84, 204**	5. Indoor/outdoor environmental quality (lighting, temperature, noise)
27	Acoustics comfort	**26**	6. Light comfort
39	Indoor air quality and ventilation	**21, 41**	7. Light quality, Lighting and daylighting
40	Thermal comfort	**80, 220**	8. Satisfactory physical working conditions (qualitative)
41	Lighting and daylighting	**40**	9. Thermal comfort
42	Noise and acoustics		
57	Indoor/outdoor environmental quality		
80	Building physical condition (qualitative)		
84	Indoor Environmental Quality (IEQ)		
204	Quality of indoor environment (lightning, temperature, noise)		
220	Satisfactory physical working conditions		

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Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	Productivity/Ways of Working		
10	Location analysis	**78, 216**	1. Adequacy of space (survey based data), suitability of premises and functional environment
8	Workplace impact on research and product development breakthroughs		
9	Employee productivity	**46, 206**	2. Amount of nearby amenities for employees, Location and access to amenities
28	Office design and layout		
43	Interior layout and active design	**138**	3. Amount of R&D activities
44	Biophilia and views	**44**	4. Biophilia and views
49	Productivity	**71, 151, 256**	5. Churn rate, need to relocate employees, number of moves per year
51	Organizational culture		6. Customer acquisition
71	Churn rate	**245**	7. Customer profitability
73	Productivity (turnover, absenteeism, occupants' satisfaction)	**247**	8. Customer retention
75	Space utilization (survey based data)	**246**	9. Customer satisfaction, completion of projects to customer satisfaction
77	Mission and vision	**231, 248**	10. Distance to customers, Distance to required transportation modes, Distance between company sites and businesses
78	Adequacy of space (survey based data)	**177, 178, 186**	
88	Site and location		11. Employee productivity
91	Learning environment, educational suitability, and appropriateness of facility for its function	**9, 49, 73, 243**	12. Employees' opinions on how well the workplace supports their productivity
135	Training and development days	**184**	
138	Amount of R&D activities		13. Equipment provided meets business needs
151	Number of moves per year	**217**	14. Informal communication
174	Use of virtual and flexible workplaces	**260**	15. Innovation
175	Number of teamwork settings	**278**	16. Interior layout and active design, Office design and layout
177	Distance to required transportation modes for customers	**28, 43**	17. Learning environment, educational suitability, and appropriateness of facility for its function
178	Distance to customers	**91**	
179	Use of company logos and colors in workplace design		18. Location analysis, Site and location
184	Employees' opinions on how well the workplace supports their productivity	**10, 88**	19. No loss of business due to failure in premises services
186	Distance between company sites and businesses	**215**	20. Number of teamwork settings
187	Time wasted with interruptions (due to open space layout)	**175**	21. Organizational culture, Mission and vision, Communication of status
215	No loss of business due to failure in premises services	**51, 77, 259**	22. Quality of end product
216	Suitability of premises and functional environment	**228**	23. Quality of work
217	Equipment provided meets business needs	**275**	24. Quantity of work
228	Quality of end product	**276**	25. Renovations required
231	Completion of projects to customer satisfaction	**270**	26. Space utilization (survey based data)
243	Employee productivity	**75**	27. Space/unit of income
245	Customer acquisition	**269**	28. Time wasted with interruptions (due to open space layout)
246	Customer retention	**187**	29. Training and development days
247	Customer profitability	**135**	30. Use of company logos and colors in workplace design
248	Customer satisfaction	**179**	31. Use of virtual and flexible workplaces
256	Need to relocate employees	**174**	32. Workplace impact on research and product development breakthroughs
259	Communication of status	**8**	
260	Informal communication		

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Table 5-7. (Continued)

#	Indicators before cleaning
269	Space/unit of income
270	Renovations required
275	Quality of work
276	Quantity of work
278	Innovation
46	Location and access to amenities
206	Amount of nearby amenities for employees

Continue on next page

Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	Space Usage		
5	Building flexibility into the overall portfolio	**119, 120, 149, 172**	1. Amount of leased vs. owned properties, Owned and leased space, Amount of rented properties, Percentage leased vs. total space
23	Spatial configuration		
55	Functional index – FI, i.e. space utilization	**5**	2. Building flexibility into the overall portfolio
74	Parking	**74**	3. Parking
108	Space utilization		4. Persons per seat, Number of workstations per employee
118	Vacancy rate	**150, 176**	5. Rentable or usable/gross
119	Amount of leased vs. owned properties	**167**	6. Space per employee (e.g. square feet per employee)
120	Amount of rented properties	**121, 145, 268**	7. Space utilization (e.g. Functional index – FI, Percentage of space occupied, Operational space vs. nonoperational space, Effective utilization of space)
121	Square feet per employee	**55, 108, 147, 148, 219**	
145	Space per employee		
146	Whether workplace standards are used		8. Spatial configuration, Workspace (size, shape)
147	Percentage of space occupied	**23, 205**	9. Vacancy rate
148	Operational space vs. nonoperational space	**118**	10. Whether workplace standards are used
149	Owned and leased space	**146**	
150	Persons per seat		
172	Percentage leased vs. total space		
176	Number of workstations per employee		
205	Workspace (size, shape)		
219	Effective utilization of space		
267	Rentable or usable/gross		
268	Space/employee		

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Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	Staff characteristics		
113	Talent management	**15, 31, 32, 56, 136, 277**	1. Absenteeism, presenteeism
212	Competence of CREM staff		
14	Talent attraction and retention rates	**131**	2. Average age
15	Absenteeism	**197, 255**	3. Changes in workforce size, Full Time Equivalent (FTE) employees
16	Staff turnover	**130**	4. Competence of staff
17	Revenue breakdown	**185, 202**	5. Distance employees commute, Distance to required transportation modes for employees
31	Absenteeism		
32	Presenteeism	**16, 33, 76, 137, 199**	6. Employee turnover
33	Staff turnover/retention	**132**	7. Level of education
34	Revenue breakdown	**47**	8. Physical health
47	Physical health	**129, 198, 212**	9. Professionalism and expertise of CREM staff, CRE employee qualifications, Competence of CREM staff
48	Psychological health		
56	Absenteeism	**48**	10. Psychological health
76	Employee or occupant's turnover rate	**17, 34, 163, 164**	11. Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue)
129	Professionalism and expertise of CREM staff		
130	Competence of staff	**14, 113, 242, 257**	12. Talent management, Talent attraction and retention rates
131	Average age		
132	Level of education		
136	Absenteeism		
137	Turnover		
163	Sales or revenue per square foot/meter		
164	Space (square feet/meter) per unit of revenue		
185	Distance employees commute		
197	Full time equivalent (FTE) employee		
198	CRE employee qualifications		
199	Employee turnover		
202	Distance to required transportation modes for employees		
242	Employee retention		
255	Changes in workforce size		
257	Ability to attract/retain staff		
277	Absenteeism		

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Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	User attitude		
92	Appearance	**45, 92**	1. Appearance, look and feel
12	Customer experience	**227**	2. Effective communication
13	Employee engagement scores	**210**	3. Employee satisfaction with CREM information sharing
18	Medical complaints	**209**	4. Employee satisfaction with CREM staff skills
19	Physical complaints	**128, 141, 208**	5. Employee/business units/internal customer satisfaction with CREM department performance (hospitality, responsiveness, quick reactions, results, information, etc.)
24	General perception of the building and its location		
29	Overall satisfaction		
30	Engagement	**13, 30, 90, 133, 134**	6. Engagement, Community satisfaction and participation, Atmosphere of the community, Reward systems and motivation
36	Medical complaints		
37	Physical complaints	**24**	7. General perception of the building and its location
45	Look and feel	**180**	8. Image rating based on building attributes
58	User perception (Post Occupancy evaluations)	**261**	9. Image to outside
89	Customer/building occupants' satisfaction with products or services	**12, 89, 103, 139, 140, 203, 233**	10. Internal and external customers/end users/building occupants' satisfaction with workplace and facilities, products or services, Customer experience
90	Community satisfaction and participation		
103	End user satisfaction		
128	Business units' satisfaction with CREM performance	**18, 36**	11. Medical complaints
133	Reward systems and motivation	**29, 241**	12. Overall employee satisfaction
134	Atmosphere of the community	**19**	13. Physical complaints
139	Customer satisfaction (with workplace and facilities among internal and external customers)	**58**	14. User perception (Post Occupancy evaluations)
140	Customer satisfaction with services		
141	Customer satisfaction with CREM department (hospitality, quick reactions, results, information, etc.)		
180	Image rating based on building attributes		
203	Employee satisfaction with work environment		
208	Employee/internal customer satisfaction with responsiveness of CREM		
209	Employee satisfaction with CREM staff skills		
210	Employee satisfaction with CREM information sharing		
227	Effective communication		
233	Customer satisfaction		
241	Employee satisfaction		
261	Image to outside		

Continue on next page

Table 5-7. (Continued)

#	Indicators before cleaning	#	Indicators after cleaning
	Value/Return/Yield		
66	Current replacement value	**115, 125, 162**	1. Business return on real estate assets, return on assets
114	Financial results	**66**	2. Current replacement value
115	Return on assets	**114**	3. Financial results
116	Value of properties (book or market value)	**250**	4. Income from leases and disposals
125	Return on assets	**155**	5. Real estate cost of acquisition vs. returns/IRR
155	Real estate cost of acquisition vs. returns/IRR		6. Real estate return on equity
160	Real estate return on investment	**161**	7. Real estate return on investment
161	Real estate return on equity	**160**	8. Return-on-investment/economic value added
162	Business return on real estate assets	**237**	9. Value for money
165	Market capital vs. book value	**214**	10. Value of properties (book or market value), Asset value of real estate portfolio, Market capital vs. book value
214	Value for money	**116, 165, 249**	
237	Return-on-investment/economic value added		
249	Asset value of real estate portfolio		
250	Income from leases and disposals		

5.6.4 Preliminary results and discussion

Word counting and thematic analysis performed on the long list of 278 indicators helped set a useful framework for categorization. Through clearing duplicates and sifting complementary metrics, the number of indicators has been reduced to 162, and categories have been finalized. This process brought up a few observations.

First, it is evident that, even though many researchers recall the necessity for reducing the number of KPIs, not all the sources succeeded to collect a short list of them. This might be partially attributable to an unprepared and simple use of technology that induces the taking into consideration of many data just because they are relatively easy to gather. Jordan, et al. (2009) indeed mentions this threat related to a naïve approach toward IT. Then, the number of indicators tends to expand even more because a holistic perspective is chosen, which requires putting together several scientific disciplines and professional fields. 162 is still a **large number** of indicators to deal with for workplace users.

Second, many metrics are actually devoted to describing the same aspect of performance. They simply approach the measurement from **different angles**. Incorporating those into a few comprehensive indicators helps reduce redundancy and shrink the overall number of metrics, towards the objective of minimization, as Lavy, et al. (2014b) recommend. The few resulting metrics become more meaningful because they assume the complexity of today's workplaces. For example, measuring *Space utilization* in terms of *Percentage of space occupied*, by comparing *Operational and non-operational space* and critically analyzing the *Effective utilization of space*, is functional to obtaining a complete vision upon space usage and potential room for optimization, whereas each single metric *per se* would be slightly reductive. This process replies to Fleming's (2004) and Lindholm and Nenonen's (2006) disapproval of the use of parametric measures rather than a comprehensive measurement system.

Third, among different angles, many authors (for example, Kämpf-Dern & Konkol (2017), Lavy, et al. (2014a), and Fleming (2004)) denounce that the **financial perspective** is often prevailing. Thus, it is not surprising to register that among the most frequent words, the term 'cost' recurs multiple times. Almost 10% of the indicators incorporate costs. This is especially attributable to ease of measuring this kind of data, given their quantitative nature. Also, 'revenues, yields and values', even though referring to the economic sphere as well, are way less numerous, accounting only for 10 records, versus 30 records belonging to Costs. This remarks what Brown (2008) says about CRE managers, most of whom tend to know more about reducing costs than increasing revenues. Better balance between these two categories might be beneficial to reach more solid outcomes.

Besides a financial perspective though, it is relevant that 'employees' and 'satisfaction' are recurring terms as well. This reveals the importance of balancing quantitative indicators with a qualitative stance, and embracing a holistic overture.

Last, it is interesting noticing that a few indicators come up multiple times, which stresses their cross-sector importance. Metrics being present with the same or similar wording across multiple sources must be considered of interest for different disciplines, hence reflecting a **holistic** viewpoint. These indicators demonstrate agreement by both the supply- and the demand side, and are relevant to both of them. This

probably happens also because they are easy to collect and to understand across different departments and fields of study. Moreover, it is evident that their wording is already clear and unambiguous.

Among them, those appearing more often all report on staff characteristics, namely, *Absenteeism*, *Turnover* and *Revenue breakdown*. This highlights, once again, the attention organizations direct to their people. As Puybaraud (2017) and Augustin (2014) observe, all these indicators can be strongly affected by the physical characteristics of the office space. This warning strongly encourages exploring the opportunity for bringing together into a unified system all indicators related to the workplace to different extents.

1 KPIs and the NGW

In Phase 0 of this research, the characteristics of the Next-Generation Workplace (NGW) have been outlined. In particular the NGW has been defined as: (1) highly diverse; (2) data driven; and (3) economically, environmentally, and socially impactful/valuable. A brief comment about how the resulting list of 162 indicators intercepts these key characteristics is useful to understand if existing indicators need to be updated.

Diversity

Diversity pervades the NGW, thus it must be taken into due account by all users for better designing, managing and using their workplaces. It is worth taking stock of the list of 162 indicators to check which of them represent diversity in all its different aspects (**Table 5-8**).

A few indicators can be identified for each of the diversity facets that have been recognized in Phase 0.

Table 5-8. KPIs and diversity

Diversity	Indicator	#	Category
Workforce			
Work practices	Absenteeism, presenteeism	1	Staff characteristics
Work practices	Engagement, Community satisfaction and participation, Atmosphere of the community, Reward systems and motivation	6	User attitude
Work practices	Equipment provided meets business needs	13	Productivity/Ways of Working
Individual characteristics	Accessibility for disabled	1	Building operation and management
Individual characteristics	Average age	2	Staff characteristics
Individual characteristics	Physical health	8	Staff characteristics
Individual characteristics	Psychological health	10	Staff characteristics
Individual characteristics	Medical complaints	11	User attitude
Individual characteristics	Physical complaints	13	User attitude
Workplace Management			
Disciplines	Employee satisfaction with CREM staff skills	4	User attitude
Disciplines	Competence of staff (facility management)	5	Building operation and management
Disciplines	Professionalism and expertise of CREM staff, CRE employee qualifications, Competence of CREM staff	9	Staff characteristics
Expectations	Employee satisfaction with CREM information sharing	3	User attitude
Expectations	Employee/business units/internal customer satisfaction with CREM department performance (hospitality, responsiveness, quick reactions, results, information, etc.)	5	User attitude
Expectations	Internal and external customers/end users/building occupants' satisfaction with workplace and facilities, products or services, Customer experience	10	User attitude
Expectations	Organizational culture, Mission and vision, Communication of status	21	Productivity/Ways of Working
Work spaces			
Outside the building	Amount of nearby amenities for employees, Location and access to amenities	2	Productivity/Ways of Working
Outside the building	Location analysis, Site and location	18	Productivity/Ways of Working
Outside the building	Use of virtual and flexible workplaces	31	Productivity/Ways of Working
Inside the building	Space utilization (survey based data)	26	Productivity/Ways of Working
Inside the building	Spatial configuration, Workspace (size, shape)	8	Space usage

Work processes			
Activities	Adequacy of space (survey based data), suitability of premises and functional environment	1	Productivity/Ways of Working
Activities	Churn rate, need to relocate employees, number of moves per year	5	Productivity/Ways of Working
Activities	Interior layout and active design, Office design and layout	16	Productivity/Ways of Working
Activities	Quantity of work	24	Productivity/Ways of Working
Degree of interaction	Employee productivity	13	Productivity/Ways of Working
Degree of interaction	Informal communication	14	Productivity/Ways of Working
Degree of interaction	Number of teamwork settings	20	Productivity/Ways of Working
Identity, status, privacy	Effective communication	2	User attitude
Identity, status, privacy	Quality of work	23	Productivity/Ways of Working
Identity, status, privacy	Time wasted with interruptions (due to open space layout)	28	Productivity/Ways of Working
Work patterns	Innovation	15	Productivity/Ways of Working

Diversity, concerning both the software and hardware dimension of the NGW, is covered by a range of KPIs in the literature. These mainly belong to the categories of *Productivity/Ways of Working, Staff characteristics,* and *User attitude*. In sum, 27 KPIs can be considered suitable to represent diversity, which means that around 20% of all the indicators that have been systematized from the literature can be implemented to describe the workplace for how it has been evolving lately. However, these risk being dispersed in the long list of existing indicators.

In a next step, it is interesting to check if extant performance management practices take into consideration different indicators, besides the literature. Innovative indicators could beneficially integrate the current list. This issue is addressed by sounding out popular tools for workplace evaluation and rating (see **Chapter 5.7**) and interviewing practitioners (see **Chapter 6.3**).

Data

New data are going to feed workplace design, management and use in the near future, if not already at present. It is worth taking stock of the list of 162 indicators to scout for indicators that potentially involve these innovative data (**Table 5-9**).

Table 5-9. KPIs and data

Data	Indicator	#	Category
Personal parameters			
	Physical health	8	Staff characteristics
	Psychological health	10	Staff characteristics
	Acoustics comfort	2	Environmental quality
	Light comfort	6	Environmental quality
	Thermal comfort	9	Environmental quality
Social Networks			
	Employee productivity	13	Productivity/Ways of Working
	Informal communication	14	Productivity/Ways of Working
	Time wasted with interruptions (due to open space layout)	28	Productivity/Ways of Working
	Use of virtual and flexible workplaces	31	Productivity/Ways of Working
	Effective communication	2	Productivity/Ways of Working
	Engagement, Community satisfaction and participation, Atmosphere of the community, Reward systems and motivation	6	User attitude
Environmental factors			
	Acoustics quality, noise and acoustics	1	Environmental quality
	Indoor air climate	3	Environmental quality
	Indoor air quality and ventilation	4	Environmental quality
	Indoor/outdoor environmental quality (lighting, temperature, noise)	5	Environmental quality
	Light quality, Lighting and daylighting	7	Environmental quality
Occupancy patterns			
	Persons per seat, Number of workstations per employee	4	Space usage
	Absenteeism, presenteeism	1	Staff characteristics

Eighteen KPIs belonging to the categories of *Staff characteristics, Environmental quality, Productivity/Ways of Working,* and *Space usage* potentially include innovative data. This means that 11% of the indicators scouted form literature are suitable to represent the NGW performance by accepting data from innovative tools and techniques. These can potentially unveil pioneering information for supporting the design, management and use of evolved workplaces. Nevertheless, they still account for a small percentage of all the indicators potentially available.

Again, it seems interesting to check if extant performance management practices take into consideration different indicators, besides the literature. Indeed, innovative KPIs could favorably expand the current list. This possibility is explored by sounding out popular tools for workplace evaluation and rating (see **Chapter 5.7**) and interviewing practitioners (see C**hapter 6.3**).

Value

The NGW has been recognized as impacting on the social, environmental and economic sphere. It is worth taking stock of the list of 162 indicators to reveal their potential values in the three spheres.

In order to ensue in this intent it is necessary to build up a scheme for organizing indicators and proceed with their classification. This advancement is addressed in **Chapter 6.1**.

2 Remarks

The analysis confirmed that many indicators exist to date. However, they are affected by a few shortcomings: (a) they are numerous, therefore overwhelming, which makes them difficult to manage; (b) they reflect several angles thus referring to different disciplines, which discourages interconnection; (c) most of them seem to overlook today's ways of working and workplaces; and (d) overall, they are unbalanced toward certain aspects of the workplace, hence hindered from a holistic viewpoint, which reduces their effectiveness.

Results of this literature review offer a first attempt for systematization and categorization from a holistic perspective. This is functional as a starting point to follow up on mitigating the shortcomings of the existing sets of KPIs.

The next phases of the research address the aim to (**Table 5-10**): (a) optimize the number of indicators; (b) validate the proposed categories in terms of usefulness to match different disciplines and support convergence of different viewpoints; (c) verify the need for indicators different from the existing ones; and (d) proposing a classification through which to enhance a holistic approach to workplace performance management.

Table 5-10. Phase II: Action plan

Q-2A: What data are valuable for designing, managing, and using the NGW?	*Q-2B: Which of them can be shared by all workplace users?* *Q-2C: How can the social, environmental and economic value of the NGW be enhanced?*	
Available data	**Necessity for action**	**Object of action**
Numerous	Optimization (a)	162 KPIs – duplicates, redundancies, etc.
Multiplicity of angles	Convergence (b)	KPI categories
Lack representation of NGW	Addiction (c)	Rating tools and evaluation methods experienced by users
Lack holistic approach	Classification (d)	Impacts/values

5.7 Several tools for workplace evaluation and rating

Before reducing the indicators and validating the categories, it is appropriate to verify if any other KPI is worth being added to the list extracted from the literature. This exploration is carried out by integrating the literature previously investigated about performance measures with different sources, namely evaluation and rating tools.

In fact, beside 'monitoring' of buildings, also 'evaluation' of the state of the building is common practice among companies. Gertler (2011) says 'evaluations' are used to answer specific questions related to design, implementation and results of a planned, ongoing, or completed project, so that they happen at a discrete point in time. Evaluations often look for an external perspective from technical experts. As well as monitoring, also evaluations rely on indicators.

Specific tools and techniques can be applied to 'evaluating' building performances. Evaluations operate by collecting and checking many data about buildings and their functioning, thus they are worth analysis in the scope of the present study. A few data these tools evaluate might be useful also to be controlled as KPIs with a 'monitoring' approach.

Lindholm and Nenonen (2006) build up a classification of corporate real estate performance measurement practices, which can be adopted as a handy framework for the present study (**Table 5-11**). They distinguish three levels of measurements: 'strategic performance systems', 'tactical tools', and 'data collection techniques'. '**Strategic performance systems**' collect only metrics that can be considered as strategic for continuous controlling. Therefore, they are particularly interesting for top level strategic management. '**Tactical tools**' are defined as important tools for evaluating, controlling and improving internal processes on an as-needed basis (for example, post-occupancy evaluations – POEs, or building-in-use – BIUs[21]), and are not necessarily relevant at a strategic level. **'Operational techniques'** are basically data gathering methods, such as interviews, questionnaires, and observations. These can be used either to support strategic performance measurements and tactical tools, or independently.

One of the most renowned 'strategic measurement systems' is the Balance Scorecard, better defined by Kaplan and Norton (1996) as a management system. These measurement systems include the KPI approach.

With regard to 'tactical tools', instead, benchmarking is for sure the most popular one. Benchmarking is based on confronting quantitative performance indicators (data such as occupancy cost per employee, occupancy cost per square feet/meter, ratio of gross floor area, etc.) against internal, external or functional benchmarks (Lindholm & Nenonen, 2006).

There is plenty of tools on the market setting benchmarks, most of whom end up being used as rating tools. McDougall, et al. (2002) screen a handful of commercial tools, specifically devoted to post-occupancy evaluation, which can all fall under the label of tactical tools. They analyze in-depth three of them: Building Quality Assessment (BQA); Serviceability Tools and Methods (STM) and the Post-occupancy Review Of Building Engineering (PROBE/BUS). Common flaws are that they serve more to create audit scenarios, than to measure performance for continual improvement, which makes them indeed useful for benchmarking exercises.

[21] For details see Vischer (1996).

Ciaramella and Tronconi (2011) thoroughly analyze the most popular rating tools and cluster them in two classes: (a) those devoted to evaluating overall building performances, and (b) those devoted to evaluating environmental sustainability, with a particular sight on building performances (see **Table 5-11**).

Ciaramella and Tronconi (2011) describe 14 international tools in the first class, among which the Office Building Classification BOMA, Post-Occupancy Evaluation (POE), and BOSTI (Buffalo Organization for Social and Technological Innovation) methods. Beside these, they find 10 tools in the second category, among which BREEAM (Building Research Establishment Environmental Assessment Method), GBTool (Green Building Challenge Tool), and LEED (Leadership in Energy and Environmental Design).

Table 5-11. Elaborations on Lindholm and Nenonen (2006), and Ciaramella and Tronconi (2011)

	Strategic Performance Systems	**Tactical Tools**		**Data collection techniques**
Level	Strategic level	Internal use, processes/projects (not necessarily relevant at strategic level)		Operational (in support of strategic performance systems and tactical tools, but can be used also independently)
Spectrum	Strategic/holistic	Comprehensive		Punctual
Timing	Continuous/permanent controlling	On an as-needed basis		When the need for measuring is not so comprehensive
Purpose	Management of processes or outcomes	Analyzing current situation or identifying developing areas		Collecting data feeding the other two types of tools
Examples	BSC KPI	Benchmarking/rating tools		Interviews Questionnaires Observations
		Building performances	*Environmental sustainability*	
		POE, BIU, PROBE/BUS, BOMA, BOSTI, etc.	LEED, BREEAM, GBTool, etc.	

Conventionally, these tools base their ratings on a quantitative approach. However, alongside quantitative indicators, also qualitative performance assessments are conducted. Standards, rating tools and more in general 'tactical tools' combining perceptual metrics with physical building performances, are nowadays quite diffused.[22]

Tactical tools, by definition (Lindholm & Nenonen, 2006), are applied in specific moments over the life cycle of a building, on an as-needed basis. Sometimes this happens to certify its characteristics or performances at a specific point in time.

For instance, LEED standard certifies the 'greenness' of buildings at the design stage. However, often the same buildings have been found to perform poorly once in the normal operation, showing a significant shift between predicted and actual operation (Hua, et al., 2014). Of course, the construction and occupancy phases are likely to impact the actual functioning of a building. Therefore, the need for continuous monitoring on how buildings work in their in-use phase comes to light, not only in the case of LEED certified buildings, but more in general for aligning building operation with initial expectations (Costa, 2014).

[22] Post-occupancy evaluations (POEs), which are based on users' perceptions, are an example of performance assessments based on qualitative, 'soft' data. Lindholm and Nenonen (2006) list other tactical tools devoted to qualitative assessment: Building-in-use (BIU); Performance Map; MicroScanFM, based on the four perspective of the BSC framework; a 'value-added tool', elaborated and tested by Lindholm and Leväinen (2006); and ARES. Also the BRaVe rating tool, developed by the Gesti.tec Lab. of Politecnico di Milano, can be mentioned among those tools aiming to integrate both quantitative and qualitative stances (Ciaramella & Tronconi, 2011).

Other 'tactical tools' are applicable to this end, which can be included in the broad umbrella of post-occupancy evaluations (POEs) methodologies. Unfortunately, POEs are still rarely implemented or shared, for several possible reasons (Hua, et al., 2014). On one hand, architects are barely involved in their projects once their buildings enter the operation phase, consequently they never get to know about shortages and defects. On the other hand, poor performances are interpreted as a shame, so that bad results are never disseminated. Also, POEs require the integration of quantitative and qualitative data through a complex study, which is in effect challenging for data analysis and results reporting. In particular, qualitative strategies such as self-perception surveys tend to be oriented more toward physical comfort, the occupiers' ability to perform their job and the related environmental parameters, rather than on wellbeing (Alker, et al., 2014). Finally, even when carried out, POEs are not paired with visualization techniques that may aid building performance analysis and diagnosis (Hua, et al., 2014). Therefore, performing POEs one-off or following best practice guides (such as ASHRAE, BSRIA and the EPA) do not guarantee optimal working conditions on a day-to-day basis, nor the fine tuning of corporate real estate strategies.

Most of all, tactical tools lack a systematic and integrative approach over time, hence missing a holistic perspective. Only a limited number of these tools attempts to linking building performance, human performance, and business performance, which is what contemporary corporations, employees and real estate providers are looking for. Rather, strategic performance systems, such as KPI monitoring, are more suitable for this purpose. Still, tactical tools could theoretically support strategic performance systems by feeding them of key indicators.

The goal of this Chapter is to understand if some of the information gathered from these tools could be integrated in the long list of KPIs scouted in the literature. This investigation will go through two subsequent stages:

1. Analysis of a few 'tactical tools' to better understand their characteristics and the data they generally focus on; and
2. Interviews with professionals who deal with performance management, in order to grasp their practical experience with these tools and their opinions about the extent to which they might support performance monitoring.

Table 5-12 lists some of the 'tactical tools' that are currently more diffused on the market. In all, performance management tools can differ by: (a) the purpose of the measurement; (b) the object of the measurement; (c) the user who is interested in the results of the measurement; and (d) the technique for data collection (Lindholm & Nenonen, 2006). These criteria have helped build a framework comparing these tools.

Table 5-13 takes the analysis further by providing comments on the limitations and strengths of the data they collect. Discussion is open about whether there is room for them to compensate existing key performance indicators for workplace management.

Table 5-12. Comparison of tools attempting a comprehensive approach

Gallup Workplace Audit Q12	**Leesman Index (LMI)**	**Building Use Studies (BUS) Methodology**	**Indoor Environmental Quality (IEQ) Survey**	**WELL Building Standard**	**The Great Place to Work – Trust Index and Culture Audit questionnaire**
When/how it was born – Time on the market					
In 1988, George Gallup and Donald O. Clifton joined their research efforts, respectively in human needs, satisfaction and wellbeing, and in Positive Psychology. Thus, they merged progressive management science with survey and polling science. The first version of the Q12 was released in the 1990s. Gallup has collected survey results from more than 25 million employees around the world up do date.	Tim Oldman, Annie Leeson and Divyang Mistry found Leesman as an independent private company in 2010. The Lmi was launched in 2010. It has been applied to 300,000 employees, in more than 2,300 workplaces (as of 2018).	BUS was first developed in 1985. Refinement of the method dates back to the 1990s, when it was applied over the series of PROBE (Post Occupancy Review of Buildings and their Engineering) studies. Since 1995, the BUS methodology has been refined and managed my Adrian Leaman. Since 2009, it has been supervised by ARUP.	The IEQ Survey was developed at the Center for the Built Environment (CBE), University of California, Berkley. The Center was founded in 1997 under the National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) program. Over 1,000 buildings (on March 2017), with 100,000 individual occupant responses.	The International WELL Building Institute (IWBI) is a company, founded in 2013. The Standard was launched in October 2014. To date over 350 projects (76 million square feet) have been utilizing WELL.	The annual research represents 12 million employees from over 90 different countries. In the US, it surveys more than 232,000 people, working at companies with more than 1,000 employees.
PURPOSE OF THE MEASUREMENT (Lindholm & Nenonen, 2006) - Objective (as stated) and typical application					
• Measuring employee engagement • Explaining the 'Overall satisfaction level' with one's company, by capturing employee perception • Gathering diagnostic information (dissatisfactory responses – last 3 points of the scale – are branched to a follow-up probing for more information about potential problems) • Benchmarking to Gallup's database	• Providing an effective work environment • Supporting productivity • Planning a capital project • Obtaining the Leesman+ certification (awarded to workplaces that score 70 Lmi or more) • Benchmarking both internal (across entire CRE portfolios) and external	• Enabling benchmarking against 45 key variables • Comparing building performance before and after a major change • Performing POEs with reference to a standard procedure	• Improving physical environment for occupants • Developing certain building technologies through a standard research tool • Benchmarking building quality within a portfolio Often part of a POE process, to evaluate design and operation of a new or renovated building, as well as to detect and solve problems against occupant comfort, satisfaction and productivity.	• Measuring, monitoring and certifying building performances toward the improvement of the health and wellbeing of occupants • Obtaining a certification grade (Silver, Gold, Platinum) It encourages the adoption of POEs.	• Obtaining a certification of the quality of the workplace experience offered by a company (Trust Index Employee Survey) • Measuring engagement • Assessing and benchmarking companies' culture (Culture Audit Management Questionnaire) • External benchmarking, national and global (increasing visibility and attractiveness of the company)

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Table 5-12. (Continued)

Gallup Workplace Audit Q12	**Leesman Index (LMI)**	**Building Use Studies (BUS) Methodology**	**Indoor Environmental Quality (IEQ) Survey**	**WELL Building Standard**	**The Great Place to Work – Trust Index and Culture Audit questionnaire**
TECHNIQUE FOR DATA COLLECTION (Lindholm & Nenonen, 2006) – Questions (number and type) – Qualitative/quantitative approach					
Quantitative 12 question/statement survey (with 6 response options, on a 1 to 5 scale).	Mainly quantitative The Lmi is a 'functionality and effectiveness' score on a scale from 0 to 100. Introduction + 11 questions, Available in 6 languages, on average take 11 minutes to be filled out.	Quantitative + Qualitative Paper or online-based survey with both closed questions (answers on a scale 1 to 7) and open comments, therefore combining quantitative and qualitative feedback.	Mainly quantitative Web-based survey tool that takes approximately 5-12 minutes to be completed.	Mainly quantitative Technical measurements and documental analyses performed by accredited professionals and authorized assessors. Going through the whole process might take months.	Quantitative + Qualitative Trust Index Employee Survey includes 56 statements (5-point rating scale) covering credibility, respect, fairness, pride and camaraderie + 2 open-ended questions. It takes about 15-20 minutes to complete.
OBJECT OF THE MEASUREMENT (Lindholm & Nenonen, 2006) - Indicators/metrics					
1+12 questions address: 0 Overall Satisfaction 1 Expectations 2 Materials and equipment 3 Opportunity to do what I do best 4 Recognition for good work 5 Someone cares about me 6 Encourages my development 7 My opinions count 8 Mission/Purpose 9 Associates committed to quality 10 Best friend 11 Progress 12 Learn and grow	Work activities (21 items) are rated in terms of importance and satisfaction. Also physical and service features (25 items each) are rated the same way.	12 main indicators representing the overall building performance: 1 Temperature in summer overall 2 Temperature in winter overall 3 Air in summer overall 4 Air in winter overall 5 Lighting overall 6 Noise overall 7 Comfort overall 8 Design 9 Needs 10 Health 11 Image to visitors 12 Perceived productivity	7 main areas of indoor environmental performance constitute the core survey: 1 Thermal comfort 2 Indoor air quality 3 Acoustics 4 Lighting 5 Cleanliness & maintenance 6 Spatial layout 7 Office furnishing + additional/optional topics: - Security and Safety - Wayfinding - Shading systems - Operable windows - Floor diffusers - Washrooms - Accessibility - Transportation - Green building features	100 Features referring to 7 Concepts, which impact human behaviors related to health and wellbeing: 1 Air (1-29) 2 Water (30-37) 3 Nourishment (38-52) 4 Light (53-63) 5 Fitness (64-71) 6 Comfort (72-83) 7 Mind (84-100) + Innovation (101-105): beyond the requirements, it is oriented to promoting the evolution of the Standard.	2 main areas compose the final grade: - Trust Index Employee Survey (2/3 of the grade) - Culture Audit Management Questionnaire (1/3 of the grade) Employees' perception is assessed on 5 dimensions: 1 Credibility 2 Respect 3 Fairness 4 Pride 5 Camaraderie HR managers are asked to fill in a different questionnaire about organizational practices and policies.

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Table 5-12. (Continued)

Gallup Workplace Audit Q12	**Leesman Index (LMI)**	**Building Use Studies (BUS) Methodology**	**Indoor Environmental Quality (IEQ) Survey**	**WELL Building Standard**	**The Great Place to Work – Trust Index and Culture Audit questionnaire**
USERS INTERESTED IN THE RESULTS OF THE MEASUREMENT (Lindholm & Nenonen, 2006) - Target of the feedback					
Human Resources Owner, AD, CEO Managers	Executive boards Project managers Workplace designers Corporate real estate teams Change management consultants	Owners, Developers & Estate Managers Designers & Sustainability experts Contractors FM teams	Researchers Owners Operations staff Design teams and community (architects, engineers) Builders	Designers Managers	Managers Leaders Human Resources
Alignment/complementarity with other rating systems					
-	-	-	-	LEED Green Star BREEAM IEQ Survey	-
World areas of application					
Gallup's study *State of the Global Workplace*, based on the Q12 instrument, spreads across 140 countries. Special focuses of analysis are performed for the following regions: Sub-Saharan Africa, Middle East and North Africa, East Asia, South Asia, Southeast Asia, Australia and New Zealand, United States and Canada, Latin America, Western Europe, Commonwealth of Independent States and Nearby Countries, Central and Eastern Europe.	The Lmi was performed in 67 countries worldwide. As for the geographical location of the Leesman+ buildings, it results being mostly applied in Anglo-Saxons countries (e.g. United Kingdom, United States and Australia), and Northern Europe.	Spread over 18 countries, with 12 language versions. Mostly used in the UK and diffused across Anglo-Saxons countries, especially Australia and New Zealand.	USA, Canada and Europe.	Most of the projects are located in the US and China, but it spreads all over the world. No Italian project has been certified, yet.	Spread over 90 countries in the world.

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Table 5-12. (Continued)

Gallup Workplace Audit Q12	Leesman Index (LMI)	Building Use Studies (BUS) Methodology	Indoor Environmental Quality (IEQ) Survey	WELL Building Standard	The Great Place to Work – Trust Index and Culture Audit questionnaire
Sources					
(Harter, et al., 2006) **(Gallup, 2013)** https://q12.gallup.com/	(Leesman, PF 1497, Annex 3) (Oldman, 2017) www.leesmanindex.com	(Reid, et al., 2013) www.busmethodology.org	(Alker, et al., 2014) (Zagreus, et al., 2004) www.cbe.berkeley.edu	(WELL, 2017) www.wellcertified.com	www.greatplacetowork.com www.greatplacetowork.it

Table 5-13. Tools attempting a comprehensive approach

Tool	Description/notes	Comments/PROS vs. CONS
Gallup Workplace Audit Q12	The Q12 meta-analysis tool provides a 12 question/statement survey (with 6 response options), which aims at explaining the 'Overall satisfaction level' with one's company, by capturing employee perception on factors such as: - Expectations - Loyalty - Pride - Productivity. The 12 workplace elements are directly linked to performance outcomes. These look particularly unbalanced toward organizational outcomes, focusing specifically on items measuring the extent to which employees are engaged in their work. Only a few of the questions/statements indeed appear to incorporate some spatial repercussion: - 'Overall satisfaction' is very generic; - 'Materials and equipment' might include workspace features, but is more evaluated as a company's responsibility; - 'Opportunity to do one's own job at best' implicitly refers also to the physical environment; - 'Someone at work cares about me' might express also the number of complaints to the facility managers and how satisfactory their resolution was; - 'Opinion counts' might again include reference to the extent to which employees are involved in the designing and management of the building where they work, but not necessarily.	On the whole, it does not incorporate any explicit reference to the physical environment, despite Gallup stresses a high correlation between employees' engagement at work and employees' physical health (Gallup, 2013). It is unbalanced toward organizational/business analysis. Therefore, it is really difficult to explain the extent to which these metrics are affected by spatial characteristics of the workplace.

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Table 5-13. (Continued)

Tool	Description/notes	Comments/PROS vs. CONS
Leesman Index (LMI)	The Leesman Index measures workplace functionality and effectiveness through a perception e-survey. The survey is submitted to employees who are asked to rate their working environment, based on four main areas of investigation: - Work activities, which of them are important to employees and how well the workplace supports them; - Workplace (design) impact on corporate image, culture, sense of pride, enjoyment, community and personal productivity; - Physical features, importance and satisfaction with each of them; - Service features (namely FM and IT), importance and satisfaction with each of them. The combination between 'Work activities' and 'Workplace impact' actually defines the Leesman's effectiveness performance indicator (LMI). The surveys are conducted across a range of pre and post-occupancy workplace projects. Some questions of the survey are fixed in a core module, while some elements can be customized by the organization according to their interest and necessities. The Index combines the assessment of activities carried out by employees with the assessment of the surroundings (workplace physical features, facilities services). The questionnaire takes into account a number of variables such as industry type, location, gender, age and length of service within the same company. The goal is to provide a benchmark score for the organizations that can compare their workplaces to others throughout the globe. The Index does not measure employees' productivity per se, but to what extent their workplaces enable them to work productively (Oldman, 2017).	It seems to equally balance different factors. The Index captures the main location where the person works (type of workstation) that can be either in the main office, or in other hubs, at clients' offices, home, on the move. In addition, information are asked about what kind of space the employee uses at most (private enclosed office, shared, meeting room, etc.). Nevertheless, specific geo-positioning within the building of study is not taken into consideration. Specific physical real estate data are still missing in the model, such as services, physical features, fabric of the building, occupation strategy, etc. (Rothe, 2017). Also, data about Southern Europe are missing, including Italy.

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Table 5-13. (Continued)

Tool	Description/notes	Comments/PROS vs. CONS
Building Use Studies (BUS) Methodology	The BUS is a method for evaluating building performance through occupant satisfaction. It aims at incorporating environmental, social and organizational issues. It allows benchmarking against a large database, since it has been used over the last 30 years. It uses a survey with both closed questions (answers on a scale 1 to 7) and open comments, therefore combining quantitative and qualitative feedback. Overall it counts up to 45 questions (and corresponding variables), which can be summarized into 12 main indicators representing the overall building performance: 1. Temperature in summer overall 2. Temperature in winter overall 3. Air in summer overall 4. Air in winter overall 5. Lighting overall 6. Noise overall 7. Comfort overall 8. Design 9. Needs 10. Health 11. Image to visitors 12. Perceived productivity. In commercial buildings, occupants are asked also about their perceived productivity and how they commute from home to work.	The main value of this tool is to encourage POEs by providing a standard procedure to follow. It is unbalanced toward environmental analysis. Indeed, it counts up to 45 questions, addressing different variables in the following proportion: - thermal comfort (11); - air quality (7); - noise (6); - design, image, needs (5); - control (5); - lighting (5); - space (4), - other (3).

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Table 5-13. (Continued)

Tool	Description/notes	Comments/PROS vs. CONS
Indoor Environmental Quality (IEQ) Survey	IEQ Survey mission is to improve the performance of commercial buildings especially for what concerns environmental quality and energy efficiency. The IEQ quantifies how well a building performs from the perspective of its occupants. The goal is to encourage a feedback loop able to inform how certain design features and technologies impact on occupant comfort, satisfaction and productivity. It uses a web-based survey with both closed questions to be answered on a 7-point satisfaction scale and typed comments, therefore combining quantitative and qualitative feedback. It comprises seven main areas of indoor environmental performance: 1. Thermal comfort 2. Air quality 3. Acoustics 4. Lighting 5. Cleanliness 6. Spatial layout 7. Office furnishing. Additional topics can be added on demand to the survey, including: Security and Safety; Wayfinding; Shading systems; Operable windows; Floor diffusers; Washrooms; Accessibility; Transportation; Green building features. They are often applied during post-occupancy evaluations and implemented in pre/post analysis of moves, rather than to obtain a regular feedback. Though, the CBE was commissioned by a partner to design and perform a survey for distinct users/populations, namely occupants, operators and design team. Thus, three different surveys were administered: - A customized occupant IEQ survey, to investigate on how satisfied occupants are with the indoor environmental quality; - An operation and maintenance staff survey, to understand how satisfied the staff is with the design of the building in relation to their ability to run and maintain it; - A design and construction process survey, to poll for how satisfied the teams of architects, engineers and constructors are with the building process. This approach seems particularly interesting because it aims at matching different points of view and different users' perspectives, and tries to bridge the gap between the demand side and the supply side. Moreover, the IEQ survey asks some information about the respondents' workspace, whether it is in the core/perimeter of the building, near a window, the orientation (north, south, east, west), and the type (e.g. private office). Customizable questions may ask for zoning (on the basis of floor plan schematics), and work duties (to be analyzed in light of job-specific tasks). A CSV file is provided to clients who wish to perform further statistical analysis. For example, they may cross-check the data with logs of physical measurements. Finally, survey responses are recorded with date and time of compilation, so that they can be associated with other time-stamped data of environmental conditions.	It is unbalanced toward environmental analysis. It is highly customizable, which is good on one hand, but might be useless if companies do not exactly know what they are looking for and what kind of correlations is useful to look at. It is typically applied as part of a POE process. Therefore, it is carried out not on a regular basis, but to assess the design and operation of a building after a move or renovation. It records the time of questionnaire compilation, which is useful to cross-check results with environmental conditions at that moment.

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Table 5-13. (Continued)

Tool	Description/notes	Comments/PROS vs. CONS
WELL Building Standard	This is not a workplace survey, but a global standard for healthy buildings, particularly commercial and institutional. It is conceived as a system for measuring, monitoring and certifying building performances toward the improvement of the health and wellbeing of occupants. It can be applied at 3 different stages (types) of project: - New and existing buildings; - New and existing interiors; **and** - Core and shell (addresses building structure, window location and glazing, building proportions, heating, cooling and ventilation system, and water quality, together with consideration of the site in relation to amenities and opportunities for wellness). It consists of 100 Features referring to 7 Concepts, which impact human behaviors related to health and wellbeing: 1. Air (1-29) 2. Water (30-37) 3. Nourishment (38-52) 4. Light (53-63) 5. Fitness (64-71) 6. Comfort (72-83) 7. Mind (84-100). 8. (Innovation, 101-105: beyond the requirements, it is oriented to promoting the evolution of the Standard). The Well final scorecard aggregates the 7 Well Scores for each Concept, in a range from 1 to 10. The final scorecard sums them up and assigns an overall level to the building: Silver, Gold or Platinum. Anyway, only a few Well Features consider the utilization of a survey or similar methods for involving building occupants and taking into account their perceptions. In particular, only three out of 100 Features suggest the integration of some kind of feedback techniques. 86 – Post-occupancy surveys (WELL, 2017, p. 140): The IEQ Survey is required to be performed and results from it should be circulated among (a) owners and managers, (b) occupants – upon request, (c) the International WELL Building Institute for certification. 89 – Adaptable Spaces – Part 1 Stimuli Management (WELL, 2017, p. 143): Methods to establish different workplace zones/functions and provide various opportunities of sensory engagement are asked to be put in place. Especially, a programming plan should be developed, based on data collected through interviews, surveys, focus groups, observational techniques, and more in general research data. No other detail is provided by the Standard on how to go on with data gathering. 94 – Self-monitoring (WELL, 2017, p. 149): Encourages employees to track their health status by using sensors and wearables. Even though it promotes awareness of biomarkers associated with health and wellness, it seems to be a responsibility put on the individuals. Organizations are required only to encourage the employees wearing those devices, but not to be involved in any verification of their status. Neither hint is made at any other potential use of those trackers, e.g. in checking for space utilization.	Particular stress is on health and wellbeing, under the motto “Healthy places to be”. Interestingly the certification process must be rerun every three years (minimum), assuming that building conditions can change over time. Also, annual data must be collected for certain features that require regular reporting, throughout the Certification period. It basically checks for compliance with building regulations (e.g. 73 – Ergonomics: Visual and Physical), adherence of the spaces to construction specifications or design requirements (e.g. 52 - Mindful Eating), and/or the application of policies encouraging particular behaviors (e.g. 65 – Activity Incentive Programs). It must be performed by accredited professionals and authorized assessors.

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Table 5-13. (Continued)

Tool	Description/notes	Comments/PROS vs. CONS
The Great Place to Work	It is a certification program with the aim to quantify and strengthen the organizations' workplace culture and employees' level of engagement. It assesses and benchmarks companies against numerous successful organizations in the world and it builds every year a ranking of the Fortune 100 Best Companies to Work For, with separate national charts. The goal for companies by implementing this certification is to boost employees' engagement and gain financial advantages in the marketplace. The survey submitted to the employees is based on the Trust Index Survey. The survey does not ask any specific question about the physical environment. However, some statements might include reference to how the company approaches and manages the office space. For example, employees at Google Inc., which is first in the Fortune 100 Best Companies to Work For 2017 List., say that: - They have special and unique benefits (97%); - They are given resources and equipment to do their job (97%); - They are proud to tell others they work there (96%). Indeed, Google Inc. is particularly oriented toward supporting employees' health with an extensive insurance and other onsite benefits. They care about wellness as well, through nutrition, massages, etc. Anyways this does not include any specific information about workplace management or physical characteristics of the workspace.	Focus is on engagement and corporate culture. It does not take the physical dimension of the office environment into specific consideration.

After thorough analysis, a few common advantages and disadvantages of using the abovementioned tools can be outlined, as follows.

1. They often attempt to set a comprehensive perspective toward some sort of certification. Thus, they are meant as tools to be **implemented once in a while**, or on-demand, such as in the occasion of planning a capital investment.
2. They are often applied by **third-parties**, who are paid for that. This, on one hand, is necessary for professional (and hopefully impartial) judgement, but, on the other hand, increases the disconnect with building management practices and real operational issues.
3. Most of them aim at referring to benchmarks. Consequently they **lack in precision** about the building itself, trying to summarize a few main indicators to be compared externally (see WELL, which in the end summarizes performance into one single grade). For example, when they extract perceptual metrics, they do not refer them to specific locations inside the building, therefore showing only general assessments.
4. Most of the time these **leave apart the spatial component**, or take it into consideration only as a marginal factor (for instance, The Gallup Report does not collect any specific information about physical workspace; The Great Place to Work does not make it evident to what extent the physical workspace impacts the rating; and so on). This might be due to the fact that they are undertaken in fields other than workplace, facility, property, or real estate management.
5. This kind of surveys typically ask respondents to express an opinion/judgement trying to summarize the **overall experience** they have of specific parameters (such as temperature, light, noise, etc.) at work. The statement that comes out is for sure effective and synthetic, but somehow deficient in specificity. In effect, it might be difficult to express an overall satisfaction level with any aspect of the building in abstract.[23] Moreover, those kind of opinions are likely to be biased by peripheral phenomena, related to causes other than the physical environment *per se*, such as engagement. However, none of the tools that have been analyzed seems to offer any correlational index to address this issue.
6. The **target** of the feedback captured through these tools corresponds most of all to those who develop, manage, operate and design buildings, and to researchers. Users at the demand side are left apart. Their results tend to be used **for external communication** (for instance, raise visibility, or attract talents), rather than for internal workplace management.
7. Among the most popular and well-known indexes, only a few of them include data about **Italian** workplaces. This can be explained in part because of the immaturity of the Italian real estate and workplace management sector. Unfortunately, not many Italian companies seem to have been interested in collecting these kind of data to date. Hence, very little information about Italian practices exists to feed these international tools. The Leesman Index case highlights this issue.[24]

[23] Being able to investigate building occupants while they are making use of the building could allow for interesting insights on how they use the space and what their experience in real-time feels like. This could be done through apps that pop-up every now and then asking for feedback about feelings and emotions experienced just in time while using the workplace. Similar experiments have already been done in contexts different from the workplace, as recounted by Mayer-Schönberger and Cukier (2013).

[24] The Leesman society does not have enough data about Italian offices so they cannot include Italy in their statistics. Dr. Peggie Rothe, Development Director at Leesman, declares: *"[…] unfortunately Italy is one of the countries in which we haven't yet done many surveys, and the total amount of respondents is still less than 500. This means that we can't really analyse the Italian data to draw any conclusions about the Italian workplaces."* Indeed the Leesman index is built up on questionnaires that are filled by companies on a voluntary basis. Peggie Rothe explains more in detail: "*Our survey is deployed across organisations that come to us to have their workplaces measured. This might either be in combination with a workplace change (in which case often pre and post surveys are done) or it can be a measurement that is done as a "health check" and to simply understand how well the workplace is performing. So we do not randomly select participants, the survey would most often go out to all employees in the workplaces that our clients*

In conclusion, meta-studies deriving from these indexes, tools and techniques are mainly useful for proponents of buildings, namely the supply side, with rating purposes. Whereas the demand side of workplaces (as they are defined in Phase I) might benefit from a slightly different approach, more focused on 'monitoring' workplace performance on a regular basis.

Moreover, since they tend to be applied for certifying performance, they are not necessarily relevant at a strategic level, as Lindholm and Nenonen (2006) observe for 'tactical tools' in general. Indeed, the approach of 'tactical tools' totally diverges from the idea of continuous monitoring, which is typical of 'strategic performance systems'. That is why they are not the right tools for setting corporate real estate and workplace strategies.

However, they collect many data that could potentially feed the implementation of a KPI approach, which is then valuable to check for working conditions and keep the office performance under control.

want to measure. The reason for the small amount of Italian data is simply that we haven't worked with that many Italian clients, so the survey hasn't been sent out to many Italian respondents. We haven't specifically been targeting the Italian market as we haven't sensed a strong demand." (Rothe, 2016)

6 PHASE II: Workplace Data – Synthesis

"THE NEW CIRCUMSTANCES UNDER WHICH WE ARE PLACED CALL FOR NEW WORDS, NEW PHRASES, AND FOR THE TRANSFER OF OLD WORDS TO NEW OBJECTS."

—THOMAS JEFFERSON, THIRD PRESIDENT OF THE UNITED STATES

WHY (AIM). Based on the extensive analysis of the literature performed in Chapter 5, Chapters 6 proceeds in the development of Phase II of the research, namely elaborating on the data-side of the workplace. The analytic process performed in the literature review comes here to a synthetic moment. The analytic part (Chapter 5) proposed a de-composition of the existing knowledge on workplace data. The information that has been obtained is now elaborated through the 're-composition' of new knowledge.

WHAT (CONTENT). Chapter 6 describes the synthetic process that was undertaken to infer a short list of KPIs, which is agreed upon by all workplace users, as they were defined in Phase I.

A ***proposal for classification*** is advanced with the aim of organizing indicators and constructing a useful framework for supporting the synthetic-interpretive reasoning applied to obtain new knowledge.

The ***methodology applied to Phase II***, which consists in a Delphi method is described in details. This is followed by analysis of the results, which is presented step-by-step returning each single stage of the Delphi process.

Discussion on the final set of KPIs provides critical arguments on categories and classes, the number of KPIs, their priority, differences between users at the demand side and at the supply side, and additional comments on the most common metrics in the literature which still appear also in the system resulting from the Delphi process.

Conclusions on workplace indicators highlight the usefulness of this system in supporting feed back and forward in the next-generation workplace-making process.

6.1 Organizing indicators: a proposal for classification

A need emerges to unifying, systematizing, and interpreting the numerous indicators that came up after collection. Also, a bridge may be opportune to connect them to indicators potentially gathered from evaluation and rating tools. In addition, organizing KPIs is required to reconnect them to the previous steps of investigation developed in Phase 0. There, indeed, three main workplace values have been recognized: social, environmental, and economic. Is it possible to organize KPIs according to this criterion of interpretation? In effect, the literature presents some support to this purpose.

To elaborate a framework for classification, it is possible referring to the idea of *"the total workplace"* (Becker, 1990), combined with several other contributions that echo the same scheme.

The concept described by Becker (1990) includes physical facilities, beside organizational and social elements. Varcoe (1996) as well identifies three facilities performance criteria that all measures must relate to: customer satisfaction, flexibility, and productivity. Kämpf-Dern & Konkol (2017) identify three important aspects of a physical workspace environment impacting performance: ambient (covering physical factors such as noise, climate, light, etc.), material (implying spatial organization, equipment, etc.), and socio-spatial (including privacy, territoriality, crowding, etc.).

These three dimensions are reiterated also by Alker, et al. (2014). Here, they mostly relate to the impact workplace users might want to look at while asking *"how does my building impact my people?"* According to them, the overall impact can be considered as trifold: economic/organizational, environmental/physical and social/human.

Therefore, three main classes seem to recur throughout the literature. The same can also be easily related to the three workplace impacts and values that emerged from the literature review in the first part of this work, as displayed in **Table 6-1**.

Table 6-1. Impacts and values from literature

Source	Economic impact	Environmental impact	Social impact
(Becker, 1990)	Organizational elements	Physical facilities	Social elements
(Varcoe, 1996)	Productivity	Flexibility	Customer satisfaction
(Alker, et al., 2014)	Economic/organizational	Environmental/physical	Social/human
(Kämpf-Dern & Konkol, 2017)	Material	Ambient	Socio-spatial

The economic impact is meant to reflect the organizational structure and functioning within the workplace, together with a firm's financial goals in terms of efficiency and effectiveness of the business activity.

The environmental impact expresses physical characteristics of the property/asset/building, which is being utilized for implementing the core business of the organization.

The social impact represents the extent to which perception and satisfaction of building users are affected by, and affect in turn the workplace.

The classification presented in this chapter applies on top of the categories that have been previously used to systematize the indicators. According to Jacob (2004), classification happens on the basis of predetermined guidelines or principles, and through a scheme that is artificial and arbitrary:

> […] artificial because it is a tool created for the express purpose of establishing a meaningful organization; and arbitrary because the criteria used to define classes in the scheme reflect a single perspective of the domain to the exclusion of all other perspectives. (Jacob, 2004, p. 522)

Hence, while the approach for categorization was inductive, reasoning in support of classification is deductive. Categories had been inferred from a creative synthetic process. Classes are derived from literature, and will be subsequently filled with entities (i.e. indicators).

Classification is useful at this point of the research for a few main reasons.

First, Lavy, et al. (2010b) conveys that some sort of clusterization, grouping, or categorization must give FM professionals the possibility of selecting the list of performance metrics they are most interested in. Thus, overcoming all particular groupings from literature with a more comprehensive method is valuable, especially considering that not only facilities managers, but also many other stakeholders are expected to take advantage of the KPI set proposed in this work.

Second, a classification is practical in order to integrate indicators gathered through different sources, such as literature review, rating tools, and interviews.

Third, classification proposes a higher level of grouping complementary to categorization. Categories come out with a bottom-up approach from the KPIs themselves, reflect their themes, and are meant to serve the purpose of distinguishing them within the KPI set. Besides, classes come out with a top-down approach, represent their impacts *per se* and on one another, thus are meant to serve the purpose of showing their impacts/values both inwards and outwards the KPI set. In all, this process allows to build an informative framework where to collect all the indicators. The framework helps, on one hand, identify the impacts related to those metrics and, on the other hand, refer them to the professional areas that are more likely to retain that data category.

Prior to attempting classification by impact of all the indicators scouted both in the literature and practice (i.e. through interviews), it is necessary to better understand what categories or classes have been adopted in the sources. In effect, many of the sources that have been consulted base indicators' clusterization on different types of impacts the indicators express. Clusters detected in the literature have been listed in **Chapter 5.6**, but have not been utilized for categorization, while it was preferred to create new categories from scratch, through word counting and thematic analysis. Here, those clusters, or categories, can be useful to reconnect the indicators they contain to the respective classes of impact.

Some sources already elaborate **three** clusters. Alker et al. (2014), and Chwalbińska-Kusek and Olszewska (2015) adopt a common approach distinguishing between financial/organizational, physical, and perceptual metrics. These clusters already fit the suggested trifold structure of impacts.

Other sources seem to make a more refined distinction of **four** sets of indicators.

Lavy et al. (2010, 2014a, 2014b) organize facility performance indicators into four classes, based on their objective and what they represent. 'Financial' indicators are mainly cost-related and respond to economic impacts; 'functional' and 'physical' metrics incorporate the performance of buildings and facilities, therefore may be matched to the environmental impact; 'survey-based' metrics are typically unquantifiable or based on subjective opinions, hence tend to merge with the social/perceptual impact. Anyway, they

argue that the latter category contains indicators that may fall into one of the other three categories, thus it is liable to be erased or slightly modified (Lavy, et al., 2010b).

Lindholm and Nenonen (2006), building up on Kaplan and Norton (1996), and following up also to Amaratunga and Baldry (2003) mention four main perspectives: (1) 'financial perspective' which matches the economic impact; (2) 'business process' and (3) 'learning & growth' perspective that can be both referenced to the environmental aspects; and finally (4) 'customer perspective' to respond to the social dimension.

Finally, some other sources utilize **multiple** clusters, mostly interpreting the objectives subtended to the use of certain indicators.

Metrics listed by Lindholm & Leväinen (2006) are categorized according to the real estate strategies they outline. Each strategy is defined by real estate objectives and operations. Different objectives suggest which strategy, with its corresponding measures, flows into the three abovementioned impacts. 'Value of assets' and 'costs' express the financial side; 'flexibility', 'marketing and sale', and 'innovations' appertain to the physical impact; whereas 'productivity' and 'employee satisfaction' belong to the social sphere.

In Jordan's, et al. (2009) contribution, 'transaction management', 'lease administration' can be referred to an organizational and economic impact; 'facility management', 'project management', and 'occupancy planning' clearly reflect a physical impact; whereas 'account management', dealing with people, implies a social impact.

Similar is the case of Jones Lang LaSalle (JLL, 2017a). Here, 'provide long-term value for stakeholders', 'shed low margin business units' incorporate indicators reflecting an economic impact. 'Acquire emerging companies that extend product offering' implicates some sort of environmental/spatial impact. Indicators contained in 'help customers', 'drive growth', and 'drive innovation' express the social impact.

The table in **Appendix 12.9** lists all the indicators by source, fitting their categories into the three classes that have been herewith established, namely economic, environmental and social impact.

At first, systematizing KPIs from the literature into the trifold system of classes according to impact/value dimensions confirms that this kind of clusterization is actually possible. Subsequently, application of this principle is undertaken on the list of indicators obtained after cleaning by going through the same reasoning. This means that classes are attributed to the categories, and include all the indicators contained in that category (), according to the following definition:

- Economic-financial/organizational indicators have an overriding impact on the economic activity of the company (for example, building value, business value, and market power) and have a direct influence on the financial objectives and organizational values of the company;
- Environmental indicators have an overriding impact on the physical environment (for example, sustainability, land consumption, and use of resources) and have a direct influence on the environmental objectives/values of the company; and
- Social indicators have an overriding impact on the people/workers (for example, wellbeing, satisfaction, and quality of life) and have a direct influence on the social objective/values of the company.

Table 6-2. Classification of indicators by category

Class – Impact – Value		
Economic-financial/organizational	**Environmental**	**Social**
Cost	Building operation and management	Productivity/Ways of Working
Value/Return/Yield	Environmental quality	User attitude
Business effectiveness	Space usage	Staff characteristics

This stage is explicitly deductive and requires some verification afterwards.

Verification will be provided following the same strategy as applied by Lavy, et al. (2010a). Here the authors aim at sorting a list of indicators they put together from literature into the four categories mentioned above (i.e. financial, functional, physical, and survey-based). In order to do so, they arrange the indicators into those four pre-determined classes. In the end, they submit this set to eleven interviewees for verification through a brief questionnaire, asking them only whether they agreed or not with the proposed clusterization, and to explain why, when they disagreed.

Verification will be performed only at the very end of the process. Once obtained the final short list of metrics, falling under specific classes, these will be appropriately verified in the focus groups and interviews.

6.2 Methodology applied to Phase II

Based on the analysis of common methods applied by several researchers in this field, for the present phase of the research a multi-method approach is chosen. Thus, a first set of interviews is followed by a Delphi technique. This process is conducted to match indicators from literature with indicators from evaluation and rating tools, and finally to integrate them into an appropriate classification framework.

The whole methodology is applied on four companies (**Table 6-3**). Two of these companies have been involved as case studies since the beginning of this research, the other two companies were added in due course in order to enlarge the sample and assure a solid consensus on the topic of investigation. The two additional companies have been selected with the same approach that supported the choice of the case studies in Phase I, namely:

- Medium-large sized companies (more than 500 employees), headquartered in Italy, this to guarantee a reasonable complexity of the organizational and managerial structure; and
- Companies that have renewed their premises or have moved to new premises in recent times (less than 5 years), or are going to do it by the next 5 years, this to make sure that they are sufficiently familiar with the new ways of working, and demonstrate a tendency toward the next-generation workplace.

In the end, the sample of four companies comprises two that have already gone through a workplace change (those in the Normal Operation), and two that are setting up for an imminent change (those in the Planning stage).

Table 6-3. Schema of the case studies, drawn according to Turner's model (Turner, et al., 2008).

Co. No.	Organization/type of business	Project Stage	Location
2	Pharmaceutical company	Planning	Parma, IT
3	Utility company	Planning	Milan, IT
4	Automation technology company	Normal Operation	Milan, IT
5	Insurance company	Normal Operation	Milan, IT

Prior to Delphi administration, the researcher got acquainted to each company's culture and experience with workplace management and workplace change. This step was undertaken through semi-structured interviews with a few representatives in each company. These encounters explored the current workplace strategies, and verified the degree of familiarity with performance assessment techniques at a corporate level. Besides, these dialogues were directed to grasp suggestions for innovative KPIs to compound the existing ones. Eventually, also the best modalities to perform the Delphi research in each organization were arranged through these meetings.

In all, the methodology applied to Phase II of this research entails subsequent steps.

First, a round of interviews is carried out in order to grasp thoughts and hints by workplace managers on potential KPIs they deem important for better managing workplaces. These indicators are added to the long list collected from literature.

Second, a Delphi technique is applied to reduce the long list of KPIs and deepen the results. This technique encompasses in turn: a first questionnaire, a round of interviews and questionnaires, and finally a last questionnaire.

6.2.1 Interviews

Semi-structured interviews were performed with different interlocutors in each company via phone. Facilitators were initially asked to direct the list of questions to the best informer or informers within their respective companies. In the end, the interview template (see **Appendix 12.10**) was addressed to different company departments, as follows (**Table 6-4**).

Table 6-4. Interviewees

	Co No 2	Co No 3	Co No 4	Co No 5
	Pharmaceutical	**Utility**	**Automation technology**	**Insurance**
Interviewees	1. Company Services & Security 2. Corporate Technical Office & Engineering Project Management	1. Property Manager 2. HSE Systems and Models	1. Country Real Estate Manager	1. Real Estate & General Services 2. Head of Service Analytics

In Company 2, two people participated to the first phone interview.

1. President > CEO > Group Human Resources and Organization (Bettini) > HR Corporate Functions (Ghiretti) > **Company Services & Security** (Bertolini) > Security + Spaces & Storage (> Moving) + Lodging, Catering, Mobility & Controlling + Fleet Management
2. President > CEO > Global Manufacturing Division (La Grasta) > Corporate Engineering (Bugarin) > **Corporate Technical Office & Engineering Project Management** (Feroldi) > General Equipment & Structures Projects + Suppliers Technical Documentation & CAD Services (> Archive & Designers).

In Company 3, two people took part to the interview. Namely:

1. CEO > Administration, Finance & Control (Crenna) > Real Estate Management (Capolongo) > **Property Management (Andreolli) – 18 people** > Ufficio Adempimenti Tecnici + Property BU
2. CEO > Environment, Health and Safety (Artinghelli) > **HSE Systems and Models (Felcini) – 2 people**

In Company 4, one person was interviewed, namely the Country Real Estate Manager. In the company organigram this business function is positioned as follows:

1. CFO > Corporate Function AFC (Administration, Finance, and Control) > **Country Real Estate Management** (Tentori) > Project Management + Property Management + Facility Management + OHS Management.[25]

In Company 5, two people were addressed the semi-structured questions:

1. Country CEO > Human Resources & Services > Corporate Real Estate & Facility Management > **Real Estate & General Services (Sobacchi)**
2. Country CEO > Chief Operation Officer > Distribution & Customer Service Excellence > **Service Analytics (Vendegna)**

Interview questions (see **Appendix 12.10**) were addressed to capture:

[25] Being this a multinational company, whose Italian headquarters are located in Milan, the REM sector has a functional report in the general Group Function Real Estate, which answers to the Group Head Real Estate.

- If any rating tools have been ever applied by the company, especially through their departments; what kind of performances were certified; whether they think any measures collected through these tools might/should be regularly monitored by introducing them as KPIs; and
- If any type of building performance analyses (for instance, POEs, or BIUs) have been ever applied by the company; what kind of performance were measured; and whether they think any measures collected through these methodologies might/should be regularly monitored by introducing them as KPIs.

The goal was to catch potential measures that might be present in these evaluation tools, but have not yet been included into a rigorous framework of KPIs for workplace management.

6.2.2 Delphi method

The application of a Delphi methodological procedure pursues the goal to reach consensus on an issue that can range from the qualitative identification of factors entailing a certain event, to the extraction of quantitative or semi-quantitative data in a knowledge area where no data exist, yet (Hinks & McNay, 1999).

In the present case, expected outcomes are specific to the knowledge area of workplace management, where no consensus exists among all workplace users. Therefore, a Delphi method seems appropriate to reach this goal. Indeed, Linstone and Turoff (1975) in their book on the Delphi method state that the need for employing a Delphi emerges when:

- *"The problem does not lend itself to precise analytical techniques but can benefit from subjective judgements on a collective basis*
- *The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise*
- *More individuals are needed that can effectively interact in a face-to-face exchange*
- *Time and cost make frequent group meetings infeasible*
- *The efficiency of face-to-face meetings can be increased by a supplemental group communication process*
- *Disagreements among individuals are so severe or politically unpalatable that the communication process must be referred and/or anonymity assured*
- *The heterogeneity of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity o by strength of personality ("bandwagon effect")"* (Linstone & Turoff, 1975, p. 4).

The first six properties apply for sure to the present case, thus it can be concluded that a Delphi process is appropriate to the present case, which is also supported by the application of the same method in similar researches such as those conducted by Hinks and McNay (1999), Becker (1990), and De Masi (Cecco, 2017).

On this specific application, Delphi follows the form of a *"Delphi Exercise"* (Linstone & Turoff, 1975, p. 5). The process theoretically covers four phases. Here, these have been contracted in three stages for easiness of employment: (1) exploration of the subject (through Questionnaire 1); (2) achievement of an understanding of how the group views the issue, and (3) when there is significant disagreement, evaluation of the reasons of different opinions (both through focus groups/interviews; and (4) synthesis of the analyses and considerations (through Questionnaire 2).

1 *The sample*

A limited number of subjects was selected to compose the Delphi group. These subjects cover the user categories that have been discussed in Phase I of this research.

Their nomination happened thanks to the help of direct contacts among four different companies, namely the people who facilitated also the first round of interviews.

2 *The process*

The Delphi method went through subsequent stages, that the companies took part in in slightly different ways, as the table shows (**Table 6-5**):

a. Questionnaire 1 – administered to all the four companies;
b. Focus group or one-to-one interview – the first administered to the utility and automation company, and the latter to the pharmaceutical and insurance company (depending on each company's availability); and
c. Questionnaire 2 – administered to all the four companies.

Table 6-5. Participation to the companies in the Delphi stages

Co. No.	Organization/type of business	Project Stage	Questionnaire 1	Focus group	Interviews	Questionnaire 2
2	Pharmaceutical	Planning				
3	Utility	Planning				
4	Automation technology	Normal Operation				
5	Insurance	Normal Operation				

The template of both the questionnaires and focus group/interview ca be found in **Appendix 12.13, 12.15, 12.16**.

Selected subjects were called to fill a first questionnaire (Questionnaire 1). The same participants were subsequently involved in focus groups or interviews, finalized to comment on the results of Questionnaire 1. Eventually, the same people had to fill a last questionnaire (Questionnaire 2), based on the outputs of the focus groups and interviews.

Initial and final questionnaire administration ensures that each participant is given equal weight in the choice of important KPIs, while during focus groups and interviews some opinions may appear stronger than others. Besides, a face-to-face encounter is useful to confront potential different opinions toward a consensus view, to give qualitative meaning to the KPIs, and to support interpretation of quantitative results gained through the questionnaires.

2.a Questionnaire 1

The first task for the Delphi group was to select the most important items to them in a long list of KPIs, resulting from the previous phases. The group was informed that the objective of the research is to extract a short comprehensive list of indicators that are meant to communicate to all workplace users an integrated sight on the place they work. Participants were advised that the final system of indicators would ideally be composed of only KPIs, which represent the mutual interest of all the people who design, manage and use the workplace.

The questionnaire was administered online. Each company had 5 working days to complete it.

Only indicators identified as 'essential' from more than 50% of the participants (21 votes) passed through to the second stage of investigation. They populated an ordered list based on the frequency of votes, available in **Appendix 12.14**.

2.b Focus groups and interviews

Questionnaire 1 was followed by a round of open discussion, either through face-to-face focus groups or phone interviews (when necessary), in order to deepen a few emerging aspects and debate relevant themes.

Focus groups and interviews were participated in by the same people who had filled the previous questionnaire. Following the template available in **Appendix 12.15**, they were encouraged to discuss the following topics:

1. Categorization, classification, and definition of the indicators;
2. Methods and techniques for data collection;
3. Periodicity of data collection and circulation of the indicators;
4. Roles, responsibilities, and competences for data collection and integration;
5. Longevity of the indicators; and
6. Communication modalities.

2.c Questionnaire 2

Questionnaire 2 was administered right after the focus groups or interviews sessions, and aimed to finalize the system of relevant indicators, by asking two questions:

a. What importance/priority people assign to the indicators; and
b. What indicators are currently being collected in the different companies.

The sample involved in Questionnaire 2 was composed of the same people who took part also in Questionnaire 1 and the focus groups/interviews.

3 Coverage of user categories

According to Hinks and McNay (1999), the components of a Delphi group must be:

- Reasonably informed about the issue under discussion; and
- Representative of all the viewpoints of interest.

These requirements correspond to the purpose of a 'contributory Delphi' (also called 'Kantian Delphi'), whose attempt is *"to design a structure which allows many 'informed' individuals in different disciplines or specialties to contribute information or judgements to a problem are which is much broader in scope than the knowledge that any one of the individuals possesses"* (Linstone & Turoff, 2002, p. 27).

In order to respect these two recommendations, visitors and customers have been excluded from the sample, unless they were strongly familiar with the workplace for some reason. This is despite in the previous chapter them appearing as important users of the workplace. The researcher together with the companies' facilitators considered them as not sufficiently aware of the dynamics around the workplace, which instead regard closely all the other users. Moreover, visitors and customers are only occasional users, so that it might have been complicated keeping them involved over the whole development of the procedure.

Thus, each of the selected companies were asked to nominate at least 1 representative of the following user categories:

1. Owner/President/CEO;
2. Designer/architect/engineer involved in building design or revamp;
3. Corporate Real Estate Management;
4. Office Financial Administration;
5. Facility Management;
6. Human Resources;
7. ICT Department;
8. Manager in other company's department different from the abovementioned;
9. Employee/Clerical in other company's department different from the abovementioned; and
10. Consultant/Collaborator/Internee.

The sample must be theoretically composed of 10 at least representatives from each company for an overall number of at least 40 people. Each type of user was meant to be represented by four people belonging to different companies. In effect, one company asked to involve more participants in the investigation, while some people in other companies were not able to take part in this phase of the research. Also, the pharmaceutical company declared not to have a corporate real estate management department, therefore it could not provide any participant in this user category.

Despite initial intentions, not all the people initially involved in the research succeeded in taking part in it until the end. However, a progressive decrease in participation must be expected in the employment of a Delphi study (Jillson, 1975). Moreover, even if some members of the Delphi group withdraw from face-to-face discussion groups, this does not necessarily hinder the quality of the final results (Brockhoff, 1975). In effect, the mere number of components of a discussion group is not the decisive variable. Some of them often act as nonparticipants during meetings, thus do not influence group decisions in any way. What is decisive, instead, is the number of members who actively take part in the discussion.

3.a Participants in Questionnaire 1

Overall 39 people participated in Questionnaire 1, belonging to the four companies under examination, as described in **Table 6-6**. In the end, a balanced representativeness of each user category was reached (**Figure 6-1**).

Table 6-6. Number of participants in Questionnaire 1 by user categories and company

	Co. No. 2	Co. No. 3	Co. No. 4	Co. No. 5	
User categories	**Pharmaceutical**	**Utility**	**Automation**	**Insurance**	**Total**
Consultant/Collaborator/Internee	1	1	2	1	5
Corporate Real Estate Management	-	1	1	2	4
Designer/architect/engineer	1	1	1	1	4
Employee/clerical in other department	1	-	2	1	4
Facility Management	-	1	1	1	3
Human Resources Management	1	1	2	-	4
ICT Department	-	1	1	1	3
Manager in other department	-	1	2	2	5
Office Financial Administration	1	-	1	1	3
Owner/President/CEO	1	1	1	1	4
Total number of participants	**6**	**8**	**14**	**11**	**39**

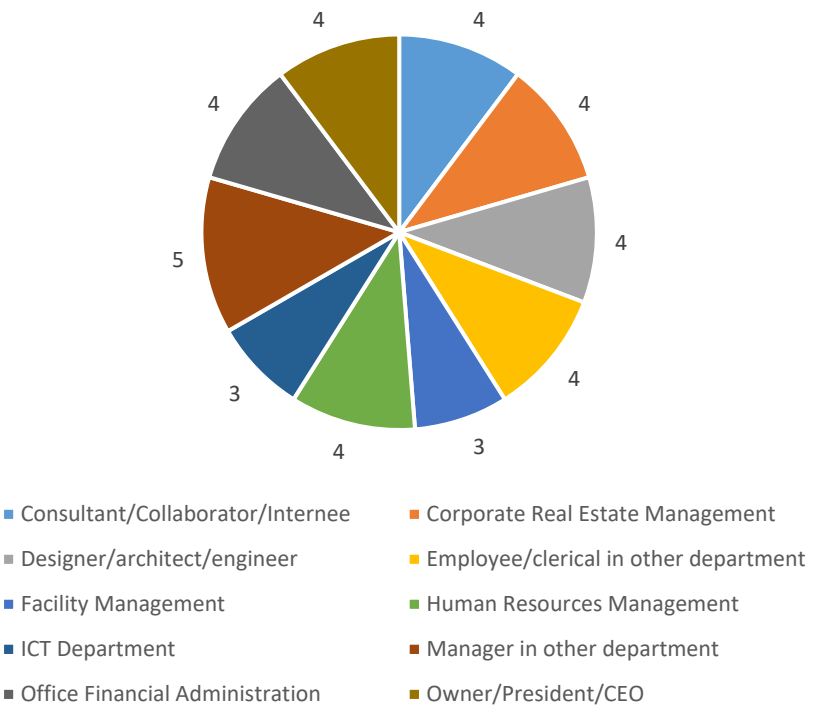

Figure 6-1. Proportion of participants in Questionnaire 1 by user categories

3.b Participants in focus groups and interviews

Focus groups and phone interviews were organized in each single company at different times. **Table 6-7** shows that, in all, 33 people participated in some form of discussion with the researcher, either through group debate (i.e. Utility and Automation companies) or one-to-one conversation on the phone (i.e. Pharmaceutical and Insurance companies). Even though a few people withdrew from discussion, the overall proportion of user categories was not compromised (**Figure 6-2**). Moreover, it must be said that, despite the large number of people formally present during the focus group at the Automation company, not all the participants actively engaged themselves in the debate. About half of them expressed their thoughts and manifested their positions, whereas the other half remained nearly silent. This kind of dynamic must be expected to some extent, in line with the statements by Brockhoff (1975). In the end, this situation functions to rebalance the numerousness of the participants in Company 4 to almost equal that of the participants in the other companies.

Table 6-7. Number of participants in focus groups and interviews by user categories and company

	Co. No. 2	**Co. No. 3**	**Co. No. 4**	**Co. No. 5**	
Type of discussion	Interview	Focus Group	Focus Group	Interview	
User categories	**Pharmaceutical**	**Utility**	**Automation**	**Insurance**	**Total**
Consultant/Collaborator/Internee	1	-	2	1	4
Corporate Real Estate Management	-	1	1	2	4
Designer/architect/engineer	1	1	1	-	3
Employee/clerical in other department	1	-	2	-	3
Facility Management	-	1	1	-	2
Human Resources Management	1	1	2	-	4
ICT Department	-	1	1	1	3
Manager in other department	-	-	2	1	4
Office Financial Administration	1	-	1	1	3
Owner/President/CEO	1	1	1	-	3
Total number of participants	**6**	**6**	**14**	**6**	**33**

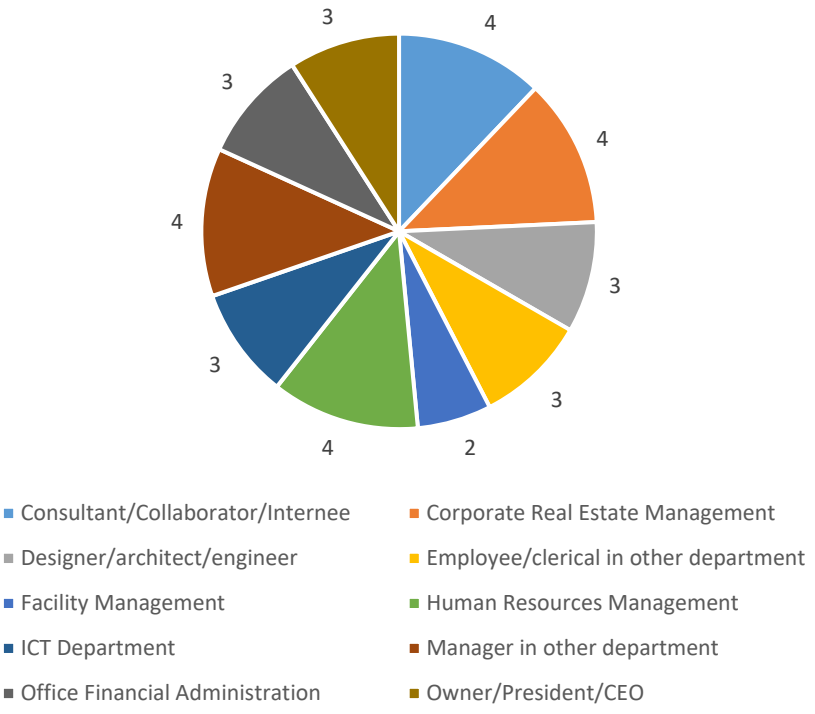

Figure 6-2. Proportion of participants in focus groups and interviews by user categories

3.c Participants in Questionnaire 2

Overall 25 people participated in this phase, belonging to the four companies under examination, as described in **Table 6-8**. Thirty percent of the people dropped out compared to Questionnaire 1, but a decline in response rates is physiological in the second round of a Delphi study (Jillson, 1975).

Still, this resulted in losing the balance on industry and on user categories. The Automation company alone covers half of the participants in Questionnaire 2. Facility Management and Owner/President/CEO appear underrepresented in this phase (**Figure 6-3**).

Table 6-8. Number of participants in Questionnaire 2 by user categories and company

	Co. No. 2	Co. No. 3	Co. No. 4	Co. No. 5	
User categories	**Pharmaceutical**	**Utility**	**Automation**	**Insurance**	**Total**
Consultant/Collaborator/Internee	1	-	2	1	4
Corporate Real Estate Management	-	1	1	-	2
Designer/architect/engineer	-	1	1	-	2
Employee/clerical in other department	1	-	2	-	3
Facility Management	-	-	1	-	1
Human Resources Management	-	1	2	-	3
ICT Department	1	1	1	1	4
Manager in other department	-	-	2	1	3
Office Financial Administration	1	-	-	1	2
Owner/President/CEO	-	-	1	-	1
Total number of participants	**4**	**4**	**13**	**4**	**25**

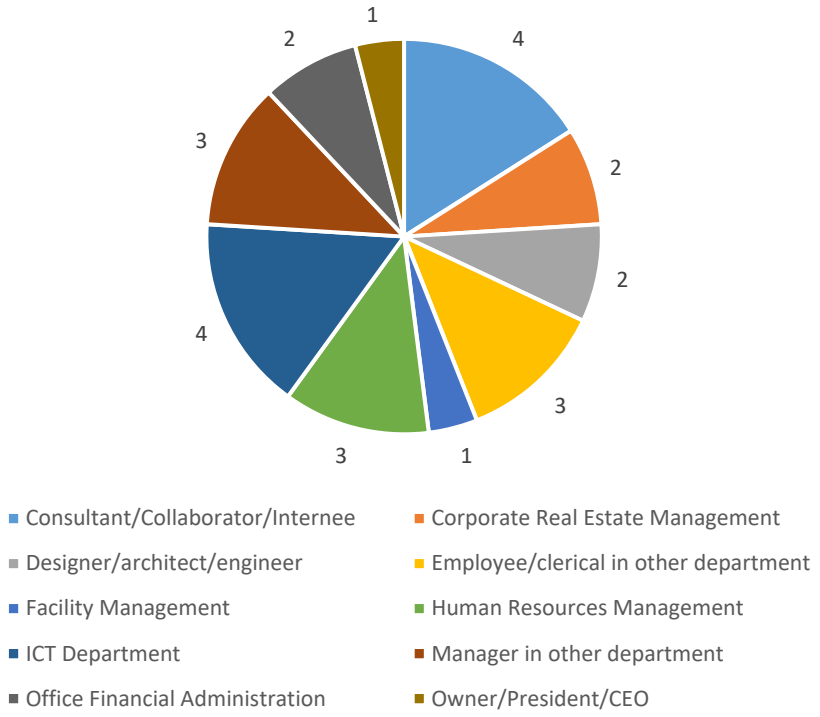

Figure 6-3. Proportion of participants in Questionnaire 2 by user categories

6.3 Results from interviews I round

Starting from the premise that none of the companies involved in the research make use of a Balanced Scorecard, a framework of Key Performance Indicators, or any other strategic systems to manage workplace performance, the investigation moved to examine their approach towards tactical tools, namely commercial rating/certification tools, and performance analysis methodologies such as POEs, BIUs, etc.

Company 2 reported to having applied rating tools mainly in the areas of environmental quality and comfort, and human resources. In the case of environmental parameters, their certifications aimed most of all at verifying regulatory compliance. This happened in the designing stage when a major spatial renovation occurred, and it was then verified through a one-shot post-occupancy measurement. In the case of human resources, commercial tools aim at awarding the company, with credit as a good enterprise to work for. This is verified periodically. To the admission of the same interviewee, the company has never interpreted real estate as its core business, therefore its interest in rating the performance of its real estate assets has always been limited. However, in the perspective of a future move to a new headquarters, they have gone through a deep study of their premises in-use. This approach will be applied in the future also in the case of minor and local interventions. However, to date, interviewees has not felt any necessity for integrating their current workplace management practices with potential KPIs gathered from POEs, BIUs, or rating tools. They declared to have never considered looking at the impact of the workplace on productivity.

Company 3 has never applied any rating tools. At the moment they do not refer to any benchmark and have only an Excel spreadsheet where they collect some data without any reporting to strategic levels. Nevertheless, since they are in the initialization stage of the project for a new headquarters in Milan, they have been undertaking a study on the building in-use, and are looking forward to implementing some environmental certification of the future building. Indicators they would like to keep controlled are mainly concentrated in the field of environmental sustainability. This is coherent with their core business; indeed, the goal would be for them to gain visibility in the market through monitoring key indicators that could show their effectiveness against competitors.

Company 4 used the rating tool BraVe, patented by the Politecnico di Milano to assess the overall performance of commercial buildings. Also, the same company developed an ad-hoc internal tool to monitor energy efficiency, so that they would perform internal benchmarking against other corporate headquarters around the world. Still, its application is not mandatory, thus concrete implementation and usefulness within the group seems not significant. Nevertheless, from these rating tools KPIs worth monitoring on a regular basis could regard energy performances, and environmental/economic sustainability in terms of paper consumption, waste production, and space occupancy. Their experiences with performance analysis methodologies are limited to a tool developed by the space planning consultant they hired in the occasion of office refurbishment. However, at a corporate level a control dashboard exists to check for a few KPIs on a regular basis. From these sources, KPIs valuable to workplace management seem to range from workforce size and people mobility, to occupancy costs and energy consumption. In particular, the latter two indicators are checked yearly against corporate target objectives.

Company 5 is familiar with rating tools certifying the organizational and human resources environment. Application of these tools is performed on a yearly basis with the objective of achieving the awards as a

good enterprise to work for. To cover environmental aspects, LEED has been taken into consideration, but only the 'construction' package was deemed worth implementing. Still from rating tools no KPI was considered effective for continuous monitoring. Nevertheless, after the application of a couple of methodologies for performance analysis while designing their new workspaces, a few aspects emerged that might be useful to monitor constantly. These regard the use people make of the office space, both in terms of internal and external mobility.

In all, no common approach to performance evaluation can be recognized, and perspectives towards KPIs monitoring were varied. The companies that already passed through workplace change and were currently in the phase of normal operation (i.e. Company 3 and 4) demonstrated more familiarity with regard to tactical tools. Indeed, they both have matured some experience with rating tools and performance analysis methodologies, while aiming at verifying the effect of workplace change. From these they acknowledge a few indicators that might be significant for performance monitoring. Indicators they list express, especially, the way people use the workspace.

The other two companies were still facing the first phases of a workplace change process. Even if they seemed somewhat oriented toward an evolution, their approach to workplace performance was strictly related to regulation compliance and environmental compatibility spheres.

In **Table 6-9** and **Table 6-10**, answers from the companies are juxtaposed. Later the KPIs collected from these introductory interviews are thoroughly analyzed, before matching them with the list that had been previously created from the literature.

Table 6-9. Interviews' results on rating tools

	Co No 2	*Co No 3*	*Co No 4*	*Co No 5*
	Pharmaceutical	*Utility*	*Automation technology*	*Insurance*
Rating tools				
Gallup Workplace Audit Q12	-	-	-	-
Leesman Index (LMI)	-	-	-	-
Building Use Studies Methodology (BUS)	-	-	-	-
Indoor Environmental Quality Survey (IEQ)	-	-	-	-
WELL Building Standard	-	-	-	-
The Great Place to Work	✓	-	-	✓
Other rating tools				
	A. Indoor Air Quality (IAQ) B. Ergonomics of the thermal environment (ISO 7730:2005) C. Voices (by Willis Tower Watson) D. Top Employers	-	A. BraVe (by Politecnico di Milano) B. Ad-hoc energy efficiency tool developed by the same company ("Green CREM")	A. LEED construction B. Top Employers
Time/frequency/status				
- One-off			A	A (work in progress)
- When a major space planning/organizational project is undertaken	A, B		B (ongoing – application is not mandatory)	
- On a regular basis	C (every 2-4 years) D (every year)			B (every year)
Suggestion of KPIs from rating tools				
	Air quality (odors, ventilation) Light quality	Environmental compatibility, i.e.: Air quality (pollutants, particulate matter, radon, asbestos, allergens, dust mites) EMC/RFI, radiations VOCs Light quality (chromatic effects, reflections) Light comfort	Energy consumption (light, gas, water) People means of transportation (private vs. public) Waste Paper consumption and use Space occupancy	-

Table 6-10. Interviews' results on performance analyses

	Co No 2	*Co No 3*	*Co No 4*	*Co No 5*
	Pharmaceutical	*Utility*	*Automation technology*	*Insurance*
Performance analysis tools				
Type of tool	A. Post-occupancy evaluation B. Building-in-use study	A. Building-in-use study	A. DEGW B. Corporate control dashboard	A. Partners4Innovation B. Corporate Dynamic Workplace
Time/frequency/status				
- One-off		A (before planning the new HQ)	A (for designing the new workspace)	A, B (while designing the new workspace)
- When a major space planning/organizational project is undertaken				
- On a regular basis			B Ongoing	
Suggestion of KPIs from performance analysis tools				
	Perception of colors Perception of privacy	-	People internal and external mobility (resident vs. mobile) Space occupation (workstations, meeting rooms, each type of space) Occupancy cost/person Occupancy cost/sqm Occupancy cost/total revenues (Italy) Sqm/person Reduction of energy consumption per year (target 2% year on year) Vacant spaces/total spaces (GLA/GFA) Workforce (number of employees)	People internal and external mobility (resident vs. mobile) Movements of the people in the space Accesses to the premises (number/business unit/month)

1 *Analysis of the KPIs derived from interviews*

After collecting all the indicators that came up from interviews, these have gone through the same sifting as was performed on indicators gathered from the literature:

- Analysis:
    - Word counting and thematic analysis; and
    - Categorization;
- Cleaning:
    - Duplicates; and
    - Redundancies.

This happened at two different levels: (a) internal, among all indicators gathered from interviews; and (b) external, against KPIs that had been previously analyzed from the literature.

Results of this process are synthetically reported in **Table 6-11**.

The resulting additional indicators were then added to the corresponding categories and prepared for administration through Questionnaire 1.

Indicators collected from interviews are 22, and fall under different categories. Except for Business Effectiveness and Value/Return/Yield, the other seven categories are covered by two or more additional indicators. Some of these new indicators can be matched with the ones previously scouted from literature, others instead are worth adding separately to the long list and being evaluated afterwards by group agreement.

At the end of this process, seven indicators result being somewhat original and deserve to be brought through to the subsequent phase, by adding them to the others in coherent categories. The final list of indicators counts 169 items, divided into nine categories (see **Appendix 12.11**). This is the list that goes to submission through Questionnaire 1.

2 *Coding*

All indicators in the final list were given an identification code (ID) in order to track their behavior in the next phases:

- Indicators from literature are identified by an Arabic number. They appear listed from the most recent to the oldest source, and have been numbered in the order they were found in the original source. Once they go through analysis, they are assigned a new Arabic number corresponding to each category, which in turn identified with a short code (e.g. BOM-22 corresponds to the twenty-second KPI listed in the category Building Operation and Management). In this case listing takes place in alphabetic order, with the objective of juxtaposing as much as possible similar indicators.
- Indicators from interviews are identified by a Roman number. Once they are matched with each other and added to the related category, either they are assigned an Arabic number, if they can be merged to existing indicators, or they are assigned a letter, if they deserve to be added to the final list. Again, each code is preceded by the code of the corresponding category.

Table 6-11. Synthesis of the results from interviews

#	Indicators before cleaning	#	Indicators after cleaning
	Building operation and management		**BOM**
I	Paper consumption	I	A. Paper consumption and use
IX	Energy consumption (light, gas, water)	IX	22. Resource consumption – energy, water, materials (Energy management)
	Business effectiveness		**BE**
	-		-
	Costs		**CT**
II	Occupancy cost/person	II, III, IV	3. Occupancy costs
III	Occupancy cost/sqm		
IV	Occupancy cost/total revenues		
	Environment quality		**EQ**
V	Air quality (odors, ventilation)	V, VI	4. Indoor air quality and ventilation
VI	Environmental compatibility, i.e.: Air quality (pollutants, particulate matter, radon, asbestos, allergens, dust mites), EMC/RFI, radiations, VOCs	VII VIII	7. Light quality, lighting, and daylighting 6. Light comfort
VII	Light quality (chromatic effects, reflections)	X	32. Waste
VIII	Light comfort	XI	24. Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings
X	Waste		
XI	Reduction of energy consumption per year		
	Productivity/Ways of Working		**PW**
XII	Space occupation (workstations, meeting rooms, each type of space)	XII, XV	B. Space utilization (workstations, meeting rooms, each type of space)
XIII	Accesses to the premises (number/business unit/month)	XIII	C. Accesses to the premises (number of accesses/business units/month)
XIV	People internal and external mobility (resident vs. mobile)	XIV	D. People internal and external mobility (resident vs. mobile)
XV	Movements of the people in the space		
	Space usage		**SU**
XVI	Space occupancy	XV	7. Space utilization (e.g. Functional index – FI, % of space occupied, etc.)
XVII	Sqm/person	XVI	6. Space per employee (e.g. square feet per employee)
XVIII	Vacant spaces/total spaces	XVII	9. Vacancy rate
	Staff characteristics		**SC**
XIX	People means of transportation (private vs. public)	XIX	E. People means of transportation (private vs. public)
XX	Workforce (number of employees)	XX	3. Changes in workforce size, Full Time Equivalent (FTE) employees
	User attitude		**UA**
XXI	Perception of colors	XXI	F. Perception of colors
XXII	Perception of privacy	XXII	G. Perception of privacy
	Value/Return/Yield		**VRY**
	-		-

6.4 Outputs from Questionnaire 1

In Questionnaire 1, participants evaluated the level of importance of each indicator by stating whether they thought it is 'essential', only 'desirable', or of 'tertiary level importance', as previously done by Hinks and McNay (1999). Moreover, the opportunity to state 'I do not know, I do not understand this indicator' is also given, since participants may be not familiar with some technical indicators extraneous to their own field of competence.

The 169 items appear organized into the 9 categories that were created in the analytical stage. Despite work to avoid redundancy made through cleaning, the long list still contains a few similar indicators. This is functional to allow people to select the most suitable indicator among similar choices.

The option to add indicators to each of the 9 categories was also given, if participants considered the existing categories omitted some important workplace aspects. Eventually, the possibility to add additional indicators independently from the proposed categories was also open in a dedicated field at the end of the questionnaire.

In order to accomplish the required elaborations, indicators were assigned a numerical value based on the rating they received (**Table 6-12**):

Table 6-12. Conversion from ratings to numerical values for elaboration

Rating	Corresponding numerical value
Essential	3
Desirable	2
Of tertiary importance	1
I do not know	0

In the following paragraphs, first a few comments regarding general trends in ratings are brought up, on both user and KPI categories.

Later, indicators were put together into an ordered list based on the frequency of essential votes. Two draft lists were created based on the frequency of votes, taking inspiration from the strategy performed by Hinks and Mc Nay (1999).

A first list of 43 indicators collected all those indicators that were rated as 'essential' by more than the 50% of the sample, which meant those attracting more than 20 essential votes. Since the number of indicators was quite large compared to the literature (average 25.8 KPIs), a second list presented a restricted selection of KPIs. This second list of 28 indicators collected all those which were selected as essential by 60% or more of the sample, which meant those attracting more than 24 'essential' votes. However, both lists were brought forth to the next steps, so that all the indicators rated as 'essential' by the majority of the participants were taken into consideration for deeper analysis.

1 "I do not know, I do not understand this indicator"

The questionnaire gave the chance to respondents to declare whether they could not comprehend the meaning of indicators (*I do not know, I do not understand this indicator* - IDK). This shows the degree of knowledge on the subject across different companies and different workplace users.

Overall, 39 respondents rated 169 indicators, which resulted in a total of 6,591 answers. Overall 792 times people declared to not understand some indicators, which corresponds to the 12% of possible answers.

Regarding companies, on a simple average (**Figure 6-4**), 41% of 792 IDK options belonged to the insurance company, while only 7% came from the utility company. This dissimilarity might be justified by different levels of internal communication strategies applied in each company.

Regarding workplace user categories, on a simple average (**Figure 6-6**), 16% of 792 IDK options was selected by employees/clericals. The Corporate Real Estate Management function registered the lower number of IDK answers (3%).

Results slightly changed when calculating the weighted average. Indeed, the number of respondents per company varied considerably (for example, in the automation company 14 people filled out the questionnaire, while in the pharmaceutical only 6). This affected the weights of their votes, as the graphs displays (**Figure 6-5, Figure 6-7**).

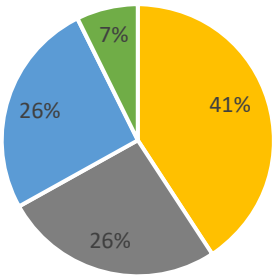

Figure 6-4. Proportion of IDK answers by industry (792) Simple average

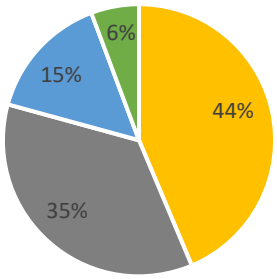

Figure 6-5. Proportion of IDK answers by industry (792) Weighted average

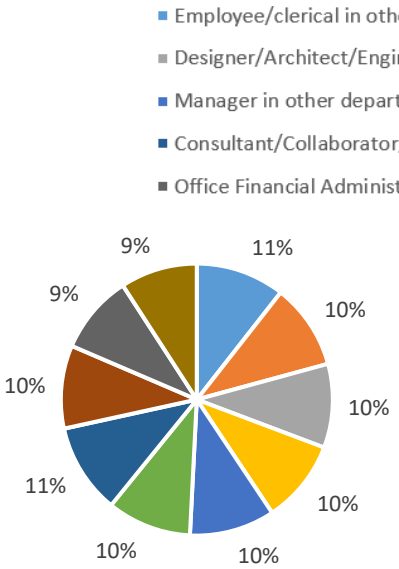

Figure 6-6. Proportion of IDK answers by user category (792) Simple average

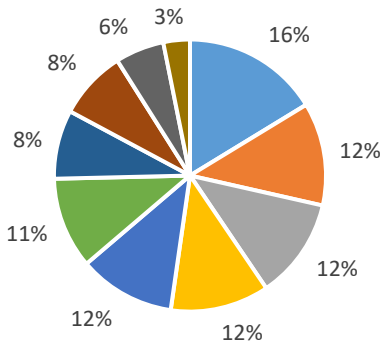

Figure 6-7. Proportion of IDK answers by user category (792) Weighted average

For the KPI categories receiving most of the IDK answers, *Value/Return/Yield* was the most obscure category, by far. Here almost 30% of the indicators were not understood by respondents (**Table 6-13**). Indicators belonging to this category that were particularly unclear to people were: *Current replacement value* (18 IDK)*; Value for money* (13 IDK)*; Real estate cost of acquisition vs. returns/IRR* (13 IDK)*;* and *Real estate return on equity* (12 IDK). Clearly, all these indicators express a technical measure of the financial value of real estate, thus are quite sectorial and of limited interest for a broad panel of users as that involved in this questionnaire. Nevertheless, also indicators of more common sense, such as *Return-on-investment/economic value added* registered a high number of IDK answers (9 out of 39 participants). On average, about one fourth of the participants said that they could not understand the indicators listed in this category.

Space usage, Building operation and management, and *Costs*, collected a number of IDK answers just above the overall average, respectively 15%, 15% and 13% (**Table 6-13**).

Environmental quality seemed well understood in general, since only 1% of the indicators present in this category received an IDK answer (**Table 6-13**).

Table 6-13. IDK answers by KPI category

KPI category	# of KPIs in the long list	# of possible answers (39 respondents)	Sum of IDK answers in each category	% of IDK answers in each category
Building operation and management	34	1326	194	15%
Environmental quality	9	351	2	1%
Productivity/Ways of Working	34	1326	143	11%
User attitude	16	624	41	7%
Staff characteristics	13	507	48	9%
Space usage	10	390	58	15%
Business effectiveness	18	702	77	11%
Costs	24	936	117	13%
Value/Return/Yield	10	390	112	29%
Total	**169**	**6,591**	**792**	**12%**

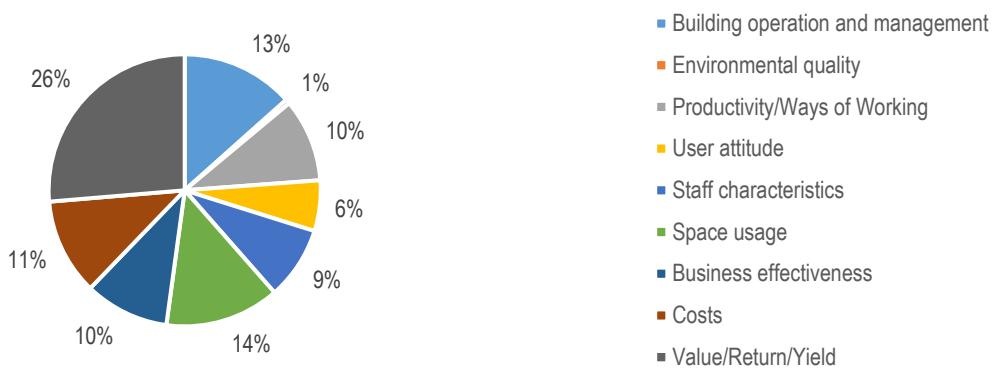

Figure 6-8. IDK answers by KPI category (overall proportion)

For each category of indicators, the average number of IDK answers was compared to the average vote received from different user groups. The average votes have been considered both including and excluding 0 values, which were associated with *I do not know* options.

Indeed, in the context of the present study, *I do not know* options corresponded to the lowest level of importance for indicators. Since the objective is to obtain a set of KPIs that can be shared by all workplace users, KPIs which are not understood by most people lose their relevance and must be dropped from the final set. Thus, the average vote including 0 values was considered significant.

At the same time, it is interesting also to notice how the average vote excluding 0 values compares to the number of 0 votes assigned to different indicators, by user category. In order to balance out the weight of different user categories, calculation entails the average number of 0 votes.

2 *Results by user and KPI category*

Building operation and management

Facility Managers and Corporate Real Estate Managers, together with Designers/architects/engineers rated indicators regarding building operation and management as highly important – average scores around 2.2. At the same time, they revealed the least number of unknown indicators in this category, beside Financial Office Administrators – around 10% (**Figure 6-9**).

On the contrary, employees and managers in other company departments, and HR managers showed a large count of unknown indicators in this category – between 20 and 30% (**Figure 6-9**), that they considered not very important. The ICT department evaluated building operation KPIs as not very important, despite its knowledge about them seeming overall sufficient.

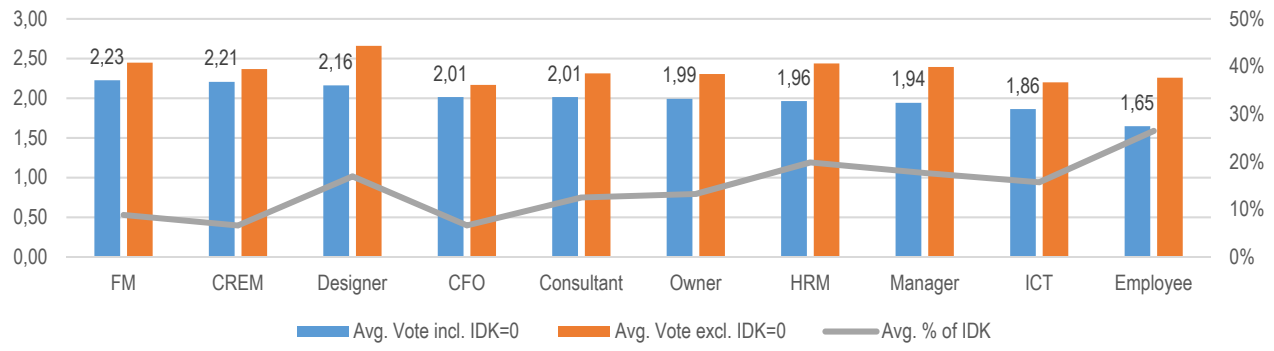

Figure 6-9. Averages Building Operation and Management

Business effectiveness

Corporate Real Estate Managers and Owners seemed the most interested in KPIs regarding business effectiveness, followed by Consultants and the Chief Financial Administration – scoring higher than 2.3 (**Figure 6-10**). Designers and Employees were the least interested in the topic, and registered the highest number of indicators they did not understand (close to 30%).

FM average vote resulted being significantly affected by the number of IDK answers (around 20%). Indeed, when excluding IDK choices, FM highly appreciated business effectiveness (average above 2.5), similar Owners and CREM (**Figure 6-10**).

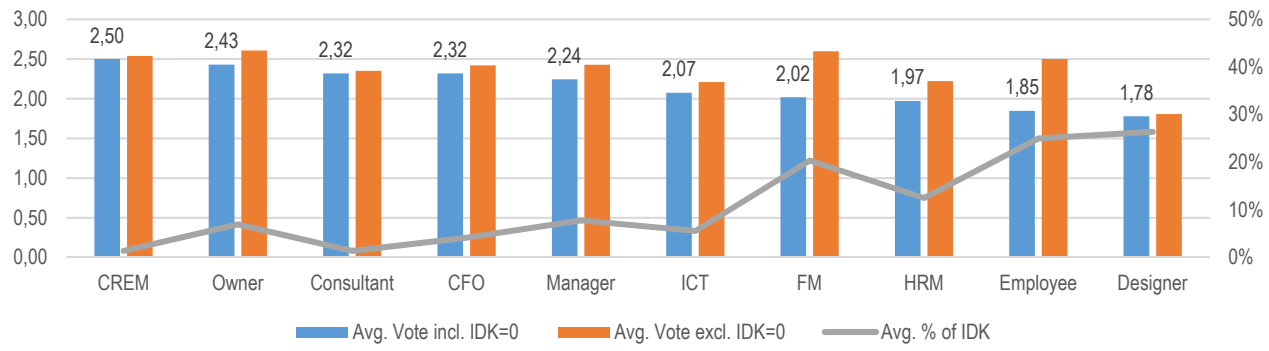

Figure 6-10. Averages Business Effectiveness

Costs

KPIs about costs obtained the highest scores (higher than 2.4) from CREM, FM, and CFO, that are also the most familiar with this family of indicators (**Figure 6-11**). Surprisingly, Owners did not focalize their 'essential' votes on costs. Designers and ICT people rated costs as less important. They also registered IDK answers for about 25-30% of indicators in this category (**Figure 6-11**). This deficiency is particularly worrying on the designers' side, who demonstrated a lack of awareness of many of the costs related to management and maintenance of office buildings in the operation phase.

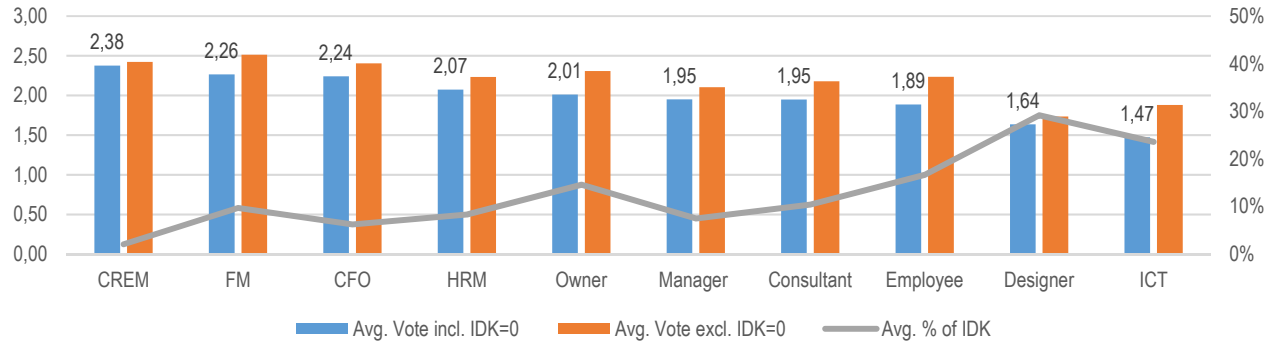

Figure 6-11. Averages Costs

Environmental Quality

KPIs on environmental quality obtained very similar scores across all users. Financial Administrators were those who least estimated this category (2.4), if compared to the others (scores between 3 and 2.7). However, the bar chart is pretty flat (**Figure 6-12**), revealing that there is consistent agreement among all respondents regarding the importance of environmental quality and comfort.

Also, indicators on environmental quality seem clear to all users, as the percentage of IDK answers was negligible (**Figure 6-12**).

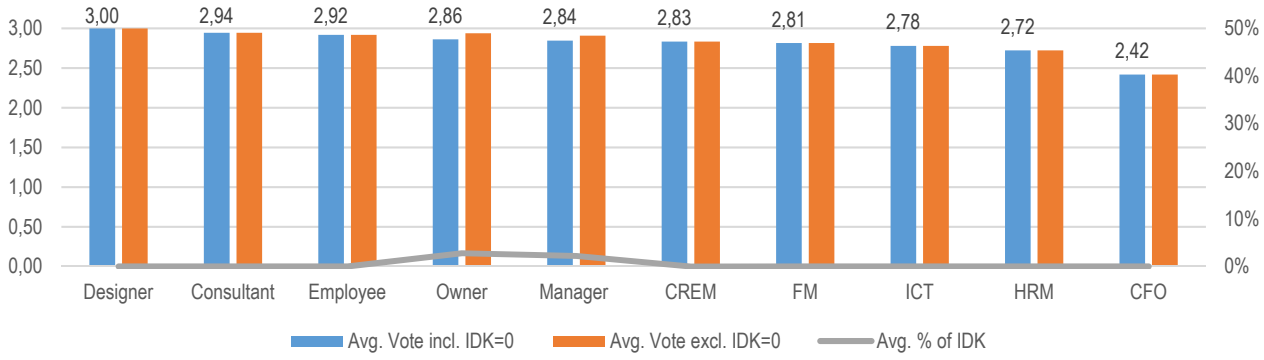

Figure 6-12. Averages Environmental Quality

Productivity/Ways of Working

Indicators regarding productivity and the ways of working attracted interest of designers and managers in particular – scoring about 2.2 or higher (**Figure 6-13**). ICT people seemed unengaged in this area, which is surprising since technology nowadays is considered a key enabler of productivity. ICT people also declared that they did not understand about 30% of the indicators in this category (**Figure 6-13**), which stands clearly over the average level of IDK answers for all other users.

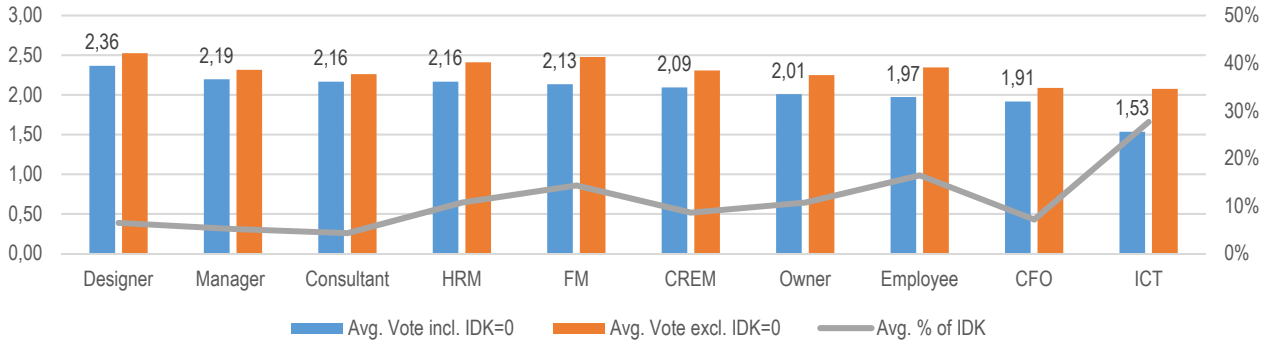

Figure 6-13. Averages Productivity/Ways of Working

Space usage

On average, space usage was most important to corporate real estate managers and designers – scores higher than 2.3 (**Figure 6-14**).

Comprehensibly it seemed less important to ICT people and consultants – scores lower than 1.8 (**Figure 6-14**), who in fact tend to use the space in a much more flexible way than all the other users.

Owners said they did not understand almost 30% of the KPIs in this category (**Figure 6-14**). This aspect reflects the scarce awareness these users often have of the spaces they use. This data confirmed that it is common for company owners, presidents and CEOs to not consider the space as their core business, thus not being familiar with space measurement and management techniques.

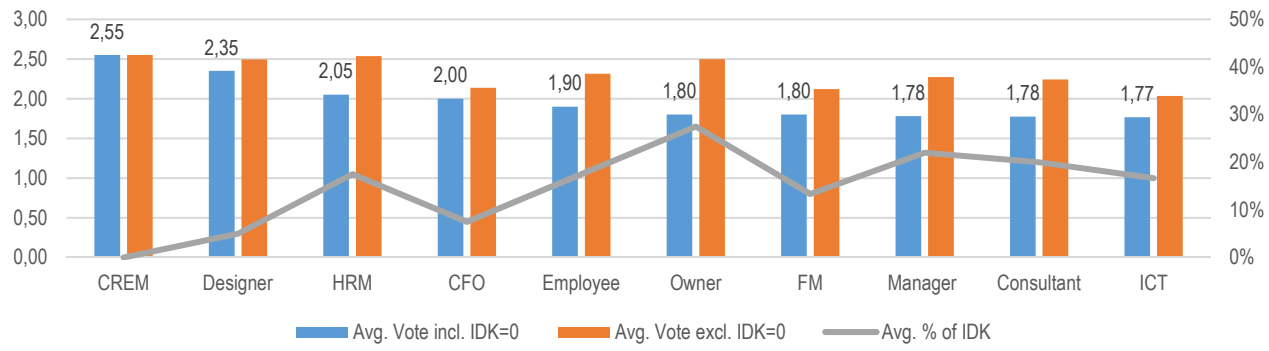

Figure 6-14. Averages Space usage

Staff characteristics

Staff characteristics KPIs were especially evaluated by consultants, mangers, and designers – scores higher than 2.3 (**Figure 6-15**). It is peculiar that the human resources management did not attribute much importance to this category of indicators, which should theoretically belong to their competences and daily work. Excluding IDK answers, also FM consider many indicators in this category as essential.

People in the ICT and Financial Office Administration areas did not consider these indicators as most important, on average. ICT again seemed not very familiar with KPIs entailing staff characteristics, since they did not understand about 25% of them (**Figure 6-15**).

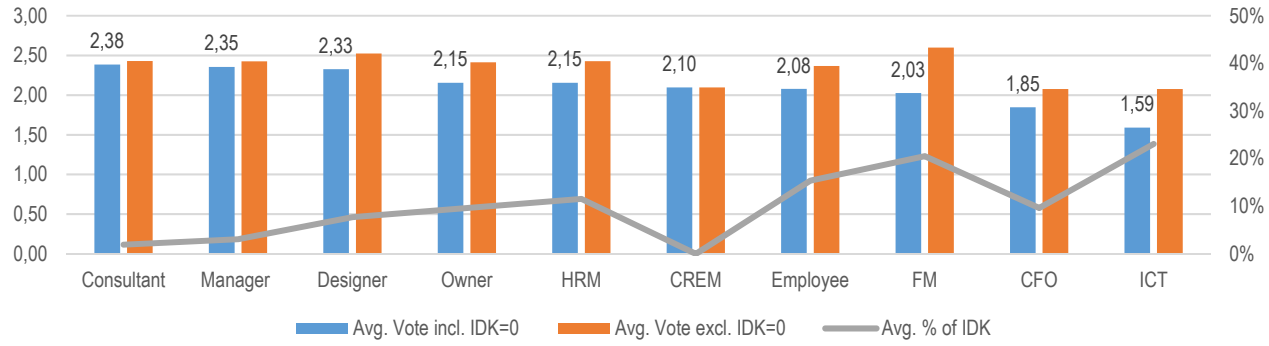

Figure 6-15. Averages Staff characteristics

User attitude

KPIs entailing user attitude rallied support most of all from FM and CREM – scores higher than 2.4 (**Figure 6-16**). However, excluding IDK choices, HRM reached high scores, which is coherent with their area of competence and function in the corporate environment. Nevertheless, HRM registered the highest percentage of IDK answers across all the users – about 20% (**Figure 6-16**). This is the main reason why the average score for this KPI family stands around the mean of all user categories.

On the contrary, CFOs and ICT people are at the tail end of the average scores, even if they did not seem totally unfamiliar with these indicators – scores still higher than 1.8.

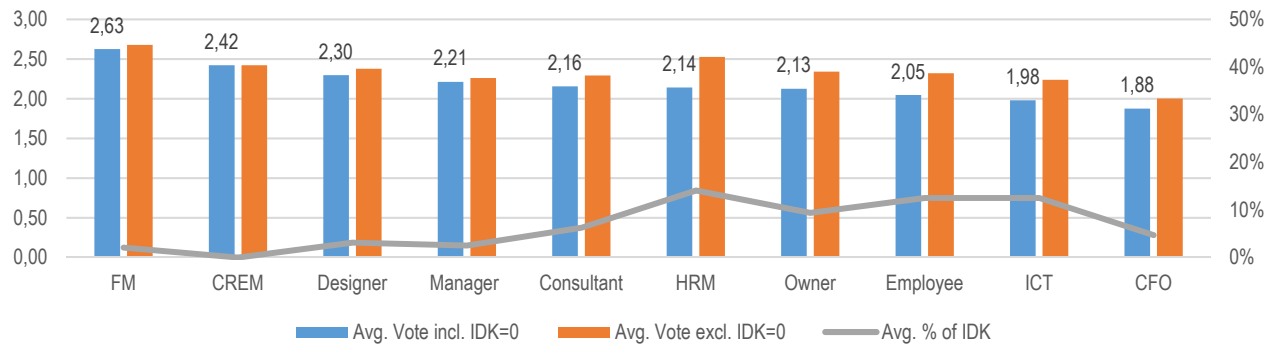

Figure 6-16. Averages User attitude

Value/Return/Yield

Indicators of value, return and yield were typically important to the Financial Office Administration and Corporate Real Estate Managers. Consultants were the most detached from these KPIs – scores of about 1.3 (**Figure 6-17**), which is comprehensible considering that they are partially independent from the company, thus less impacted by its financial results.

This category however registered the highest percentages of unknown indicators (IDK), which reached 45% for Consultants, but were still around 40% for HRMs, Managers and Employees.

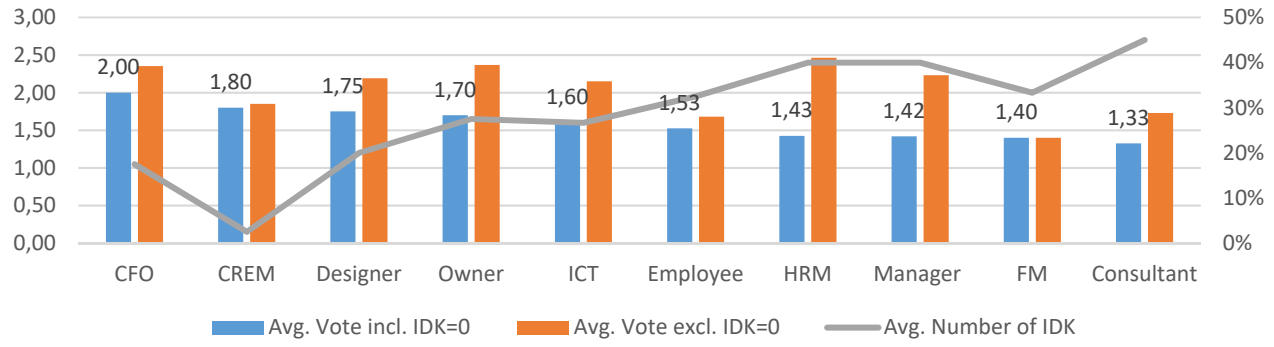

Figure 6-17. Averages Value/Return/Yield

3 *Results matching user categories and KPI categories*

Despite convergence of opinions on KPIs that can be registered across user categories, a few trends emerged, by comparing different categories of KPIs and users.

For what concerns user categories (**Figure 6-18** and **Table 6-14**), a decrease in the average vote generally corresponded to an increase in the average number of IDK answers (0). This trend was more evident when including IDK answers in vote counting, but it was still detectable even when excluding them.

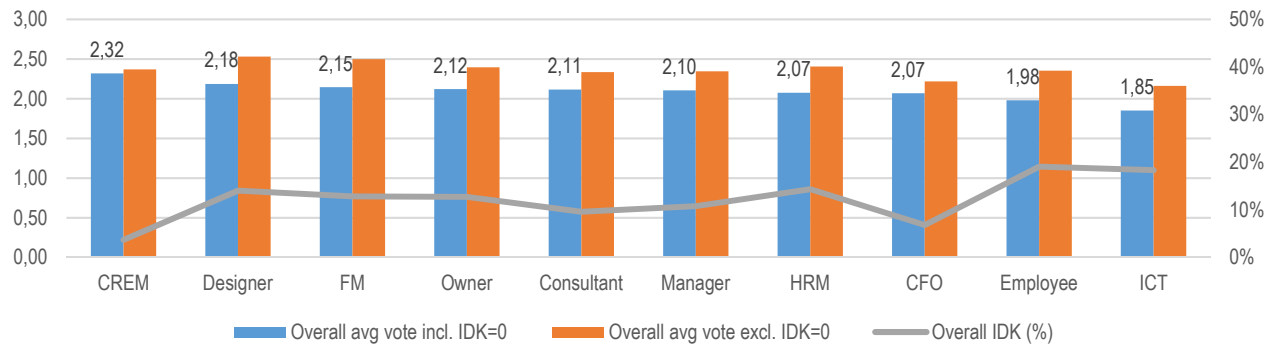

Figure 6-18. Average overall

On one hand, this tendency supports the idea that different user categories are familiar with different aspects of the office environment. As expected, knowledge about KPIs was not equally distributed across user categories. For example, CREM demonstrated a broad knowledge of KPIs in all areas. On average they said they did not understand only 4% of the KPIs listed in the questionnaire. They are followed by CFOs with 7% of not intelligible indicators. On the other side of the spectrum we find Employees and ICT people, respectively with an average of 19% and 18% of unknown indicators.

Of course, there are professions, such as CREM and CFO, which entail the application of KPIs, whereas other professions are not at all involved in this activity. Also, the long list of indicators was put together especially from CREM, FM and organization management sources, therefore it is normal that these KPIs sound more familiar to these users.

Consultants also appeared accustomed to many KPIs, curiously a lot more than employees. This result reverses the perspective brought up in the first part of the study, according to which consultants are less involved in the workplace-making process, since they are inconstant users of the space and manifest only short-term needs and values. Again, the low level of IDK answers by consultants can probably be explained because of their jobs that deal with performance indicators by description. However, the number of essential KPIs voted by consultants, encourages thinking that they feel engaged in the space they use, even if only occasionally. Hence, a more central role in the workplace-making process by consultants and collaborators is advisable.

Table 6-14. Average votes and count of IDK answers by users

Overall averages	Overall avg vote incl. IDK=0	Overall avg vote excl. IDK=0	Overall IDK (sum)	Overal IDK (avg)	Overall IDK (%)
CREM	2,32	2,37	25	6,25	4%
Designer	2,18	2,53	95	23,75	14%
FM	2,15	2,50	65	21,67	13%
Owner	2,12	2,39	86	21,50	13%
Consultant	2,11	2,34	65	16,25	10%
Manager	2,10	2,34	91	18,20	11%
HRM	2,07	2,41	97	24,25	14%
CFO	2,07	2,22	46	11,50	7%
Employee	1,98	2,35	129	32,25	19%
ICT	1,85	2,16	93	31,00	18%
Total	**2,10**	**2,36**	**792**	**20,31**	**168**

On the other hand, it is evident how the level of familiarity (small number of IDKs) parallels the aspects users are interested in and rated as 'essential'. Preference of certain areas was evident from specific user categories (**Table 6-15**). Thus, preference revealed sectorial competences mostly depending on professional experience. For instance, CFOs were a lot more interested than others in the value/return/yield category – VRY scores 2.00 for CFO, while, compared to the other users, they are the least interested in environmental quality. CREM is interested in space usage (SU=2.55), whereas FM looks at user attitude (UA=2.63). Owners are concerned with business effectiveness (BE=2.43).

Table 6-15. Average votes (incl. IDK=0) by KPI categories and users

Overall averages	EQ	UA	BE	SC	PW	BOM	CO	SU	VRY
CREM	2,83	2,42	2,50	2,10	2,09	2,21	2,38	2,55	1,80
Designer	3,00	2,30	1,78	2,33	2,36	2,16	1,64	2,35	1,75
FM	2,81	2,63	2,02	2,03	2,13	2,23	2,26	1,80	1,40
Owner	2,86	2,13	2,43	2,15	2,01	1,99	2,01	1,80	1,70
Consultant	2,94	2,16	2,32	2,38	2,16	2,01	1,95	1,78	1,33
Manager	2,84	2,21	2,24	2,35	2,19	1,94	1,95	1,78	1,42
HRM	2,72	2,14	1,97	2,15	2,16	1,96	2,07	2,05	1,43
CFO	2,42	1,88	2,32	1,85	1,91	2,01	2,24	2,00	2,00
Employee	2,92	2,05	1,85	2,08	1,97	1,65	1,89	1,90	1,53
ICT	2,78	1,98	2,07	1,59	1,53	1,86	1,47	1,77	1,60
Total	**2,81**	**2,18**	**2,16**	**2,12**	**2,07**	**2,00**	**1,99**	**1,98**	**1,59**

Legend: EQ = Environmental Quality; UA = User Attitude; BE = Business Effectiveness; SC = Staff Characteristics; PW = Productivity/Ways of Working; BOM = Building Operation and Management; CO = Costs; SU = Space Usage; VRY = Value/Return/Yield.

Moreover, Human Resources Management and Information Communication Technology departments tended to appear respectively in the mean and at the lower edge of the vote spectrum for each KPI family. On one side, this highlighted the marginal role they still have in matters concerning the workplace. On the other, this raised the suspicion of a slight disinterest in the matter, especially by ICT people. In this latter case, it is maybe intuitive that ICT is more detached from spatial considerations, since communication technology is functional to make people independent and flexible from the physical workspace. Anyway, it is indisputable that an appropriate use of technological tools impacts on and is impacted by most of the KPIs present in the list, from costs to staff characteristics, to business effectiveness. Thus, more awareness and interest by ICT in the topic was expected and is indeed desirable for the future.

Hopefully, this study will increase responsiveness among all workplace users about the interrelations existing between all KPIs categories, which affects all of them.

With regard to KPI categories, on average, the category of Environmental Quality (EQ) obtained the highest ratings (**Figure 6-19**). Conversely, the category of Value/Return/Yield (VRY) obtained the smallest number of essential votes.

Of course, environmental quality affects all users both at the demand side and at the supply side. All users are directly impacted by EQ KPIs as workplace occupants. In this perspective, EQ KPIs are easily applicable to everyone's daily life in the office. On the contrary, KPIs concerning the value created by real estate and asset management are less likely to be experienced in the common working life.

Deeper considerations about KPI categories will be presented in the subsequent step of analysis.

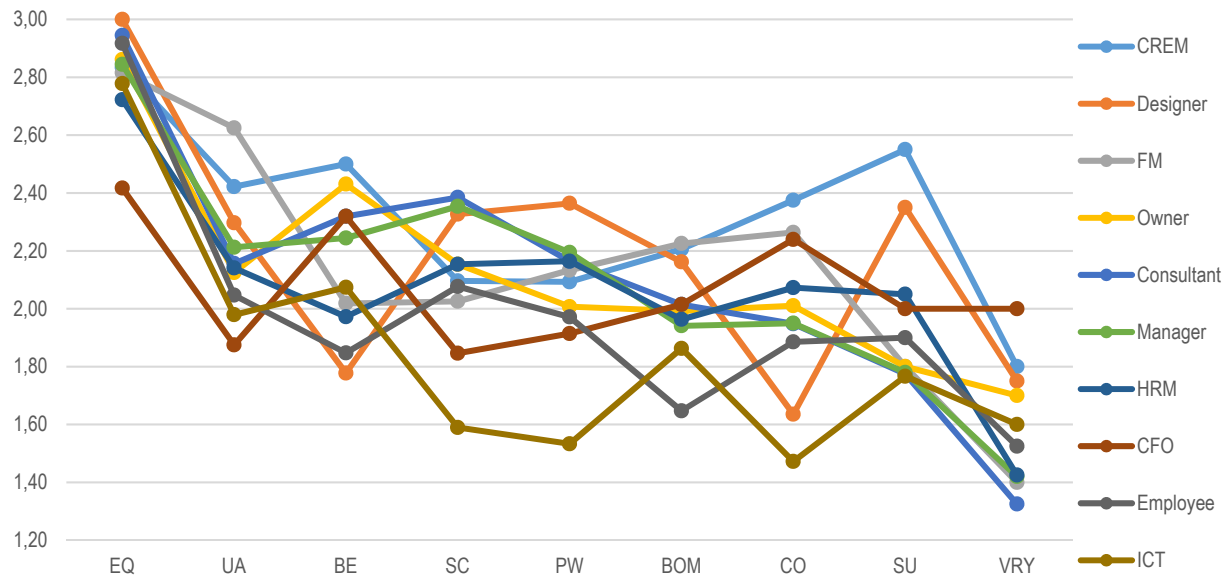

Figure 6-19. Average votes (incl. IDK=0) by user categories

Legend: EQ = Environmental Quality; UA = User Attitude; BE = Business Effectiveness; SC = Staff Characteristics; PW = Productivity/Ways of Working; BOM = Building Operation and Management; CO = Costs; SU = Space Usage; VRY = Value/Return/Yield.

4 Convergence/divergence of opinions

At first, convergence/divergence of opinions across different companies and users was verified for essential indicators. This first step of analysis addressed two queries:

- Convergence/divergence of opinions **across different companies** may emerge. This confirms or disconfirms whether it is possible to obtain a set of KPIs regarding workplace issues which is valid in a cross-sector context. Results allow to verify suitability for external benchmarking; and
- Convergence/divergence of opinions **across different users** may emerge. This confirms or disconfirms whether particular interests/competences can merge together harmoniously into a holistic framework, or are too extreme, and should rather be treated separately. Results allow the verification of suitability for transparency.

4.a Across different companies

Results confirmed that it is possible to draw a short list of indicators that are agreed upon by different industries.

Indicators voted as essential by 25 or more people presented a compact boxplot across the four companies (**Figure 6-20**). Variance did not exceed 0.10, registered by *Effective communication*, where the average minimum value corresponded to 2.13 and the maximum to 3.00.

Indicators voted as essential by 21 to 24 people presented a slightly more dispersed boxplot, but is still acceptable (**Figure 6-21**). Variance did not exceed 0.18, registered by *Absenteeism, presenteeism*, where the average minimum value corresponded to 1.71 and the maximum to 2.83.

Convergence of votes was verified in the short lists both of 28 and 43 indicators. This convergence represents cross-sector interest, which means that this set of indicators can be considered 'universal', by admission of the interviewees.

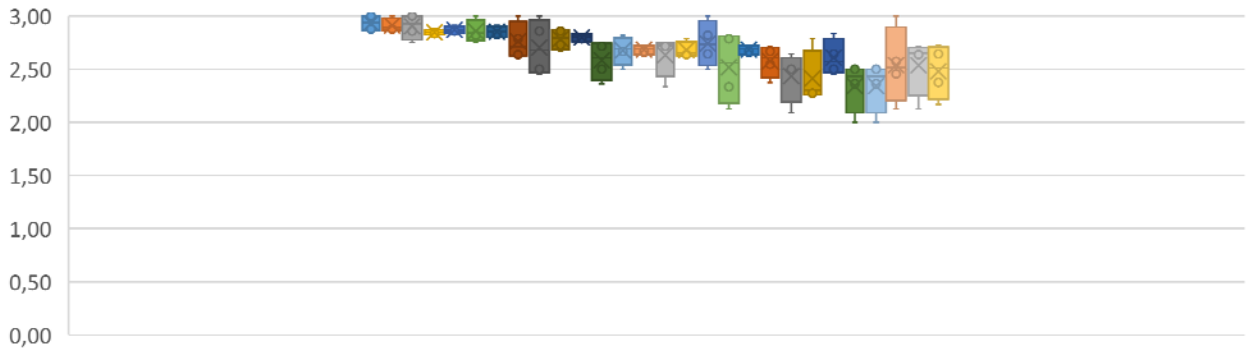

Figure 6-20. Average values by industry (>= 25 'essential' votes) - 28 KPIs

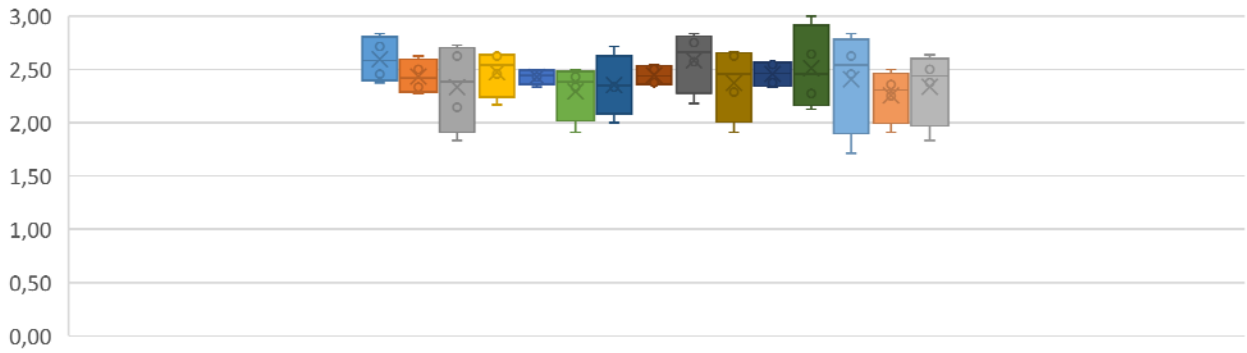

Figure 6-21. Average values by industry ('essential' votes < 25 and > 20) - 15 KPIs

4.b Across different users

Results confirm that it is possible to draw a list of indicators that are agreed upon by different workplace users. Indeed, votes converged on a few of them, which represented general interest and can be considered as transversal.

Indicators voted as essential by 25 or more people presented a compact boxplot across the four companies (**Figure 6-22**). Variance did not exceed 0.24, registered by *Physical health* and *Psychological health*, where the average minimum value corresponded to 2.13 and the maximum to 3.00.

Indicators voted as essential by 21 to 24 people presented a slightly more dispersed boxplot, but is still acceptable (**Figure 6-23**). Variance did not exceed 0.45, registered by *No loss of business due to failure in premises services*, where the average minimum value corresponded to 1.50 and the maximum to 2.80.

Convergence of votes was verified in the short lists both of 28 and 43 indicators. This convergence represents cross-user interest, which means that this set of indicators can be considered generally comprehensible and sharable, by admission of the interviewees.

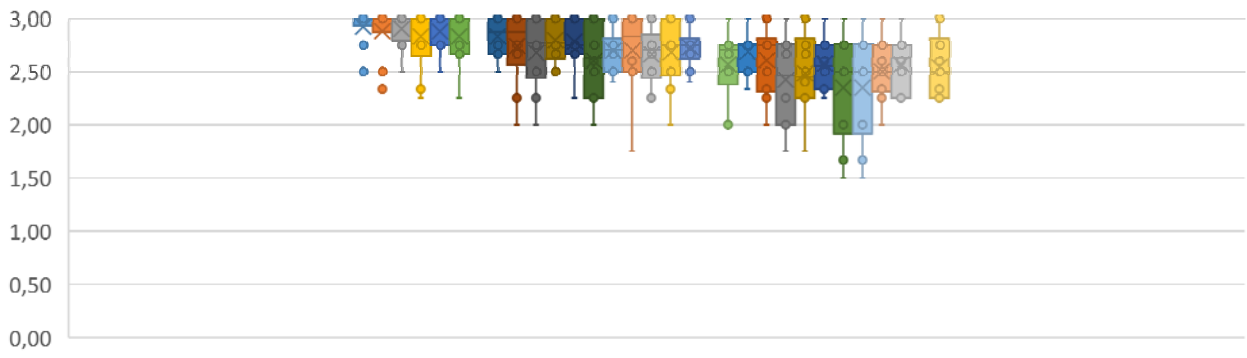

Figure 6-22. Average values by user category (>= 25 'essential' votes) - 28 KPIs

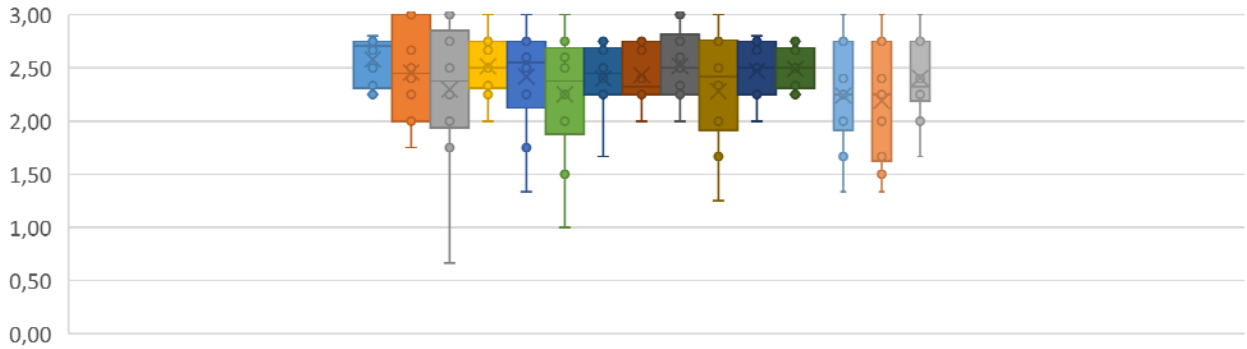

Figure 6-23. Average values by user category ('essential' votes < 25 and > 20) - 15 KPIs

5 Essential KPIs

Composition of the short list

Proceeding to the next step of investigation, a short list of 43 KPIs was assembled only with those indicators that more than 50% of participants rated as 'essential'. The composition of this 43-list deserves some comments, since essential votes concentrated on specific KPI categories. In fact, the proportion of KPIs belonging to different categories varied a lot and revealed noticeable disparities from the long list initially submitted through the questionnaire.

Most of essential ratings were gained in the Building Operation and Management group, which accounted for more than one fourth of the votes (27%) in the short list (**Figure 6-24**). Environmental quality immediately followed, with 26% of essential votes. KPIs pertaining to BOM and EQ together accounted for more than 50% of the total number of votes in the short list. Productivity/Ways of Working, User Attitude and Staff Characteristics took together about 30% of the votes. Costs attracted only 2% of essential votes, whilst KPIs in the Value/Return/Yield field were rated as essential by maximum 14 participants. Thus, no KPI in this category passed to the next step of elaboration.

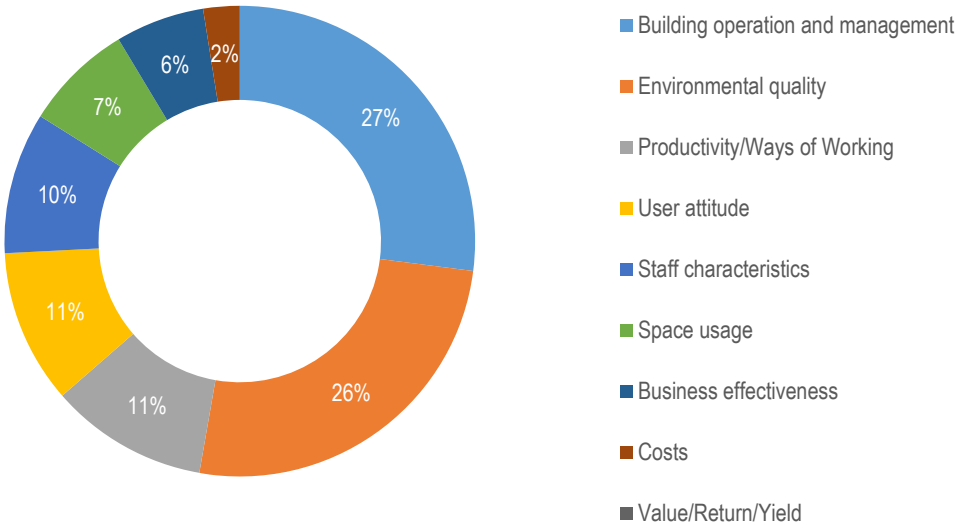

Figure 6-24. Sum of votes in the 43-list by KPI category

Taking into account the 43-list, this differed substantially from the long list with respect to the number of KPIs belonging to the nine categories (**Table 6-16**).

Table 6-16. KPI in the long list vs. KPIs in the short list

KPI category	KPIs in the long list		KPIs in the short list		
	Number	%	Number	%	Sum of votes
Building operation and management	34	20%	11	26%	314
Environmental quality	9	5%	9	21%	299
Productivity/Ways of Working	34	21%	5	12%	126
User attitude	16	9%	5	12%	123
Staff characteristics	13	8%	5	12%	113
Space usage	10	6%	4	9%	87
Business effectiveness	18	11%	3	7%	71
Costs	24	14%	1	2%	29
Value/Return/Yield	10	6%	0	0%	0
Total	**169**	**100%**	**43**	**100%**	**1162**

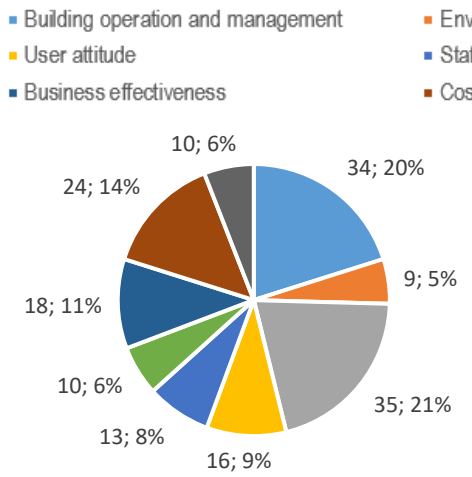

Figure 6-25. Composition of the long list (169 KPIs)

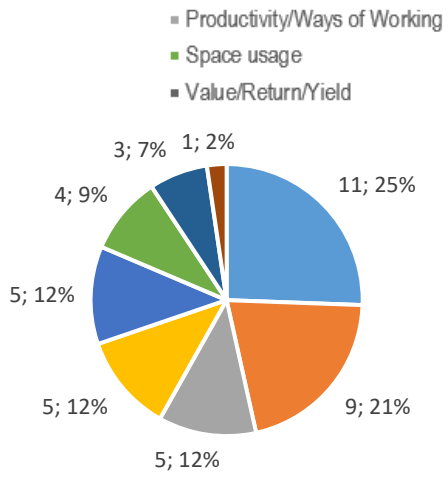

Figure 6-26. Composition of the short list (43 KPIs)

The short list accounted for about one fourth of the indicators originally composing the long list. The proportion of some categories significantly changed from the long list (**Figure 6-25**) to the short list (**Figure 6-26**). In particular:

- *Environmental Quality* indicators, that summed up to only 5% of the long list, grew up to 21% of the short list. All the 9 KPIs pertaining to this category were maintained in the short list. This is the only category where all indicators passed through this first sifting;
- *Costs* indicators, on the contrary, underwent a substantial contraction, shrinking from 14% to only 2% in the short list;
- *Value/Return/Yield* indicators totally disappeared in the short list;
- *Building operation and management, User attitude,* and *Staff characteristics* reduced their number of two thirds, though they kept the same proportion in the overall sum of indicators; and
- *Productivity/Ways of Working* shrinked significantly its weight in the short list but this almost equaled *User attitude, Staff characteristics*, and *Space usage* around 10% each.

It is worth underlining that *Environmental Quality* KPIs were subject to no variation at all, which means that despite them being the smallest category in literature, they appeared as fundamental when involving all user interests. Quite the reverse happened to *Costs* and *Value/Return/Yield* KPIs, which together accounted for a good 30% of the indicators in the long list gained from literature but seemed almost insignificant from a cross-user perspective.

This phenomenon highlights a few evidences:

a. The dimension of a category (i.e. number of KPIs) in not directly proportional to the relative importance of this category to all workplace users (see for example *Costs*). Neither it is true that compact categories (i.e. small number of KPIs) are not subject to radical changes when submitted to selection (see for example *Value/Return/Yield*). In effect, the number of KPIs scouted in the literature seems independent from the relevancy they gain in a cross-user context;
b. The literature seems disconnected from practical usefulness, in a holistic sense. This is evident from both 'essential' votes counting, and the number of IDK answers. Literature may be well supporting specialized sectors but does not push these toward gaining awareness of transversal interests of a variety of users. Indeed, if KPIs in the literature already reflected a holistic approach, essential votes would be evenly distributed over the nine categories, and the number of IDK answers would not differ as much across user categories. The lack of a holistic perspective is denounced by several authors and the present work aims at bridging it; and

c. Practices motivated by well-established professional habits can be far from the perception of all the people dealing with the built environment. Especially when trying to overcome specialisms and local competences related to single disciplines or jobs, as this questionnaire has tried to do, several misalignments come to light, even if it is still possible to confirm the convergence of people's interests toward a few important KPIs.

Indicators added by participants

Participants were given the possibility to add indicators in each of the proposed categories and also at the end of the questionnaire in a separate category. In total six indicators were added to the lists.

A Facility Manager added five indicators in the category *Building operation and management*, whereas a Real Estate Manager added one indicator in the closing part of the questionnaire. These additional indicators are displayed in **Table 6-17**. Of course, each of them occurred only one time.

It is worth noticing that people who added indicators belong to the FM and CREM categories, which are expected and confirmed as being the most familiar with performance indicators referring to the workplace.

In effect, these new indicators had some similarities with already existing indicators that were presented in the list, but offered a slightly different angle. Thus, these deserved discussion by a larger group of people in order to determine whether they were interesting for all workplace users.

Existing indicators which have something to do with the proposed ones can be found in **Table 6-17**.

Table 6-17. Indicators added by participants vs. indicators existing in the long list

Category of added indicators	Added indicators	Similar existing indicators	Category of existing indicators
Building operation and management	Number of requests made vs. number or requests met with timing	- Effectiveness of help desk service, Response time, Responsiveness to problems [BOM-9]	Building operation and management
Building operation and management	Number of audits/month	- Number of building quality audits [BOM-16] - Use of audits for service providers [BOM-31]	Building operation and management
Building operation and management	Response time	- Effectiveness of help desk service, Response time, Responsiveness to problems [BOM-9]	Building operation and management
Building operation and management	Resolution time	- Effectiveness of help desk service, Response time, Responsiveness to problems [BOM-9] - Work order completion in facility management [BOM-33]	Building operation and management
Building operation and management	Cost of corrective intervention	-	
Other	Application and analysis of Transactional Net Promoter Score (TNPS) evaluation techniques	-	

All these six additional indicators were brought forth for discussion in the next step of investigation. During discussion, similarity with already existing indicators was highlighted and debated.

6.5 Outputs from Focus groups/Interviews

The list of indicators for discussion in the focus group was arranged by adding the indicators that respondents proposed in Questionnaire 1 (additional six) to the short list of 43 indicators. In the end, the final list for the focus group was composed of 49 indicators. This list can be found in **Appendix 12.14**.

Following up on the considerations done in **Chapter 3.3**, and **Chapter 6.1** about the values/impacts of the workplace, indicators were displayed into a matrix of categories and classes (**Table 6-18**). This matrix was used as a support to drive debate with the groups or single people interviewed.

Indicators appeared in the matrix listed by descending number of 'essential' votes.

Table 6-18. Example of the KPI matrix

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Environmental quality	*KPI*		
Building operation and management			
Space usage			
Business effectiveness			
Costs			
Value/Return/Yield			
Productivity/Ways of Working			
User Attitude			
Staff characteristics			
Other			

At first, people were asked if they thought it is better to discuss a short list of 43 indicators, or a very short list of 28. The Delphi groups/interviewees indicated that the list including 43 indicators was more comprehensive of all important aspects to cover. Therefore, 43 indicators were discussed in the focus group and interview sessions, in addition to the six indicators joined by respondents, for a total number of 49 indicators.

In this phase, people could still erase unnecessary indicators, add indicators from the long lists, or suggest new indicators, which they believed relevant to all workplace users.

This phase discussed with interviewees the following topics:

- The definition of each indicator;
- The placement of each indicator in the corresponding class; and
- The placement of each indicator in the corresponding category.

Additional open questions regarded KPI gathering and circulation, with particular focus on:

- Methods and techniques;
- Periodicity;
- Competences;
- Longevity; and
- Communication.

6.5.1 KPI definition and placement

1 Results by KPI category

Environmental Quality

All Environmental Quality KPIs appeared both in the list of 43 indicators and in the list of 28 indicators. Most of them were easy to comprehend by all workplace users. However, a few suggestions have been gathered to slightly clarify the meaning of some of them. **Table 6-19** and **Table 6-20** show the comparison between the two lists of Environmental Quality KPIs, respectively before and after discussion.

Comments that arose during focus groups and interviews can be recapped as follows.

1. More than a few interviewees suggested to move comfort-related KPIs to the category of social impact, in order to better distinguish them from indicators of physical/technical parameters. This considering that comfort is often related to people's behavior, while technical parameters are independent. Therefore, comfort-related indicators might be communicated to the users with suggestions for improving these conditions (for instance, you are not happy with acoustics comfort, then help everyone keep a low voice pitch, or consider using dedicated spaces if you need to concentrate; you are not happy with thermal comfort, then consider adjusting your clothing).
2. On the contrary, quality-related indicators regard, especially, the interest of maintainers and technicians, and they could be communicated to all employees only in case of technical problems. On the contrary, some people said it is important to them to be always informed about the level of these physical parameters. A solution to satisfy these remarks can be found in separating socially impactful from environmentally impactful KPIs, so that it is easier to manage them disjointedly when appropriate.
3. *Satisfactory physical working conditions (qualitative)* was deemed important but better rephrased as *Ergonomics comfort*, otherwise it could easily be confused as a sum of the previous three comfort-related indicators.
4. *Indoor/outdoor environmental quality (lighting, temperature, noise)* elicited a long debate about its meaningfulness. A few people considered it redundant, hence unnecessary. However most of the people said being aware of how internal environmental quality matches external conditions is very important to all workplace users. In conclusion, suggestion was compiled to convert this indicator into *Indoor vs. outdoor environmental quality*.

Table 6-19. Environmental Quality KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Environmental quality		• Light comfort • Acoustics comfort • Thermal comfort • Satisfactory physical working conditions (qualitative) • Light quality, Lighting and daylighting • Indoor air climate • Indoor air quality and ventilation • Acoustic quality, noise and acoustics • Indoor/outdoor environmental quality (lighting, temperature, noise)	

Table 6-20. Environmental Quality KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Environmental quality		• Light quality, Lighting and daylighting • Indoor air climate • Indoor air quality and ventilation • Acoustic quality, noise and acoustics • Indoor vs. outdoor environmental quality (lighting, temperature, noise)	• Light comfort (natural vs. artificial) • Acoustics comfort • Thermal comfort • Ergonomics comfort (qualitative)

Building operation and management

Building operation and management included nine indicators from the 28-list, two indicators from the 43-list, and five indicators added by respondents to Questionnaire 1 (**Table 6-21**). Through focus groups and interviews many KPIs in this category were subject to modifications (**Table 6-22**).

1. *Accessibility for disabled* has a strong social connotation, thus can be referred to as social impact. Moreover, it should be considered in a broader sense. It has been suggested to reword it into *Design for All* with a view to engagement.
2. *Ethics, health and safety practices (Health and safety, Provision of safe environment)* was considered as too generic, and slightly overlapping with other indicators from different categories such as *Ergonomics, Physical health, Psychological health,* and *Standards of cleaning* in this same category. People said it would be interesting to interpret it as *Quality of communication strategies to encourage ethics, health and safety practices*. To this extent one interviewee mentioned the usefulness of motivational messages, wayfinding, and information campaigns circulating mottos such as “hold the handrail while taking the stairs”, “avoid the elevator to spare energy and be fit”, “recycle trash”.
3. *Standards of cleaning* has to do with wholesomeness, and hygiene, thus referring to health and safety.
4. *Networking IT* and *Telecommunications* can be considered as a joint indicator, better rephrased as *Accessibility to IT networks*. This can be referred to the category of *Productivity/Ways of Working*.
5. *Security* has been said to be of sectorial and technical interest. It has not obtained many votes probably because it is taken for granted by most workplace users. It has been recommended to drop it.

Three indicators resulted being somewhat joinable, because they incorporate similar aspects.

6. *Competence of staff* seems difficult to measure, thus might be included in the concept of *Reliability*. However, comments arose about the importance of a human touch in these kind of jobs. Hence, indicators asking for the effectiveness and proactiveness of a service by level of satisfaction from the internal client/end-user seem of supreme relevance to keep the staff motivated and committed to their responsibilities.
7. *Reliability* required to be expanded and better specified as *Reliability of the maintenance service*, which sounds very similar to *Effectiveness of help desk service*.
8. *Effectiveness of help desk service, Response time, Responsiveness to problems* has more relevance if considered as a qualitative/perceptual metric, especially as opposed to *Number of requests made vs. number or requests met with timing*, *Number of audits/month*, *Response time*, *Resolution time*, and *Correction of faults*.

Some considerations arose as general comments:

9. Indicators that were added during questionnaire completion are quite technical and operative, but most of the people declared they are interesting and understandable to them.
10. Among the additional KPIs, *Number of requests made vs. number or requests met with timing* is mentioned by the majority as the most appropriate. The others can be dropped.
11. *Cost of corrective intervention* would find better placement in the category of *Costs.*
12. This category appears broad since it includes indicators related to different areas. In particular, some indicators should be referred to both the Facility Management and the IT areas. A couple of interviewees brought up the opportunity of creating an additional category, or sub-category, to host IT-related KPIs, while others suggested that this latter are detached from the building itself because the IT service must offer support also to offsite workers, by enabling their productivity. Thus, IT-related KPIs can be moved to the category of *Productivity/Ways of Working*.

Table 6-21. Building operation and management KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Building operation and management		• Accessibility for disabled • Ethics, health and safety practices (Health and safety, Provision of safe environment) • Networking IT • Competence of staff • Reliability • Effectiveness of help desk service, Response time, Responsiveness to problems • Telecommunications • Standards of cleaning • Security • Correction of faults • Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings - Number of requests made vs. number or requests met with timing - Number of audits/month - Response time - Resolution time - Cost of corrective intervention	

Table 6-22. Building operation and management KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Building operation and management	• Cost of corrective intervention	• Standards of cleaning • Number of FM requests made vs. number or requests met with timing • Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings	• Design for All (Accessibility for disabled) • Quality of communication strategies to encourage ethics, health and safety practices • Reliability of the maintenance service (Competence of facility management staff)

Space usage

Space usage comprehended one indicator from the 28-list and two from the 43-list. **Table 6-23** and **Table 6-24** show the comparison between the two lists of Space usage KPIs, respectively before and after discussion. Most of the comments regarded a prospective evolution of traditional indicators into more modern KPIs.

1. Both *Persons per seat, Number of workstations per employee* and *Space per employee (e.g. square feet per employee)* stood out as outdated. These cannot serve the purpose of representing current ways of using the workspace, anymore. In addition, the same are not interesting to most of the users as a quantitative data *per se*.
2. *Space utilization (workstations, meeting rooms, each type of space*) seems unanimously a much better indicator of space usage effectiveness, which is also informative to all users when they have to choose what space to work in. In a logic of smart working, this KPI emerges as a critical one, both at the demand side and at the supply side. It is considered a useful measure for change management purposes. More spaces were added to the brief list included in this indicator, namely filing and archive spaces, and collaborative spaces.
3. *Parking* alone sounds reductive and needs a broader definition in order to imply all means of transportation to and from the office. In effect, one indicator was present in Questionnaire 1, suggesting the idea of mobility/transportation management, i.e. *E – People's means of transportation (private vs. public)*. This latter was reintroduced in the list, absorbing also *Parking*, but placed in the category of Staff characteristics. This information was actually considered very useful for all workplace users to decide which means of transportation to use. Indeed, companies could potentially make available to their employees a variety of services such as shuttles, car sharing, bike sharing, or carpooling. This relates to both financial/organizational impacts (i.e. costs) and environmental impacts (i.e. sustainability).

Table 6-23. Space usage KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Space usage		• Persons per seat, Number of workstations per employee • Space per employee (e.g. square feet per employee) • Space utilization (workstations, meeting rooms, each type of space) • Parking	

Table 6-24. Space usage KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Space usage		• Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space)	

Business effectiveness

This category accounted for one indicator from the 28-list and two from the 43-list. The list of KPIs that was administered in the questionnaire can be found in **Table 6-25**. **Table 6-26** shows how these indicators appeared after discussion.

Some interviewees had difficulties in commenting these indicators because they could not see a direct relation between business effectiveness and the work environment. Especially ICT people manifested perplexities with respect to how much the spatial dimension of the work environment affects business performance. The author believes that a holistic approach toward workplace management, as the one proposed within this research, is of paramount importance exactly with the goal of making this correlation more evident to all users, being apparently still not clear for all.

Despite this initial doubtfulness, comments arose about business KPIs. Especially CFOs and Owners demonstrated a familiarity with this category of indicators and considered them important to be shared also with the other users, who still care less, at the moment.

1. *Critical date management* is often already measured through the Customer section of a Balanced Scorecard in different ways (e.g. on time delivery). Some interviewees proposed to substitute it with Company Revenues, which was actually present in the long list as *17/34/163/164 - Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue)*.
2. *Task efficiency and deadlines met* is similarly common among companies. It looks alike to the previous indicators, and even more appropriate. However, this could be also interpreted as a side of *Productivity*, that can be found in the category of User attitude.
3. *Schedule adherence in project management* did not receive significant comments, thus it is considered irrelevant and can be erased.

Table 6-25. Business effectiveness KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Business effectiveness	• Critical date management • Task efficiency and deadlines met • Schedule adherence in project management		

Table 6-26. Business effectiveness KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Business effectiveness	• Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue) • Deadlines met (on time delivery)		

Costs

The only indicator in the category costs was dragged from the 28-list (**Table 6-27**), and was only slightly modified thanks to discussion (**Table 6-28**).

In effect, a few participants confessed their disappointment in seeing only one indicator to represent costs.

1. According to participants suggestions, it would be useful referring costs to people, hence having cost/person KPIs. They referred to *60/122/144/251 - Occupancy costs, * Occupancy cost/person, * Occupancy cost/sqft, * Occupancy cost/total revenues*, in the long list.
2. *Operating costs* are considered to have also a strong environmental impact.
3. More suggestions arose about the opportunity of having a dashboard where KPIs could be compared to internal benchmarks. CFOs and Owners demonstrated an interest in communicating these indicators for engagement purposes.

Table 6-27. Costs KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Costs	• Operating costs (maintenance, utility, energy)		

Table 6-28. Costs KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Costs	• Operating costs/person (maintenance, utility, energy)		

Value/Return/Yield

No indicator in this category was rated as essential by more than 14 people, hence none of them was present in the 43-list debated during focus groups and interviews (**Table 6-29**). However, a few interviewees emphasized the importance of covering this aspect for reaching a check on results from a holistic viewpoint. These considerations brought to reintroduce one KPI in this category (**Table 6-30**).

1. They suggested to recuperate and promote some of the KPIs from the long list. In particular, it would be beneficial including investment vs. return KPIs, e.g. number of travels reduced thanks to the implementation of appropriate ICT tools. In fact, in the long list one indicator could fit this purpose. *237 - Return-on-investment/economic value added* seemed appropriate to reintroduce in the list.
2. People stressed the significance of updating this indicator depending on the current objectives and ongoing projects of the company, i.e. investments on real estate assets and workplace facilities.

Table 6-29. Value/Return/Yield KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Value/Return/Yield	-		

Table 6-30. Value/Return/Yield KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Value/Return/Yield	• Return-on-investment/ economic value added		

Productivity/Ways of Working

Three of the Productivity/Ways of Working KPIs were gained from the 28-list, and other three from the 43-list. Indicators in this category went through many comments, which produced quite sensible variations from their initial to the updated versions (see the comparison between **Table 6-31** and **Table 6-32**).

1. *Adequacy of space (survey based data), suitability of premises and functional environment* sounded fitting and well formulated.
2. *Equipment provided meets business needs* required more specification. It is appropriate referring it to the ICT sphere. Thus, combining it with KPIs dragged from Building operation and management sounded reasonable.
3. *Space utilization* seemed referring more to the Space usage category, thus was erased from here.
4. *Employee productivity* is confirmed as a key indicator to grasp the effectiveness of workplace projects, though some uncertainty came up with respect to how to perform its measurement. Some interviewees, for example, noticed an increase in 'orders entering at Personal Computer (PC)', which might have been influenced by a change in workplace configuration and would be interesting to verify the cause of. In any case, this indicator has a strong financial/organizational value.
5. *No loss of business due to failure in premises services* deserved rephrasing, for example by introducing a parametrization (e.g. vs. total revenue). Anyways, keeping track of this aspect seems very challenging, unless serious failures or severe malfunctioning occur, which makes it probably not worth the effort. Possibly this KPI fits more the case of manufacturing facilities than office buildings. In the office context other indicators in the long list would sound more relevant, e.g. *Customer retention*. In any case this aspect belongs to the financial/organizational impact or even to the category of Business effectiveness.
6. The aspect of *Innovation* seems important both in terms of implementation of innovative workspaces and introduction of innovative equipment. Measurement of this aspect would encompass quantifying the Δ to benchmarks, both at spatial and technological level. For instance, percentage of collaborative space implemented vs. percentage of collaborative space prospective.
7. *Effectiveness of ICT help desk service, Responsiveness to problems (perceptual)* and *Accessibility to ICT networks* were imported from the category of Building operation and management.
8. Overall, indicators regarding wellbeing and wellness seem missing in this category. These could include also company restaurant, fitness center, and other similar facilities. Nevertheless, no specific suggestion arose to fill this gap, which is somewhat addressed in the category of User attitude.

Table 6-31. Productivity/Ways of Working KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Productivity/Ways of Working			• Adequacy of space (survey based data), suitability of premises and functional environment • Equipment provided meets business needs • Employee productivity • No loss of business due to failure in premises services • Innovation • Space utilization (workstations, meeting rooms, each type of space)

Table 6-32. Productivity/Ways of Working KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Productivity/Ways of Working	• Customer retention	• Accessibility to ICT networks	• Adequacy of space (survey based data), suitability of premises and functional environment • Employee productivity • Innovation in spaces and equipment (Δ to benchmark) • Effectiveness of ICT help desk service, Responsiveness to problems (perceptual)

User attitude

User attitude hosted four KPIs from the 28-list and one from the 43-list (**Table 6-33**). Participants validated the importance of all these five indicators, despite proposing some improvements, as follows (**Table 6-34**).

1. *Engagement, Community satisfaction and participation, Atmosphere of the community, Reward systems and motivation* is of key relevance, because it seems evident that engagement rises where workspaces have been renovated. *Reward systems and motivation* relate more to financial/organizational impacts, however do not make this indicator more effective.
2. *Effective communication* is fundamental especially when a workplace change occurs. Hence, this should be intended as effective communication of objectives, values, vision and mission from the organization to the employees, as included in a KPI in the long list (i.e. *Organizational culture, mission and vision*). This aspect strongly relates with engagement. In a broad sense, it has to do also with wayfinding, inclusion, and so on.
3. *Image to outside* is extremely important having to do with the attitude of the company outwards, and incorporated also the idea of social responsibility. It is interesting to grasp through brief questionnaires to visitors and/or clients.
4. *Overall employee satisfaction* sounds too generic and can be erased because it is already included in more specific indicators (e.g. engagement, adequacy of space, comfort, etc.).
5. *Perception of privacy* as well seems important, even though it is already included in the area of Productivity/Ways of Working (e.g. *Adequacy of space*).

Table 6-33. User attitude KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
User attitude			• Engagement, Community satisfaction and participation, Atmosphere of the community, Reward systems and motivation • Effective communication • Image to outside • Overall employee satisfaction • Perception of privacy

Table 6-34. User attitude KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
User attitude			• Engagement, Community satisfaction and participation, Atmosphere of the community • Effective communication of corporate culture • Image to outside

Staff characteristics

Staff characteristics included two indicators both appertaining to the 28-list. Interviewees emphasized the innovative stance of these aspects, which are rather underestimated in the workplace and not commonly measured. Comments regarded the placement of these KPIs in the social class of impact/value, since indeed they are affected by environmental parameters. Modifications to the initial list, as it is shown in **Table 6-35**, reflect exactly these comments (**Table 6-36**).

1. *Physical health* must not be mistaken for comfort or health and safety practices, which belong to the sphere of Environmental quality, however it is evident that all these factors affect each other. Also physical health is strongly related with psychological health.
2. *Psychological health* is imperative and must be acknowledged in a good way. It incorporates wellbeing, as for it was mentioned in the Productivity/Ways of working sections. Psychological health should take into consideration stress, in a holistic approach to the employee, thus 'Psycho-physical wellness' seems the best way to wording both physical and psychological health.
3. *Abstenteeism, Presenteeism* did not encounter much interest from participants. Most of the people considered this aspect as already incorporated in *Space utilization*, which in fact is a different way to look at *Presenteeism*. Nonetheless, information about staff characteristics as individuals seemed significant to represent.
4. Hence, it was proposed to expand staff characteristics with the topic of multiculturalism of the working environment. This element was missing also in the long list of indicators, where demographic characteristics included only age, workforce size, level of education, and so on. *Multiculturalism* is related to talent management, attraction and retention, innovation, engagement, image to outside. It involves also a significant financial/organizational component, even if it appertains to the social class.
5. *Competence of staff*, along with *Professionalism and expertise of CREM staff* were considered as complicated to measure because depending on high subjectivity. In place of these, other indicators are already present in the list, which include similar but more objective measures: *Reliability of the maintenance service, Number of FM requests made vs. met, Effectiveness of ICT help desk,* thus they have been dropped from the list.
6. *People's means of transportation* was inherited after considerations arose in the Space usage category.

Table 6-35. Staff characteristics KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Staff characteristics			• Physical health • Psychological health • Absenteeism. Presenteeism • Competence of staff • Professionalism and expertise of CREM staff, CRE employee qualifications, Competence of CREM staff

Table 6-36. Staff characteristics KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Staff characteristics		• People's means of transportation (private vs. public)	• Psycho-physical wellness • Multiculturalists (staff composition)

Other

The only indicator added in the general category was *Application and analysis of Transactional Net Promoter Score (TNPS) evaluation techniques*. The author placed it in the social class of impact/value (**Table 6-37**). However, interviewees concluded that this can be considered more as a general approach to data gathering than an indicator itself. Thus, it was eventually erased from the list. In conclusion no 'other' category exists after discussion through focus groups and interviews anymore (**Table 6-38**).

Table 6-37. Other KPIs before discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Other			• Application and analysis of Transactional Net Promoter Score (TNPS) evaluation techniques

Table 6-38. Other KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Other			-

2 General comments

Through the process that was described above, the short list was compressed from 49 indicators to 33 indicators, each indicator corresponding to a thematic category and a class of impact/value (**Table 6-39**).

Impacts appeared most of the time as transversal. Many indicators indeed entailed more than one impact, even if an organizational, environmental, or social impact can be recognized as prevalent in most cases. However, participants all agreed upon the usefulness of classification, especially for easier recognition of the professionals dealing with the related indicators.

Distribution in the three classes showed 6 KPIs representing the financial/organizational value, 11 KPIs in the environmental value, and 16 KPIs in the social value. Impacts in the social area appeared prevalent by

far. In this latter class, indicators rely on perceptual metrics and opinions of workplace users, which confirms the key role of the human component in the whole workplace-making process.

It is important to highlight that the first KPIs by vote were those referring to 'comfort': *Light comfort, Acoustics comfort, Thermal comfort*. Both votes and opinions expressed in the interviews underlined that people value most of all personal comfort rather than technical parameters, even though quantitative indicators immediately followed perceptual indicators. People generally feel that attention to employees' perception of comfort is still improvable.

Image to outside was considered very important, which remarks the role of clients/customers/visitors as key workplace users.

Some people made the point that many of the KPIs in the 43-list were actually fundamental and probably had not reached larger consensus as 'essential' only because they were taken for granted by the majority.

Many suggestions stood up about the opportunity of having a dashboard where KPIs could be compared to internal benchmarks.

For refinement of the final set of indicators, a few people proposed to organize indicators in a tree-like structure, from the more strategic ones, to the more technical ones. This proposal reminds of KPIs listed by Hinks and McNay (1999) after prioritization. Indeed, a passage encompassing KPI ordering was faced in the next step of analysis, through Questionnaire 2.

Table 6-39. KPIs after discussion

	Class – Impact/Value		
Category	Financial/organizational	Environmental	Social
Environmental quality		• Light quality, Lighting and daylighting • Indoor air climate • Indoor air quality and ventilation • Acoustic quality, noise and acoustics • Indoor vs. outdoor environmental quality (lighting, temperature, noise)	• Light comfort (natural vs. artificial) • Acoustics comfort • Thermal comfort • Ergonomics comfort (qualitative)
Building operation and management	• Cost of corrective intervention	• Standards of cleaning • Number of FM requests made vs. number or requests met with timing • Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings	• Design for All (Accessibility for disabled) • Quality of communication strategies to encourage ethics, health and safety practices • Reliability of the maintenance service (Competence of facility management staff)
Space usage		• Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space)	
Business effectiveness	• Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue) • Deadlines met (on time delivery)		
Costs	• Operating costs/person (maintenance, utility, energy)		
Value/Return/Yield	• Return-on-investment/ economic value added		
Productivity/Ways of Working	• Customer retention	• Accessibility to ICT networks	• Adequacy of space (survey based data), suitability of premises and functional environment • Employee productivity • Innovation in spaces and equipment (Δ to benchmark) • Effectiveness of ICT help desk service, Responsiveness to problems (perceptual)
User attitude			• Engagement, Community satisfaction and participation, Atmosphere of the community • Effective communication of company culture • Image to outside
Staff characteristics		• People's means of transportation (private vs. public)	• Psycho-physical wellness • Multiculturality (staff composition)

6.5.2 KPI gathering and circulation

The last part of the focus groups or interviews was dedicated to collecting qualitative considerations and suggestions for KPI gathering and circulation. In fact, some directions are needed, assuming that this system of KPIs, as it was elaborated in this study, would be implemented to drive strategies throughout the design, management and use of workplaces.

Of course, indicators at this stage of elaboration remain at a general level of definition. They do not correspond already to specific metrics, or measures. Hence, queries to this extent are general as well. However, these allowed scouting people's inclination toward specific topics that appear vague in the literature, thus need further deepening. Still, overall aptitudes can be traced, which can be useful for orienting future investigations.

A few open questions were proposed to the participants with the objective of stimulating debate on several topics such as methods and techniques for data gathering, periodicity of data gathering and circulation, competences required for KPI management, expected longevity of the KPI system, and possible strategies for KPI communication to all workplace users. Questions as they were formulated can be found in **Appendix 12.15**, while a report of the results from discussion continues in the following sessions.

1 *Methods and techniques for data gathering*

Several considerations regarded methods and techniques for data gathering. 'Data' is herewith intended as potential measures that would populate indicators. The following options were explored and commented on:

- Observation: Causal observation, chatting; Systematic observation; Indirect observation – looking for traces of behavior, e.g. how people arrange furniture, how people are dressed, how people use equipment, and so on; Plan analysis – detailed analysis of plans to determine the amount of available space, distance and proximity between different functional areas or other paths within the building.
- Interviews and questionnaires: Interview – individual or group (i.e. focus group), formal (i.e. with a predefined list of questions) or informal (i.e. simply asking people about their views on the same topic, but without set questions); Surveys – questionnaires (either short or long, open-ended or closed-ended questions).
- Instrument readings and archival logging: Instrument readings – temperature and humidity controls, computerized reports of number and location of phone calls, motion sensors that indicate whether a room is occupied, badges or proximity card readers that print out who has entered a particular location and at what time; Archival data and logging – cost and personnel data, e.g. why people joined or left a firm, cost of furniture and equipment, cost of consultants and contractors, work-related grievances/complaints, absenteeism, turnover, health problems; Computer logging and inventory – reservations of spaces such as meeting rooms or conference rooms.
- Person-integrated devices: Mobile phone apps, trackers (geo-location inside and outside the building; fit bit data, e.g. steps per day, heart rate, sleeping hours; apps that ask for feedback, e.g. car to go, enjoy, tripadvisor, yelp, fourthsquare).

Recurring remarks can be summarized as follows.

a) No one method fits all. Each indicator is peculiar and deserves its own methods and techniques. Financial/organizational KPIs are typically based on archival data and registers. Environmental KPIs

mainly involve instrument readings and computer logging. Social KPIs mostly rely on questionnaires and interviews.

b) Each technique has its pros and cons.
c) Great enthusiasm has risen for person-integrated devices that are seen as promising for the near future. These could be used both for data gathering (for example, personal parameters, satisfaction feedback and so on), and for information sharing (for example, pop-ups through apps, tracking of problems resolution, etc.). The only concern is about the respect of privacy in the use of personal data. The Italian context is somewhat peculiar to this extent. Here privacy issues have been always regarded as extremely sensitive. Several regulations restrict companies' boundaries to treating personal information. Also, labor unions are very powerful and inspect with accurate scrutiny those matters. For instance, geopositioning of employees in the workplace is not allowed today.
d) Observations, when systematic, are considered complicated to some extent, because they are invasive and require intense investments of time and human resources. On the other side, though, a human touch in the process is regarded as important in order to show to the employees that the company cares about them as individuals, not only as numbers. In addition, observers detect behaviors and provide comments that are not available elsehow.
e) Instrument readings and archival logging are the most common techniques that companies already rely on for some measurements, thus could be adapted to fit new purposes if necessary. Improving the networks of sensors, so that they can work in an integrated manner, should be the first investment for companies to look at.
f) Questionnaires are in general considered as ineffective. They are used too much thus risk being ignored. Transactional Net Promoter Score (TNPS) questionnaires might be more successful, along with the implementation of apps. Interviews, on the contrary, seem more effective, especially when organized as focus groups or workshops, even if obviously they entail a higher level of commitment.

In sum, a combination of the abovementioned techniques is the solution toward **triangulation** of data.

2 Periodicity of gathering and circulation

According to most of the opinions, periodicity of data gathering and analysis can be varied from time-to-time in relation to contextual factors. For instance, frequent monitoring is necessary right after a move or a workplace change. Here checking sentiment and comparing the situation before and after the change is fundamental. A monthly check is appropriate for a while, in this case. Later on, monitoring can become more diluted, even if it must be performed regularly, ideally **every quarter**.

Of course, periodicity of data gathering must be evaluated together with the related costs. Some techniques are more expensive than others and their implementation requires careful evaluation. Maximum importance is attributed to feedback especially when employees are called for direct participation in data gathering.

A deficiency of data circulation is lamented even by a consultant, saying that: *"As an external I have been working here for a while now, and I deem extremely important being informed. To date, this does not happen.*" This lack comes up as a general trend. Circulation of information about workplace performance does not occur regularly and people notice this as a weakness. People declare that they do not even know if many of the indicators are objects of analysis or not. A communication campaign **every semester or year** would already make people happier.

Of course, the more data gathering becomes automated, the more often information could be available to everyone and on a regular basis. Real-time information is not required as essential, especially because it

would be probably punctual. Conversely, it is better to aim at integrating key data, and reporting it as meaningful information, even if less frequently.

However, continuous monitoring is unanimously considered critical, thus switching to this approach rather than limiting on evaluation, must be a priority.

3 Competences for KPI management

On one hand people argued that: *"It is optimistic thinking that only one person could manage all these indicators, but it would be amazing"*. This especially if they have to rely on existing professionals only. All the companies argue that current job descriptions do not entail the task of KPI management; hence no one would have adequate time to dedicate to this activity. Nevertheless, most of the participants admitted that extant competences and roles, dispersed in different areas, would be enough for data gathering, with the due updates.

On the other hand, though, the main challenge regards indicators reading and interpretation. This may be done through periodical meetings to share measurement results. Probably each class or category of indicators could have a sectorial representative, who would be then in charge of cross-checking overall performances together with the other representatives. Periodical meetings would serve the purpose of managing indicators at a strategic level as: *"Managerial/strategic group meetings to evaluate overall performance"*. Team work is regarded as critical for this activity, involving Real Estate Management, Facility Management, Human Resources, Organization, and Communication departments. Clearly, various competences must be matched together and work synergistically.

The system proposed in this study is suitable to support KPIs' collection and access on a unitary platform (such as a dashboard). This would help the job of controlling indicators in an integrated manner.

A prospective *"wellness responsible"* is also mentioned as a supervisor of workplace matters. Indeed, one single reference point specialized in evaluating the interferences and influences of each indicator with one another would benefit the development of effective strategies. This person might be a project manager in the real estate or organization area, at a very high level. Recurring terms to define his hypothetical role are: ***"overview", "transversal", "integration", "cross-relate", "coordinator"***.

For now, company owners and CEOs are probably the most appropriate figures to check on the indicators from a higher viewpoint, but without specific technical competences. On the contrary, a person who could also compare the current situation with external benchmarks is likely to make the difference.

In sum, a professional is required to oversee and coordinate interpretation of all the indicators regarding the workplace. KPIs indeed must be integrated in relation to company's business and people. To date one figure entitled and capable of that does not exist. Even if the system proposed in the present study can offer a significant support to this end, specific expertise is essential for using it at the maximum potential. A new job description is required to fill this gap.

4 Longevity of the system

With regard to the longevity of the KPIs that can be found in the system to date, people generally agreed that they can aim at a long life.

Unanimously interviewees recommended periodical checks of the validity of all the indicators. Opinions on the frequency of these checks range from 9-12 months to five years. **Two-three years** can be considered an average valid period.

Checks should also regard updates of methods and techniques for data gathering. Technological improvements in fact happen at high speed today, and might affect the related indicators, with regard to the method and precision of detection, rather than to their substance.

However, everyone declared that the proposed system collects stable principles representing the hotspots every company should be interested in. For most of them the matrix displays indicators that they define as: ***"general enough", "'universally valid", "univocal"***. In any case, it seems more likely that the present set will expand thanks to supplementary KPIs, rather than that it will shrink.

Moreover, some continuity is recommended to make it possible observing trends, confronting with benchmarks, and verifying the results of policies, projects and initiatives on the workplace over time.

5 Communication strategy

Circulation of the indicators among all workplace users seems appropriate, and is actually signaled by people as a priority for the near future: *"It'd be great".* For now, none of the four companies has in place any continuous communication strategy about workplace management. Only exceptional cases, such as radical workplace transformations, are dedicated specific attention, by communication campaigns throughout process development, until a one-shot post-occupancy verification.

Nonetheless, some people warned about communicating some particular KPIs to all the users. For instance, financial/organizational KPIs might be subjected to misinterpretations and dangerous misunderstandings. In general, the risk of ambiguity is regarded as seriously threatening.

Some indicators should perhaps be reserved and accessible only to high management levels or specific functional areas: *"Filters are necessary on both a hierarchical and functional scale".* One of the strategies that have been suggested to overcome this potential risk is to organize meetings with executives and managers, who then are responsible for transferring the communication to the lower levels with a cascade structure.

In any case, it must be noted that limiting the openness and transparency of the system, either by type/category of indicator or by type/hierarchical level of user, seems contradicting the necessity for data sharing and circulation among all users that emerged from previous comments. Of course, some indicators embed sensitive data and require careful treatment. That is why a competent figure who, on one hand, is able to retrieve and interpret these kind of KPIs and, on the other, can manage an appropriate communication strategy seems a key role that any companies in search for enhancing their workplaces should be looking for establishing in a permanent manner.

Paper or digital reports through company intranet are the most common means to convey similar kinds of communications. However, these seem outdated, not at all congenial to the purpose of rising awareness and engagement on workplace management.

Alternative ideas for circulating free information about the KPIs are numerous:

- Newsfeed through mobile apps;
- Infographics, flash news, and videos with strengths and development strategies could be spread both inwards and outwards. These are suitable for a general overview of trends and objectives;

- Interactive maps or dashboards (for instance, in the form of a thermometer, or panel with the vital parameters of the building) accessible online or on dedicated screens could offer the possibility of zooming on particular aspects. These maps as well should be available also to externals, such as visitors and clients;
- Lobbies, reception areas and parts of the building where people usually get together seem the best spaces where to display this kind of information. This way it could be visible continuously, rather than only in consequence of messages forwarding;
- Face-to-face interactions are also fundamental, better if organized in small groups. *"Catalysts"*, as they have been defined, could be appointed as contact persons for feedback and feedforward. This information has been collected especially from people in the insurance company that have experienced this kind of interaction and consider them effective;
- An open day could be an occasion to explain to different interlocutors all the aspects concerning the company's vision and mission, including workplace strategies. This aims at enhancing the public image of the company:
- A communication plan on the main social media channels on this topic would be beneficial for talent and client attraction; and
- Finally, even a more traditional kind of frontal communication, such as during the annual meeting, can make sense especially for showing the cardinal relevance of the workplace in the whole organization's development strategy.

Most of all, appropriate communication strategies need to be set in place instead of circulating raw data. That is why interpretation of the indicators is extremely important and must be done by competent professionals. The right communication strategy *"on these information can favorably influence engagement."*

6.6 Outputs from Questionnaire 2

At this point of the Delphi process, the short list of indicators, as they had been elaborated during focus groups and interviews, was submitted once again to the same participants. Submission happened through a second online questionnaire, where people were asked to:

- Rate the level of importance they attributed to each KPI (on a scale from 1 to 7); and
- Declare whether each indicator was currently measured in their company or not, based on their personal knowledge.

Matching this information allowed the drawing of indications about the opportunity of KPI management.

1 KPI priority

The first exercise asked in Questionnaire 2 was to prioritize KPIs in the short list of 33 items. People were requested to allocate a grade to each KPI from 1-low importance to 7-high importance. People could also avoid awarding a KPI if they deemed it erasable from the final list. In this latter case the grade counts as 0-erasable. This passage is important for listing KPIs in a meaningful way, as required by KPI characteristics.

When looking at the sum of the grades (**Figure 6-28** – see next page), single KPIs decrease in a very smooth way from *Design for all* (164) to *Revenue breakdown* (98). The only indicators that register a more dramatic drop in the total grade are *Cost of corrective intervention* (78) and *Return-on-investment/economic value added* (73). This is not surprising if considering that both of them were largely debated in interviews and focus groups. *Cost of corrective intervention* is a new KPI suggested by one person in Questionnaire 1 in the category of *Building operation and management*. *Return-on-investment/economic value added* was recovered by focus group debate to rehabilitate the category *Value/return/yield*, which otherwise would have been empty. Both of them belong to the Financial/organizational impact that tends to attract more specific than general interest.

This is confirmed by the average grade each class obtained (**Figure 6-27**). Average grades by class make it evident that most of the people evaluate environmental impacts as slightly more important than social or organizational impacts, even though social KPIs are more numerous (16) than environmental (11) and organizational (6).

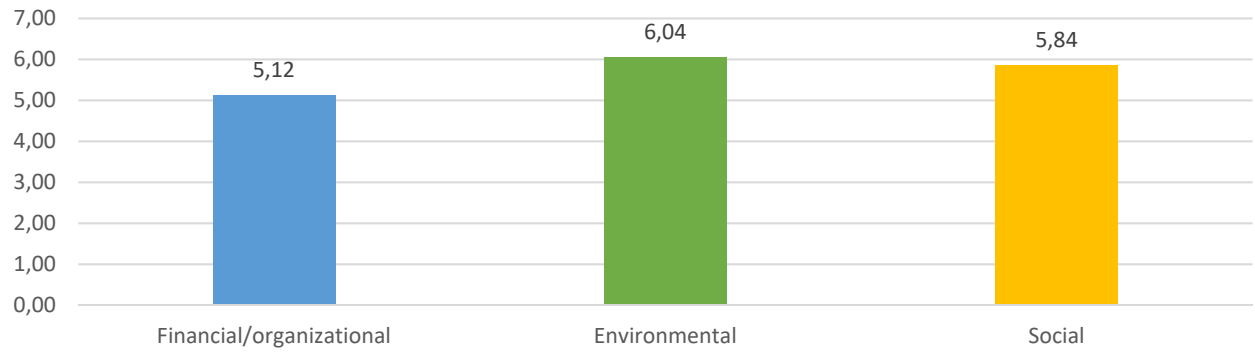

Figure 6-27. Average grade by class

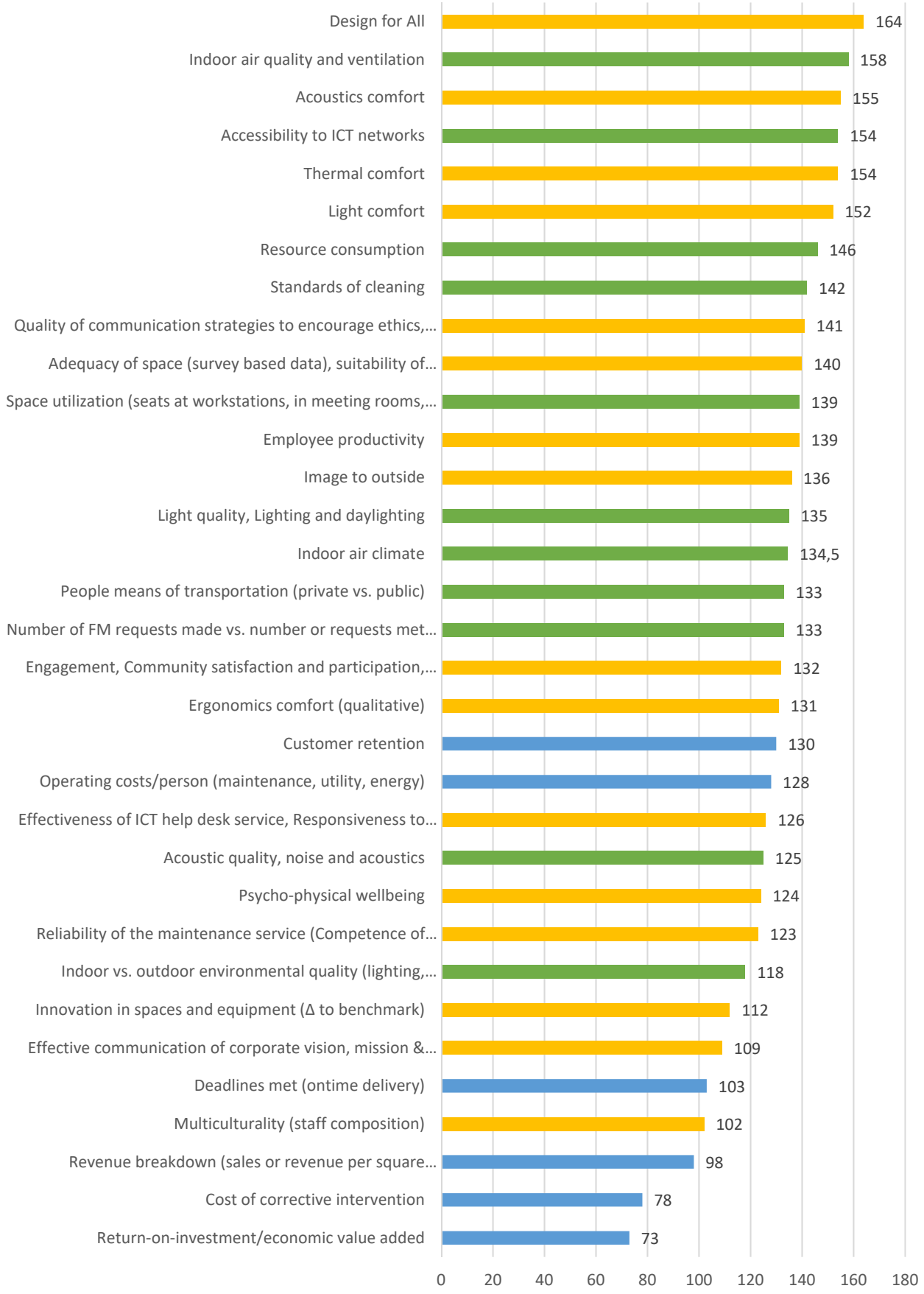

Figure 6-28. KPIs by priority

Looking at results by category (**Figure 6-29**), *Value/Return/Yield* obviously falls at the end of the descending scale of grades, whereas *Environmental quality* takes the first place for priority. It is interesting noticing that categories relating more strictly to spatial issues take the upfront positions in the bar chart, for instance, *Environmental quality, Building operation and management,* and *Space usage*. Conversely, categories which do not show a direct link with spatial issues obtain lower grades, for example, *User attitude, Staff characteristics*, and*, Business effectiveness*. Exceptions to this trend is *Productivity/Ways of working*.

Even though grades do actually differentiate the relative importance of different KPI categories, all average weights on the scale of 1-7 range from just above 6 to right below 4. Hence none of the categories can be considered of secondary importance. On one hand, this evidence confirms that the categories in the system are well balanced, thus are all necessary to complete the holistic viewpoint on workplace performance. On the other hand, this suggests that ranking is not really present in practice, and probably does not make sense in general. However, in this study ranking was considered functional to establish some sort of 'KPI opportunity' that will be defined later on in **Section 3** of this same chapter (**Chapter 6.6**).

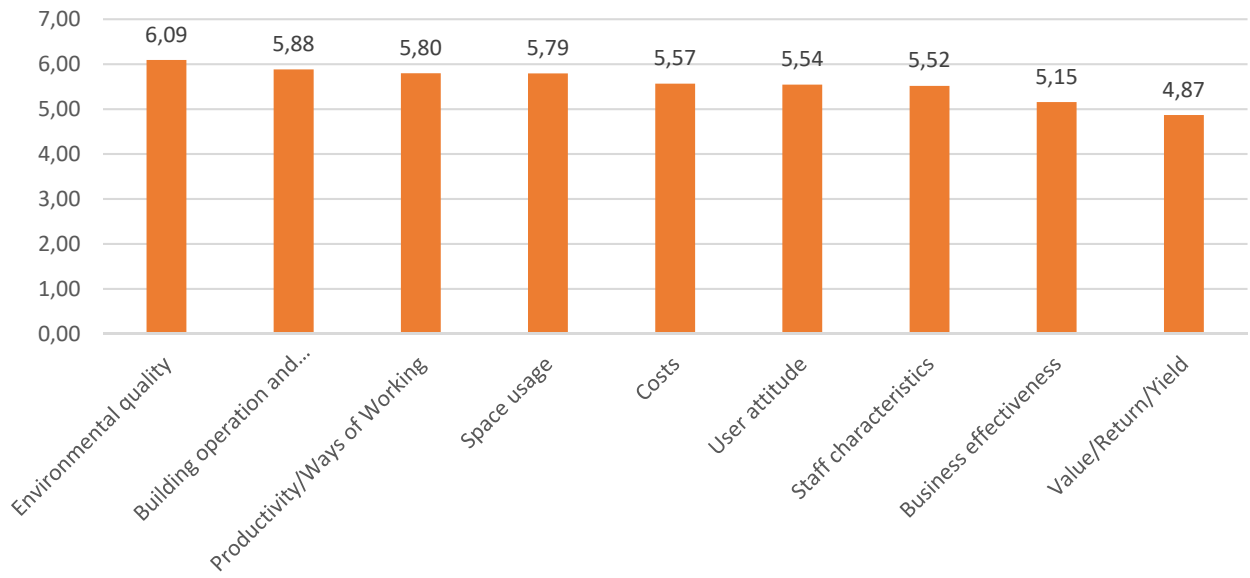

Figure 6-29. Average grade by KPI categories

The grades different users assign to KPIs are on average quite flattened across user categories around 5 (**Table 6-40**), except for a few cases, which confirm results obtained with Questionnaire 1.[26] Namely, this means that in general all user categories are almost equally interested in several aspects of the workplace. Their interest confirms once more that systematically collecting and circulating performance indicators in this realm would be not only appropriate, but also desirable for a multiplicity of different users.

Designers emerge because they put greater attention on space usage – 7.00, while they care less about value – 3.00 (**Table 6-40**). Employees and Managers are interested most in environmental quality – scores above 6.5. On the contrary they pay less attention to costs, business effectiveness and value – scores around 5.5 and below. CFOs look at productivity (6.25), rather than environmental quality (5.5). Consultants as well focus on productivity – which they grade close to 6, and do not have much interest in value, space usage and business effectiveness – all scoring below 5. HRMs on average score the highest

[26] In Questionnaire 2, Facility Management and Owner should be considered carefully, because they are represented by only one respondent each.

grades (total 5.97), with greater attention on building management, followed by environmental quality, staff characteristics and productivity – all scoring above 6.

In all, it is interesting pointing out that the total score of HRMs (5.97) reaches the highest level among other users, followed by Managers (5.81) and CFOs (5.73). On the contrary, Owners, FMs, and CREMs score the lowest total grades – below 5.0 (**Table 6-40**). FM and CREM must be considered as weird outliers in this regard, because they are represented by only one person per category in the sample. However, these differences in total grades might suggest that some user categories, such as HRM, Manager and CFO, are more motivated in increasing their awareness about workplace performance, because are those that to date have less familiarity with this kind of information. On the contrary, Owner, FM and CREM are probably more used to looking at workplace performance from their specific angles, thus demonstrate less enthusiasm toward a system of KPIs that could partially overlap or contrast with their habitual ways of approaching this topic.

Table 6-40. Average grade by KPI categories and users

Overall averages	EQ	BOM	PW	SU	CO	UA	SC	BE	VRY	Total
CREM	5,61	5,14	5,00	5,50	5,50	4,67	4,67	5,00	4,50	**5,07**
Designer	5,83	5,86	5,92	7,00	5,00	5,00	4,33	6,75	3,00	**5,41**
FM	3,11	3,86	4,00	7,00	5,00	6,33	7,00	0,00	0,00	**4,03**
Owner	4,33	4,86	4,50	4,00	6,00	3,00	2,67	2,50	0,00	**3,54**
Consultant	5,91	6,10	5,97	5,00	5,75	5,42	5,39	4,67	5,00	**5,47**
Manager	6,64	6,10	5,97	5,67	5,60	5,83	5,77	5,20	5,50	**5,81**
HRM	6,35	6,48	6,28	6,00	6,00	6,00	6,28	5,33	5,00	**5,97**
CFO	5,50	6,07	6,25	6,00	4,00	6,17	5,83	5,75	6,00	**5,73**
Employee	6,54	5,86	5,89	4,67	4,67	5,56	6,11	4,67	5,00	**5,44**
ICT	6,17	5,49	5,19	6,00	6,33	5,14	5,39	3,50	3,50	**5,19**
Total	**6,09**	**5,88**	**5,80**	**5,79**	**5,57**	**5,54**	**5,52**	**5,15**	**4,87**	**5,58**

Legend: EQ = Environmental Quality; UA = User Attitude; BE = Business Effectiveness; SC = Staff Characteristics; PW = Productivity/Ways of Working; BOM = Building Operation and Management; CO = Costs; SU = Space Usage; VRY = Value/Return/Yield.

When looking at KPIs by wearing the supply vs. demand side lens, expected trends emerge (**Table 6-41**). Users on the demand side (i.e. Consultant, Manager, and Employee) are more concerned with environmental quality issues. Conversely, the supply side (i.e. Owner, CFO, CREM, FM, ICT, Designer, HRM) values space usage most, which is one of the least interesting aspects for the demand side. Both the supply and the demand side grade business effectiveness and value/return/yield as non-overriding aspects to be shared among all workplace users.

It is noticeable that, on the whole, the demand side grades indicators with a higher score (5.57) than the supply side (4.99). This supports the idea that demand side users feel underrepresented in the workplace-making process, and appreciate being informed of the ongoing issues the supply side deals with.

Table 6-41. Average grade by KPI categories and suppy side vs. demand side users

Overall averages	EQ	BOM	PW	SU	CO	UA	SC	BE	VRY	Total
DEMAND	6,36	6,02	5,94	5,11	5,34	5,60	5,76	4,84	5,17	5,57
SUPPLY	5,27	5,39	5,31	5,93	5,40	5,19	5,17	4,12	3,14	4,99

Legend: EQ = Environmental Quality; UA = User Attitude; BE = Business Effectiveness; SC = Staff Characteristics; PW = Productivity/Ways of Working; BOM = Building Operation and Management; CO = Costs; SU = Space Usage; VRY = Value/Return/Yield.

2 KPI measurement

In all, checking for measurement practices addressed the characteristic of measurability and suitability for internal benchmarking. A few aspects can be investigated from the question *"Does your company currently measure the KPIs listed below?"*:

- It is possible to appreciate the development of current practices, by observing the distribution of *Yes* answers; and
- It is possible to find out if information is shared, by observing:
  - Distribution of *I do not know (IDK)* answers, which highlights the level of intercommunication between users; and
  - Coexistence of incoherent answers, which demonstrates the level of miscommunication.

Yes answers by life cycle phase

It is worth paying attention to how much trends differ between companies that have already faced a workplace change (i.e. Insurance and Automation) and those that are just approaching a workplace change (i.e. Utility and Pharmaceutical). **Figure 6-30** shows the number of positive answers to the question *"Does your company currently measure the KPIs listed below?"* It is evident that, the Insurance company and the Automation company collect the most *Yes* answers. On the contrary, the Pharmaceutical, and particularly the Utility company, appear less familiar with KPIs.

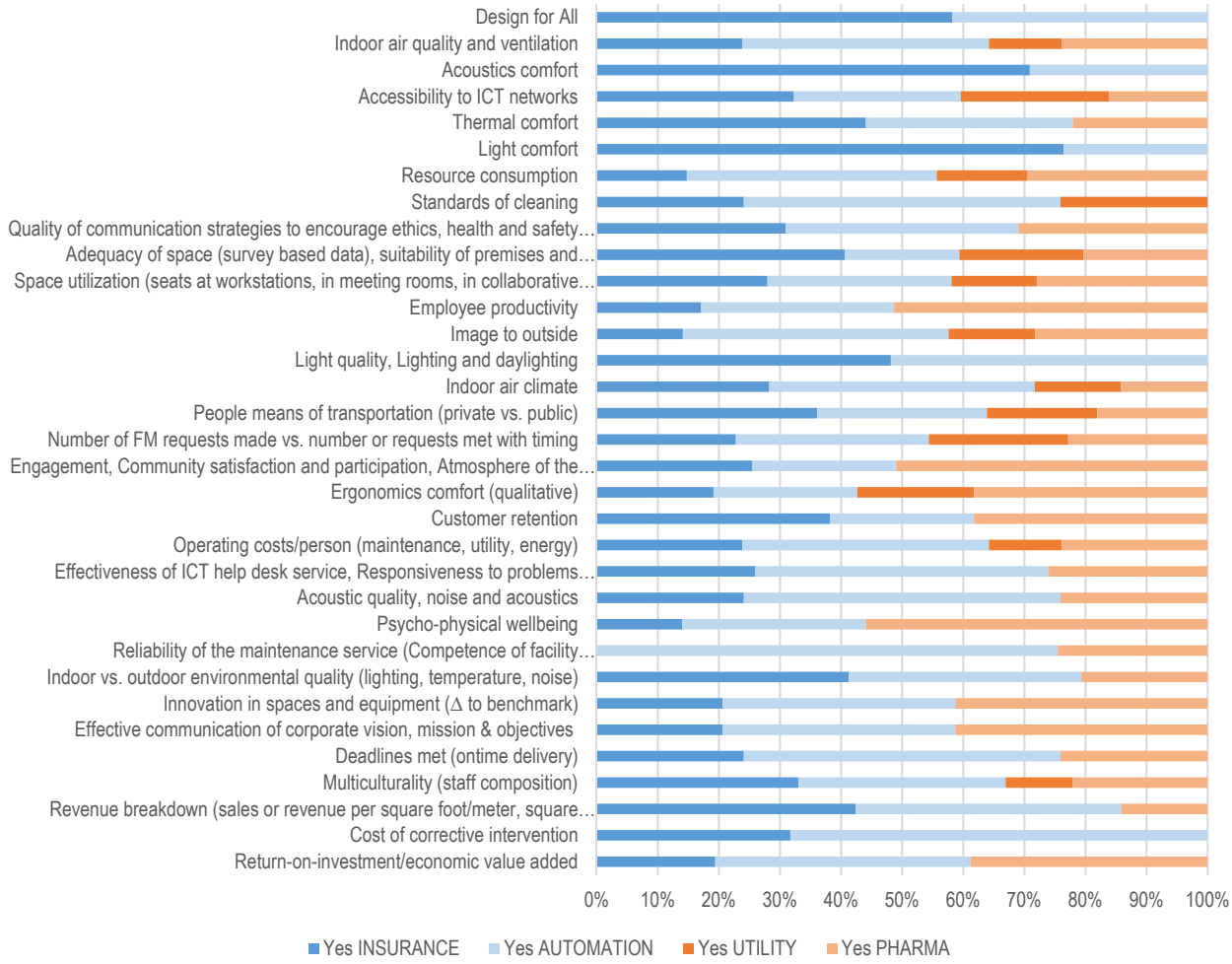

Figure 6-30. Positive answers to the question "Does your company currently measure the KPIs listed below?"

However, there is no indicator in the final list that obtained only negative responses in all the four companies. This is encouraging because it means that data gathering for all the KPIs in the system is somehow feasible, and probably considered beneficial. Indeed, none of the companies that are going to face a workplace change in the near future do measure KPIs that the more advanced companies do not take into consideration. Presumably, measurement practice is also a matter of updating technologies or processes, which appears to be happening when companies go through a workplace change.

Yes answers by user category

Frequency of *"Yes, my department takes care of the measurement"* allows the attribution to specific users of the responsibility for gathering data that belong to specific KPIs.

Figure 6-31 shows the average times a person answers *"Yes, my department takes care of the measurement"* by category of users. It is evident that FM and CREM are those primarily involved in data gathering, whereas employees do not take care of this activity at all, which makes sense. Anyways, managers of other departments seem somewhat involved in the process of KPI measurement, which highlights the cross-sectorial stance of KPIs. Moreover, apparently also consultants work for functional areas that take care of measurement. This evidence suggests that companies are possibly hiring specialists entitled to this kind of activity (especially in the social area). This would explain also the good level of knowledge and interest consultants confirmed throughout all the phases of this study.

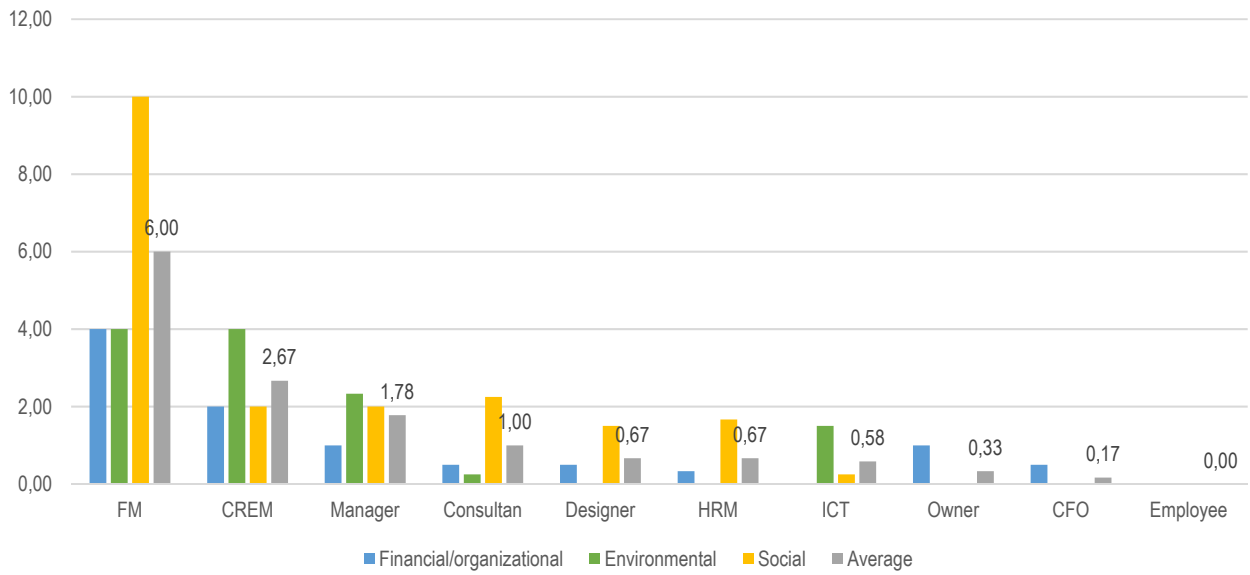

Figure 6-31. Average number of "Yes, my department takes care of the measurement" *by user categories and KPI classes*

I do not know answers

CREM and Owners collect the smallest number of *I do not know* answers (**Figure 6-32**), thus demonstrating to have more awareness of whether KPIs get currently measured or not. This evidence is not surprising, especially thinking that KPIs collected for this study mainly belong to sources from CREM and organization, even if some of them were subjected to modifications over the process. What seems unusual is the high level of *I do not know* answers from the area of HRM, and especially ICT, which even exceeds the frequency of IDK answers from Consultants. These two categories proved again to be disengaged from the process.

Figure 6-32. Average number of IDK answers by user category

3 Matching priority and measurement practice: KPI opportunity

Answers regarding measurement practices can be considered to indicate the probability of how much a KPI is theoretically available on average. This statement is based on the assumption that, if data are already available in most of the companies, this probably depends on easiness of data collection and interpretation, alignment of technologies and methods to collect this data, appropriate level of competences required to take care of it. The probability of information availability is obtained through calculating the mean average of *Yes* answers, compared to the 100% of *Yes* answers theoretically possible.

Besides, the priority grade indicates the importance each indicator has to workplace users on average. Thus it represents the willingness of people to contribute to KPI measurement, their level of engagement in information sharing, and the value people attribute to that specific aspect of the workplace. Priority grade corresponds to the sum of all grades received by all users who participated in the questionnaire.[27]

Representing these two elements on a dispersion graph (**Figure 6-33**) allows the recognition of a scale in the opportunity for KPI management (**Table 6-42**). Sequential numbering of KPIs in the dispersion graph is based on the sum of the percentage level of priority grade on the maximum priority obtainable,[28] and the percentage number of *Yes* answers on the total number of participants.

Indicators that fall in the top right area are those scoring a high priority grade and a high probability that data are already available to populate that KPI. The first four KPIs that clearly stand out of the group are: (1) *Accessibility to ICT networks*; (2) *Indoor air quality and ventilation*; (3) *Number of FM requests made vs. number or requests met with timing*; and (4) *Design for All*. Managing these indicators seems both feasible and convenient. In particular, data about *Indoor air quality and ventilation* are very likely to be readily available, whereas data on the implementation of *Design for All* is less diffused, but circulation of this information is primary.

On the contrary, indicators that fall in the bottom left area of the graph are scoring low priority and low probability of data readiness. Thus, managing these indicators may require more effort and it is probably less feasible and convenient, especially in the short-term. In the last positions are there: (30) *Customer retention*; (31) *Deadlines met (ontime delivery)*; (32) *Return-on-investment/economic value added*; and (33)

[27] The objective here is to obtain an overall level of importance, regardless of group identity as users. Hence, considering the average does not make much sense, while the simple sum better accounts for all the opinions.
[28] Maximum priority obtainable = number of participants to Questionnaire 2 x maximum grade = 26 x 7 = 175.

Cost of corrective intervention. Especially the latter two are characterized by a very low priority, which makes them stand out of the rest of the KPIs that compose a more compact group. At the same time, *Customer retention* seems barely available. Despite its relative high priority, it might be difficult to integrate this information in the whole system.

Theoretically speaking, it is interesting that, by looking at the scale of KPI opportunity by class (**Table 6-42**), the top ten indicators lean toward the environmental aspect (1, 2, 3, 5, 8, 10), the central portion of the scale addresses more the social sphere (KPIs 11 to 18), and the bottom part of the scale concentrates on financial matters (23, and 30 to 33).

From a more practical viewpoint, companies may want to implement the system of KPIs herewith proposed based on a step-by-step strategy. In this case, they should be recommended to start looking at the top-right KPIs (**Figure 6-33**) and make sure those are correctly taken into consideration, before taking care of the bottom-left ones.

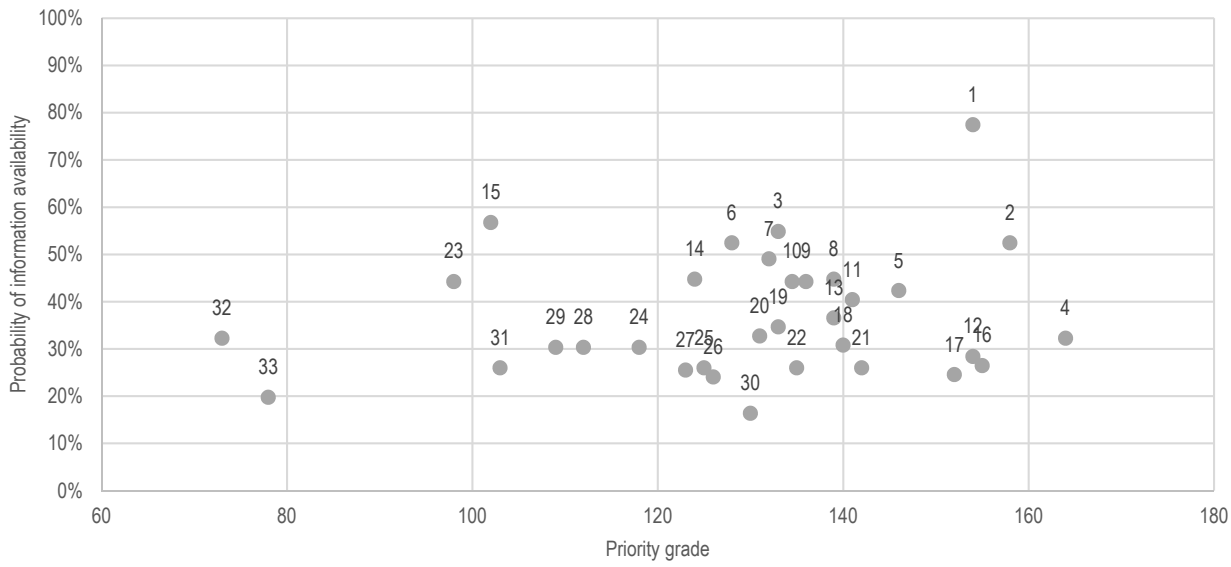

Figure 6-33. Opportunity of KPI measurement

Table 6-42. Opportunity of KPI measurement (legend)

#	Indicators
1	Accessibility to ICT networks
2	Indoor air quality and ventilation
3	Number of FM requests made vs. number or requests met with timing
4	Design for All
5	Resource consumption
6	Operating costs/person (maintenance, utility, energy)
7	Engagement, Community satisfaction and participation, Atmosphere of the community
8	Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space)
9	Image to outside
10	Indoor air climate
11	Quality of communication strategies to encourage ethics, health and safety practices
12	Thermal comfort
13	Employee productivity
14	Psychophysical wellness
15	Multiculturality (staff composition)
16	Acoustics comfort
17	Light comfort
18	Adequacy of space (survey based data), suitability of premises and functional environment
19	People means of transportation (private vs. public)
20	Ergonomics comfort (qualitative)
21	Standards of cleaning
22	Light quality, Lighting and daylighting
23	Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue)
24	Acoustic quality, noise and acoustics
25	Indoor vs. outdoor environmental quality (lighting, temperature, noise)
26	Effectiveness of ICT help desk service, Responsiveness to problems (perceptual)
27	Reliability of the maintenance service (Competence of facility management staff)
28	Innovation in spaces and equipment (Δ to benchmark)
29	Effective communication of corporate vision, mission & objectives
30	Customer retention
31	Deadlines met (ontime delivery)
32	Return-on-investment/economic value added
33	Cost of corrective intervention

4 General comments

Through Questionnaire 2 the final 33 indicators are listed based on the opportunity of KPI management. In **Table 6-43**, each category presents its KPIs in order of opportunity.

This final step of elaboration demonstrates a few issues.

First, clusters of KPIs emerge when matching classes of impact with thematic categories. This matrix-like structure of the system can help all workplace users interpret indicators and their interrelations, instead of just reading results separated from each other or on a neutral list. Effectively interpreting indicators can in turn support the elaboration of strategies and decision-making, affecting the workplace-making process in the design, management and use phases.

Second, classes and categories ease also the recognition of roles entitled to KPI monitoring, i.e. on the supply side, as suggested by the previous analyses. Typically, indicators in the financial/organizational class belong to the areas of CFO, Owner, CREM, and FM; indicators in the environmental class appertain to the areas of FM, CREM, and ICT; indicators in the social class mainly refer to the areas of HR, FM, CREM.

Third, throughout the whole investigative process, while CREM and FM confirm being active users of the workplace, HR and ICT seem rather detached from the topic. This confirms the fact that they are not yet involved enough in the workplace-making processes and the related activities around workplace strategies,.

Finally, what seems encouraging is that, when companies go through a workplace change, they tend to become more accustomed to KPI measurement. This is logical if one takes into consideration that KPIs play an important role in these kind of processes. Indeed, KPIs are confirmed to support both the phase of

investigation prior to project set up and preparation, and the phase of verification of the outputs and outcomes that follow project implementation. It is fundamental though, that KPI measurement does not happen on a one-off basis, but it is taken forth as a continuous practice. The system proposed in this study can effectively stimulate the upkeep of a continuous management.

Moreover, if any tendency can be recognized in the prioritized KPIs, this seems to reflect the extent to which indicators are closely impacted by the physical characteristics of the workplace, or depend also on external factors.

Table 6-43. Final system of KPIs for workplace design, management and use

	Class – Impact/Value		
Category	**Financial/organizational**	**Environmental**	**Social**
Environmental quality		• Indoor air quality and ventilation (2) • Indoor air climate (10) • Light quality, Lighting and daylighting (22) • Acoustic quality, noise and acoustics (24) • Indoor vs. outdoor environmental quality (lighting, temperature, noise) (25)	• Thermal comfort (12) • Acoustics comfort (16) • Light comfort (natural vs. artificial) (17) • Ergonomics comfort (qualitative) (20)
Building operation and management	• Cost of corrective intervention (33)	• Number of FM requests made vs. number or requests met with timing (3) • Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings (5) • Standards of cleaning (21)	• Design for All (Accessibility for disabled) (4) • Quality of communication strategies to encourage ethics, health and safety practices (11) • Reliability of the maintenance service (Competence of facility management staff) (27)
Space usage		• Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space) (8)	
Business effectiveness	• Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue) (23) • Deadlines met (on time delivery) (31)		
Costs	• Operating costs/person (maintenance, utility, energy) (6)		
Value/Return/Yield	• Return-on-investment/ economic value added (32)		
Productivity/Ways of Working	• Customer retention (30)	• Accessibility to ICT networks (1)	• Employee productivity (13) • Adequacy of space (survey based data), suitability of premises and functional environment (18) • Effectiveness of ICT help desk service, Responsiveness to problems (perceptual) (26) • Innovation in spaces and equipment (Δ to benchmark) (28)
User attitude			• Engagement, Community satisfaction and participation, Atmosphere of the community (7) • Image to outside (9) • Effective communication of company culture (29)
Staff characteristics		• People means of transportation (private vs. public) (19)	• Psychophysical wellness (14) • Multiculturalism (staff composition) (15)

6.7 Discussion on the final set of KPIs

In this section of the dissertation the final list of indicators is compared to indicators scouted from the literature, also commenting on how this set of KPIs bridges some of the gaps pinpointed by authors.

1 Categories and classes

The framework of 9 categories and 3 classes was confirmed in the experimental phase, as built up through a theoretical approach. Even though participants were given the possibility of adding/dropping categories and modify both classes and categories (as in Hinks and McNay (1999), and Lavy et al. (2010a)), the existing ones were all deemed appropriate and comprehensive of a well-balanced set of aspects. What varies instead is the placement of single indicators in different categories or classes than the proposed ones.

Hence, the process of creating novel classes from word counting, as undertaken in **Chapter 6.1**, demonstrates the validity of merging categories dragged from different sources and fields. Also, classes created from theoretical elaboration confirm the perspectives provided by Becker (1990), Varcoe (1996), Kämpf-Dern & Konkol (2017), and Alker, et al. (2014).

Then, both categories and classes were considered useful to orient the end-user of the KPI system. The only category that seemed less solid is *Value/Return/Yield*, which was erased from questionnaire results but reintroduced by demand during group meetings. Indeed, it was considered to represent a relevant point of view on the workplace otherwise missing in the framework.

It is interesting to notice that several categories display their impacts on more than one class. Hence, the initial correspondence that was established between categories and classes is made further more complex. From this perspective a matrix seems a particularly appropriate way of displaying KPIs. This key to interpret indicators evolves the most common frameworks in the literature, which tend to show only one perspective.

2 Number of KPIs

The final list of indicators accounts for 33 items. This number is slightly larger than the number of indicators listed in the literature. On average, each source collects around 25 indicators, from a minimum of 7 to a maximum of 70, where the median and mode correspond to 21 metrics (**Table 5-3**). Authors talking about the ideal number of KPIs say it should be kept around 10 measures, within a range between seven and 12. Anyway, there must be not more than four to six indicators, tied to maximum five or six business objectives (Jordan, et al., 2009).

Considered the holistic aim of the present work, that encompassed joining different disciplinary areas, one must expect a slightly enlargement in the overall number of KPIs. In sum, 33 items can be considered totally coherent with recommendations from literature in this circumstance.

3 Priority

Hinks & McNay (1999) in their prioritized list recognize a drift from the top of strategic policy issues down to the bottom of operational KPIs. Conversely, from the list in this study no similar trend emerges. However the presence of strategic KPIs (e.g. *Innovation in spaces and equipment*, and *Deadlines met*), operational aspects (e.g. *Standards of cleaning,* and *Resource consumption*), and customer oriented issues (e.g. *Customer retention*, and *Image to outside*) is confirmed, as in Hinks & McNay (1999).

Moreover, priority is given to indicators that mark environmental parameters for as they are perceived by people. Indeed, interviewees strongly believe that these impact primarily on the social sphere. This result couples with the observations Lavy et al. (2010a) report from the Facility Management Association Ideaction 2001 Conference in Melbourne, Australia. There, studies demonstrated that business perspective and FM perspective match each other exactly in ranking customer satisfaction indicators on top of the others.

4 Differences between users, demand side and supply side (back to users)

Sensitive differences in perception emerge from different users, which endorses the validity of the proposed user categories. If categories had been somehow incorrect, results would not have shown certain variabilities, which instead corroborate the description different categories found in Phase I.

Also, mismatches between the supply and the demand side are evident in KPI prioritization. This misalignment is expected and somewhat appreciable since it reflects substantial differences between two macro user groups that often blur both in the literature and in the practice. Instead, recognizing the extent to which they distinguish from one another substantiate claims according to which they must be acknowledged, by first all framing a supply side and a demand side (e.g. Olsson, et al. (2010), and Haugbølle & Boyd (2013b)).

5 Additional comments on the most common metrics in the literature

It is worth expanding further comments on the most common metrics that have been identified in the literature, especially focusing on those that have been reported by sources on both demand and supply side (**Table 5-5**), namely: *Staff turnover*, *Absenteeism*, *Revenue breakdown*, and *Productivity*.

5.a Staff turnover

Staff turnover has not received enough essential votes (only 10) in Questionnaire 1 to be included in the 43-list and brought forth throughout the whole investigative process. Thus, staff turnover is considered negligible to the interests of workplace design, management and use. In effect, staff turnover *per se* does not indicate much of how the workplace impacts on people. Only the percentage of employees leaving the organization voluntarily is significant to be recorded with the aim of understanding workplace impact on people and business.

However, *Multiculturality* has been added by group discussion to the final system of significant KPIs. This indicator can be considered as embodying turnover aspects, while adding much more meaning to it. This indeed is closely related to recruitment, which is one of the aspects involved in *Staff turnover* that would deserve more attention, according to Alker, et al. (2014). Then, independently from the number of recruits, job applications are in part motivated by the appeal of the premises (Miller, et al., 2014; Vertino, 2014). Thus multiculturality embraces talent attraction and retention aspects, along with intersecting with issues of *User attitude*, among which building *Image to outside*. Consequently, the new indicator *Multiculturality* succeeds in matching 'voluntarily staff turnover', 'new recruits' and 'job applications', while including also diversity matters which particularly characterize the NGW.

5.b Absenteeism

Absenteeism does appear in the 43-list drafted through Questionnaire 1, however it might be not so relevant in today's and tomorrow's context. Indeed, by group agreement is has been dropped from the list, in favor of *Space utilization*, which was considered a better way of looking at *Presenteeism*.

Indeed, as Phase 0 largely demonstrated, new ways of working encourage people to work remotely and on the move, so that people in the future are not likely to go to the office as often as today, for several reasons, mostly due to their workstyle and job characteristics.

On one hand, absenteeism is probably destined to be not recorded by organizations anymore, because their employees will be hired with project-related contracts and will be flexible on where and when to work (Mannheimer, 2011; Sias, 2017; Slumbers, 2017). On the other hand, if physical presence in the office is not mandatory and tends to decrease, absenteeism due to illness or any psychological issue (Alker, et al., 2014) will be only weakly correlated to the office space itself. Moreover, hoteling and hot desking allow people to choose a different location/workstation every day, and to change it even several times per day, independently from the level of comfort the location or workstation provides. Therefore, analyzing absenteeism, for example by breaking it down by location, might become hardly feasible and, however, insignificant.

In the end, usefulness and relevance of this metric highly depends on the ways of working of a company's employees. Some different metrics are likely to better represent comparable ideas in today's context. As for the results gained through this research, different aspects are going to be much more important in the near future, such as accesses to the premises, time spent in the building/different areas, preferred locations or workstations. All these aspects are indeed represented by *Space utilization*. This, in a context of high mobility, reflects to some extent also the attractiveness of the premises, given that people might choose whether going to the office or not based on their appreciation of the physical environment.

5.c Revenues

Whether *Revenues* are good metrics to represent the impact of the physical environment on business is highly questioned in the literature. Indeed, other metrics might exist that show a more direct correlation between the appropriateness of the physical environment and work activities.

As Alker et al. (2014) admit, revenues encompass complex measures and its interpretation in relation to spatial characteristics might be tricky. Revenues are sensitive to external factors such as market conditions, business type, staff efforts, and so on. Even if research demonstrated that good health and wellbeing affect productivity, which in most organizations is reflected in *Revenue*, *Net profit*, or *Return on Investments*, still different ways of measuring productivity might offer more reliable insights. This concern have been raised also by interviewees in the investigative process.

However, *Revenues breakdown* (together with *Return on investment*) enters not only the 43-list, but appears also in the final set of 33 KPIs, even though in the last positions by priority. This, on one hand, confirms that revenues do represent a fundamental aspect to measure the effectiveness of a business, on the other, warns about interpreting revenues' trends as directly correlated with the physical workplace.

This warning reinforces the importance of considering all the KPIs together into an integrated system, which is able to unveil their correlation over time.

5.d Productivity

Productivity is a widely discussed indicator, because its measurement is particularly challenging in case of today's knowledge workers (**Chapter 1.6**). Most of the time, it is measured through scales of perceived productivity – for example as in Leaman & Bordass (1999) and Haynes (2007), for the extent to which it is boosted by the space. Also, this is the approach currently pursued in the Leesman Index.

It is worth pointing out that employee productivity nowadays should be considered not only at an individual level, but also at a group level. As Phase 0 explains, work is going to be more and more interactive. That is why, it would be beneficial considering productivity as part of interactive/collaborative work, as Brown (2008) hints. This author asserts that spatial configuration strongly affects interactions at work, and eventually impacts on productivity.

All these elements underpin the importance of analyzing *Employee productivity* in close connection to *Adequacy of space, suitability of premises and functional environment.* In effect, these two indicators, both in the category of *Productivity/Ways of Working*, not only appear in the 43-list, but also reach a very high priority level.

A few authors suggest indirect metrics that can feed both these KPIs by entailing the interactive/collaborative component of today's work.

Brown (2008), on one side, stresses 'proximity' as a good criterion to measure the effectiveness of space configuration. He warns that proximity requirements need to be evaluated according to the knowledge base of the industry, namely: analytical, synthetic, or symbolic.

Becker and Steele (1990), on the other side, remind that different types of communication can take place at work, and these can influence the necessity for arranging the space in different ways. Hence, people can be grouped according to the project or product they are working on, according to their discipline/specialty/department, or according to the idea of 'functional inconvenience'. That is to say that spatial proximity is established not according to efficiency (the principle of least effort), but to the principle of promoting effectiveness (Becker & Steele, 1990).

In conclusion, both these viewpoints indicate that Social and Spatial Network Analysis tools are likely to reveal interesting data on how people interact in the workplace, thus provide information strictly related to productivity and the adequacy of space. For sure these two indicators are among the most challenging to manage in the system, but also among the most crucial.

6.8 Discussion: KPIs in the NGW domain

The objective of the present analysis was also to question whether existing indicators are applicable in the context of the new ways of working, and whether the same are appropriate to represent the impact of the next-generation workplace at different scales. Discussion considers now the characteristics of the NGW.

6.8.1 Discussion by diversity

Discussion by diversity was provided in a previous stage of analysis (**Chapter 1.1.1, Table 5-8**) for KPIs from the literature. Similarly, it is worth taking stock of all the KPIs collected in the final set and check which of them is suitable to represent diversity, for how it has been described in Phase 0.

Table 6-44. New KPIs and diversity

Diversity	Indicator	#	Category
Workforce			
Individual characteristics	Design for all (Accessibility for disabled)	4	Building operation and management
Work practices	Engagement, Community satisfaction and participation, Atmosphere of the community	7	User attitude
Work practices	Ergonomics comfort	20	Environmental quality
Individual characteristics	Psychophysical wellness	14	Staff characteristics
Individual characteristics	Multiculturality (staff composition)	15	Staff characteristics
Workplace Management			
Expectations	Quality of communication strategies to encourage ethics, health and safety practices	11	Building operation and management
Disciplines	Reliability of the maintenance service (Competence of FM staff)	27	Building operation and management
Work spaces			
Inside the building	Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space)	8	Space usage
Outside the building	People means of transportation (private vs. public)	19	Staff characteristics
Work processes			
Degree of interaction	Employee productivity	13	Productivity/Ways of Working
Activities	Adequacy of space (survey based data), suitability of premises and functional environment	18	Productivity/Ways of Working
Work patterns	Innovation in spaces and equipment (Δ to benchmark)	28	Productivity/Ways of Working
Identity, status, privacy	Effective communication of company culture	29	Productivity/Ways of Working

Diversity, concerning both the software and hardware dimension of the NGW, is covered by a range of KPIs in the proposed system. These belong to different categories, summing up to 13 KPIs, which represent 40% of the indicators composing the system. Their proportion doubles compared to diversity-related indicators listed in the literature. Since they now take almost half of all the KPIs, their relative weight is likely to be significant in workplace-making processes driven by this system. Many of these diversity-related KPIs were already listed in the literature, nevertheless most of them have been significantly modified by consultation with the companies. The way how they look after consultation seems even better fitting the purpose of picturing diversity, especially for what concerns:

- *Design for all (accessibility for disabled)*, in place of the simple *Accessibility for disabled*;
- *Ergonomics comfort*, in place of *Equipment provided meets business needs*; and
- *People means of transportation*, in place of *Location analysis, site and location*.

Indicators totally new, which are just introduced from scratch thanks to this process are the following:

- *Multiculturality (staff composition)*; and
- *Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space)*.

6.8.2 Discussion by data

Also discussion by data was provided previously for KPIs from the literature (**Chapter 1.1.1, Table 5-9**). Similarly, it is worth taking stock of all the KPIs collected in the final set to scout for indicators that are potentially involving these innovative data.

Table 6-45. New KPIs and data

Data	Indicator	#	Category
Personal parameters			
	Psychophysical wellness	14	Staff characteristics
	Acoustics comfort	2	Environmental quality
	Light comfort	6	Environmental quality
	Thermal comfort	9	Environmental quality
Social Networks			
	Employee productivity	13	Productivity/Ways of Working
	Effective communication of company culture	29	Productivity/Ways of Working
	Quality of communication strategies to encourage ethics, health and safety practices	11	Building operation and management
	Engagement, Community satisfaction and participation, Atmosphere of the community	7	User attitude
Environmental factors			
	Acoustics quality, noise and acoustics	1	Environmental quality
	Indoor air climate	3	Environmental quality
	Indoor air quality and ventilation	4	Environmental quality
	Indoor/outdoor environmental quality (lighting, temperature, noise)	5	Environmental quality
	Light quality, Lighting and daylighting	7	Environmental quality
Occupancy patterns			
	Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space)	8	Space usage
	People means of transportation (private vs. public)	19	Staff characteristics

Fifteen KPIs in the proposed system are suitable to represent the NGW performance by accepting data from innovative tools and techniques. This means that 45% of the indicators scouted in the literature are suitable to represent the NGW performance by using novel data. These can potentially unveil pioneering information for supporting the design, management and use of evolved workplaces, by having a significant weight in the overall number of KPIs embraced in the system.

Hopefully this will encourage a technological and structural innovation of tools and techniques for data collection, which are still quite traditional, based on discussion with interviewees.

However, limitations in the Italian regulation context constitute an obstacle to the implementation of new tools and techniques for data gathering, as many interlocutors have emphasized during interviews and focus groups. Restrictions by law related to privacy matters might affect all the indicators listed in the table, except those referring to Environmental factors.

Moreover, this research comes to an end in the moment when the scandal of Cambridge Analytica[29] concerning treatment of personal data has been affecting the terms and conditions of all the related policies in European privacy regulations and in most of the companies worldwide. It is evident that much caution must be paid by companies that intend to switch to novel tools and techniques for data collection.

[29] For more info visit: https://www.theguardian.com/news/series/cambridge-analytica-files.

6.8.3 Discussion by impact

1 Economic value and financial/organizational KPIs

As discussed in Phase 0 of this study, economic value in organizational context is usually expressed via financial measures (Riratanaphong, 2014). Today companies mostly look for measures that are able to reflect the economic value created (Epstein & Rejc Buhovac, 2014). However, there is diffused perception that sets of indicators often appear unbalanced toward financial metrics (Miller, et al., 2014; Calder & McPherson, 2007).

In the system resulting from this research, financial metrics, which are considered to reflect the economic value of the workplace and workplace initiatives are limited to only six items over 33, thus cover barely 18% of KPIs. The small percentage of financial indicators, compared to the environmental and social sphere, must be interpreted as an advantage. Indeed, the actual system seems much more balanced in terms of matching different values of the workplace, which responds to the critiques moved by different authors.

It is worth highlighting that this result has been obtained thanks to the involvement of a broad group of workplace users in the process of KPI selection. When one sticks to a single discipline or field, it is highly probable that the same habits tend to emerge again and again, similarly to what happens in the approach to the literature review called 'roll-your-snowball'. Conversely, cross-fertilization with different fields might be important to discover useful angles for looking at the same issue with complementary sights.

Indicators that appear in the system interpret both: (a) the value created by spaces, thanks to their efficiency (for example, *Cost of corrective intervention, Operating costs/person*); and (b) the value created by employees, thanks to their productivity (for example, *Revenue breakdown, Deadlines met, Return on investment/Economic value added,* and *Customer retention*).

The latter KPIs are mostly directed to represent the economic/financial health of the firm. Beside intuitive impacts for the company itself, these show also potential impacts at the city scale, in a prospective of development of the surrounding territory. The same KPIs represent impacts at individual scale, indeed they offer indirect interpretation of how well employees are able to work in the workplace.

For what concerns KPIs more strictly related to space, these are devolving their impacts at the building/portfolio scale, which is extremely important to consider for companies.

Economic/financial indicators are among the most delicate in the system, which means that they are more sensitive than others to space-independent factors, such as market conditions, macro-economic context, and the overall administration of the company itself. That is why during consultations with the companies they showed a few concerns related to sharing them among all workplace users. However, most of the comments supported the opportunity for making everyone aware of these results. With the due contextualization and explanation, indeed, these indicators are considered valuable to boost motivation and engagement of all workplace users, while returning important information to align behaviors and habits, and explaining the reasons of choices and policies undertaken at a strategic level.

Economic value and the related financial/organizational metrics are typically overseen by financial administrators, Corporate Real Estate Management departments, and Facility Management departments. **Table 6-46** briefly describes each indicator in the final system. The table also shows the users who most likely will control these KPIs in the design, management, and use of the workplace.

Table 6-46. Financial/Organizational KPIs

Metric	Description/notes/comments	Recommendation
Operating costs/person (maintenance, utility, energy) (6)	This indicator matches five different KPIs in the literature belonging to both the facility management and the corporate real estate management fields. Thus this indicator confirms to be quite traditional and consolidated. This is confirmed also by the high placement in the opportunity scale. Its results depend on one side on service management effectiveness, but on the other also on design and spatial choices (e.g. building materials, layout, features, plants, etc.). Consequently its control over time might and should be interesting also for designers, who could have a significant role in making the building perform better in this sense.	**Costs** Facility Managers Financial Administration Corporate Real Estate Managers Designers
Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue) (23)	This indicator is one of the post recurring scouted in the literature. It is present in four different sources appertaining to both the demand and the supply side. This evidence confirms that it is well-established both in literature and practice, however its placement in the opportunity scale depends on both low information availability and low priority grade. In general, it would be important to apply this indicator with a strong spatial connotation, which means that revenue breakdown should be matched with space features, such as layout, proximity, complaints on environmental conditions, and so. That is why it is important that, beside executive and financial admin., also a CREM perspective is undertaken when interpreting this indicator.	**Business effectiveness** Financial Administration Executives Owner Corporate Real Estate Managers
Customer retention (30)	This indicators corresponds to only one indicator in the literature that belongs to the demand side. Though retention can be easily paired with other aspects related to customer attitude toward the company, such as customer acquisition, profitability, satisfaction. This indicator measures the ability of employees and executives, with also the support of collaborators, to satisfy customer needs both at an operative and a strategic level. This of course depends also on how well the space succeeds to support business activities. The placement of this KPI in the opportunity scale depends especially on low information availability, while priority grade seems medium-high.	**Productivity/Ways of Working** Executives Employees Collaborators Financial Administration Owner
Deadlines met (on time delivery) (31)	This indicator derives from a source on the demand side. This indicator again measures the ability of employees and executives, with also the support of collaborators, to satisfy customer needs which affects the whole business effectiveness. This of course depends also on how well the space succeeds to support task efficiency and productivity. Its placement in the opportunity scale depends on both low information availability and low priority grade.	**Business effectiveness** Executives Employees Collaborators
Return-on-investment/ economic value added (32)	This indicator derives from a source on the demand side, and clearly expressed the organization perspective. Its placement in the opportunity scale depends on both low information availability and low priority grade. Probably this is considered one of the most sensitive data concerning the successfulness of the business which needs to be carefully interpreted and returned to workplace users accompanied by the right messages.	**Value/Return/Yield** Financial Administration Corporate Real Estate Managers Owner
Cost of corrective intervention (33)	This indicator is proposed by a participant during Questionnaire 1, which probably is the reason why it scores low in the opportunity scale both for priority and information availability. The person is a facility manager, how it is intuitive given the very technical/operational nature of this indicator. In effect, any similar indicator was available in the long list derived from literature, thus this addition must be highly appreciated. It is worth noticing that this KPI was not transferred to the category of *Costs* because it is considered mostly linked to *Building operation and management* matters, more than to general units of costs. Indeed the behavior of this KPI highly depends on the approach to building operation and maintenance, and on the efficiency and effectiveness of the service. Also design choices can significantly contribute to guarantee low costs of corrective intervention.	**Building operation and management** Facility Managers Financial Administration Corporate Real Estate Managers Designers

2 Environmental value and physical KPIs

As discussed in Phase 0 of this study, environmental value in an organizational context is usually expressed via physical conditions. Applicable solutions are identified in the literature to support more sustainable practices at the city, building and individual scale. Among these, primary importance is attributed to data management platforms, matching both physical Key Performance Indicators (KPIs) with real estate and organizational KPIs (World Economic Forum, 2016), which is exactly the goal pursued by the proposed KPI system.

In the system resulting from this research, indicators that reflect the environmental value of the workplace are 11 over 33, thus cover one third of the KPIs. These indicators are to be considered related to the physical dimension of the workplace in a broad sense. Also, they intersect with real estate, organizational and social KPIs.

In general, workplace environmental conditions are determined by physical conditions both *'of'* the building itself, and *'in'* the building. Physical conditions 'of' the building are commonly identified with indoor environmental quality (for example, *Light quality, Indoor air climate, Air quality, Acoustics quality, Indoor vs. outdoor environmental quality*). Physical conditions 'in' the building, instead, reflect how the space is organized, i.e. the design elements (Becker & Steele, 1990). Douglas (1996) says that indicators that portray space can consider its amount (i.e. area and volume), its quality (i.e. appropriateness, visual and environmental aspects), and its shape (i.e. plan and layout). In the proposed system as well all these components appear, for instance, its amount as *Resource consumption*, its quality as *Standards of cleaning, Accessibility to ICT network*, and its shape as *Space Utilization*. It is worth pointing out that all these aspects do not depend exclusively on design choices, but also on organizational/financial strategies and habits of use.

In sum, environmental indicators in the system address:

(a) Sustainability goals at urban and territorial scale, by reducing resources and energy consumption, i.e. *Resource consumption (energy, water, materials), sustainability objectives (waste, energy consumption, etc.), environmental sustainability of buildings*;
(b) Business performances, by enhancing the market value of real estate assets, and improving their overall image, such as *Light quality, Indoor air climate, Air quality, Acoustics quality,* and *People means of transportation (private vs. public)*; and
(c) People productivity and quality of life, by supporting their needs (for example, *Standards of cleaning, Accessibility of ICT networks*), and increasing their self-awareness about the impact of their behaviors on the environment (for example, *Indoor vs. outdoor environmental quality*).

The literature denounces that sets of indicators often focus on only technical performances (for example, Fleming, 2004), which tends to be a simplistic way of overseeing environmental impacts. Alker, et al. (2014) state that the physical conditions in the building can be either measured or evaluated/assessed. Indeed, workplace physical conditions are also defined by how the occupants perceive, like and feel comfortable in the available spaces. Perceptions appear as important components of many indicators in the system; these have been mainly referred to the social impact of the workplace.

Table 6-47 briefly describes each indicator in the final system. The table also shows the users who most likely will control these KPIs in the design, management, and use of the workplace.

Table 6-47. Environmental KPIs

Metric	Description/notes/comments	Recommendation
Accessibility to ICT networks (1)	This indicator results from the merge of two indicators dragged directly from the literature, in the supply side sources. Significant is that is has been transferred from the Building operation and management area to Productivity/Ways of working. Apparently it is deemed not only an aid to daily work but an enabling factor. This is confirmed by its placement in the top position of the opportunity scale. Also, it is worth pointing out the great misalignment between this primary key indicator and the role of ICT managers, which has been registered seriously disconnected from workplace issues on the whole. Hopefully this evidence will affect their level of engagement. However, the job required by ICT managers to this end must be interconnected with the designers' one.	**Productivity/Ways of Working** ICT Managers Designers
Indoor air quality and ventilation (2)	This indicators results from the match of two indicators in the literature from demand side sources. In the opportunity scale it takes a high position especially because it scores well in terms of priority. This indicator encompasses the control of pollutants, particulate matter, radon, asbestos, allergens, dust mites, along with ventilation rates. Hence, it demonstrates growing attention to health and safety issues. After construction, these parameter can be subjected to events such as technical malfunctioning, or change in habits of building occupants, otherwise unforeseeable, which is important to keep monitored over time.	**Environmental Quality** Designers Facility Managers Corporate Real Estate Managers
Number of FM requests made vs. number or requests met with timing (3)	This indicator is proposed by a participant during Questionnaire 1. It scores very high in the opportunity scale especially thanks to information availability. The person who signaled it is a facility manager, how it is intuitive given the very technical/operational nature of this indicator. In effect, a few similar indicators were available in literature, such as *Work order completion in facility management*, but the present working seems much more straightforward, thus this addition must be highly appreciated.	**Building operation and management** Facility Managers
Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings (5)	This indicators results from the match of three indicators in the literature from supply side sources. It scores well in the opportunity scale, which demonstrates more its level of priority than data availability. It is evident how environmental sustainability and responsible resource consumption is a primary goal for companies, which gain also a good image to the outside. How this indicator performs depends a lot on user behavior, their education and own environmental values, along with the appropriate design solutions. That is why, monitoring after construction is of pivotal importance to guarantee good results to this extent.	**Building operation and management** Designers Facility Managers Corporate Real Estate Managers
Space utilization (seats at workstations, in meeting rooms, in collaborative spaces; space per employee for filing and archive; each type of space) (8)	This indicator is proposed by a participant during the first round of interviews prior to questionnaire administration. In the opportunity scale it scores medium-low, especially due to scarce information availability. The person is a corporate real estate manager, which is well aware of the strategic importance of this aspect. In effect, two similar indicators exist in literature, namely *Space utilization (e.g. Functional Index, Percentage of space occupied, Operational space vs. nonoperational space, Effective utilization of space)*, *Spatial configuration, Workspace (size, shape)*, and *Space utilization (survey based data)*. All these indicators come from supply side sources, however they take either a very technical point of view, i.e. quantities of space, or a very perceptual point of view, i.e. perception of space utilization by the users. In effect, the indicator that was added is nowadays of primary relevance for companies. This is destined to be an objective data, independent from occupants' perceptions. Perceptions, indeed, might be considerably biased by different factors. It is useful to highlight that one complementary component of space utilization, which is not deliberately expressed into this one, is Proximity (Brown, 2008), which is worth taking into consideration as well.	**Space usage** Designers Facility Managers Corporate Real Estate Managers

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Table 6-47. (Continued)

Metric	Description/notes/comments	Recommendation
Indoor air climate (10)	This indicators corresponds to one indicator in the literature extracted from the demand side. In the opportunity scale it takes a medium-high position. Indoor air climate seems relatively easy to measure, since it mainly corresponds to temperature and humidity. Also, it registers high scores in terms of priority. It is worth pointing out that after construction, air climate can be affected by several events such as technical malfunctioning, or layout changes. Thus, it is important to interpolate quantitative results of this indicator with qualitative perceptions of *Thermal comfort.*	**Environmental Quality** Designers Facility Managers Corporate Real Estate Managers
People means of transportation (private vs. public) (19)	This indicator is proposed by a participant during the first round of interviews prior to questionnaire administration. The person who suggested it is a corporate real estate manager, which is well aware of the strategic importance of this aspect. In effect, no one similar indicator was available in the long list derived from literature, thus this addition must be highly appreciated. However, the fact that it was not existing beforehand might partially justify its medium-low score in the opportunity scale due to scarce information availability.	**Staff characteristics** Corporate Real Estate Managers Human Resources Managers
Standards of cleaning (21)	This indicator is obtained from one KPI in a supply side source. It scores low in the opportunity scale especially due to scarce information availability. This indicators performs well mainly when the facilities services work well. However, several design solutions can ease the operators' job. Also behavioral policies, such as clean-desk, can favor tidiness and cleanliness of the space. It is important to remark that this indicator can collect both quantitative data (e.g. number of time a space is cleaned), and qualitative data (e.g. whether people perceive a space as clean or if they make warnings).	**Building operation and management** Facility Managers Designers
Light quality, Lighting and daylighting (22)	This indicators results from the match of two indicators in literature from demand side sources. In the opportunity scale it takes a low position especially because of a lack in information availability. Indeed, despite there is growing interest in light design, up to now this aspect has not been considered worth of continuous measurement. On the contrary, after construction, light quality can be affected by several events such as technical malfunctioning, or layout changes, which could not be foreseen. Eventually, it is fundamental to interpolate quantitative results of this indicator with qualitative perceptions of *Light comfort (natural vs. artificial)*.	**Environmental Quality** Designers Facility Managers Corporate Real Estate Managers
Acoustic quality, noise and acoustics (24)	This indicators results from the match of two indicators in literature from demand side sources. In the opportunity scale it takes a low position especially because of a lack in information availability. Indeed, despite there is growing interest in acoustics design, up to now this aspect has not been considered worth of continuous measurement. On the contrary, after construction, acoustics quality can be affected by several unforeseeable events such as changes in proximity and density. It is fundamental to interpolate quantitative results of this indicator with qualitative perceptions of *Acoustics comfort*.	**Environmental Quality** Designers Facility Managers Corporate Real Estate Managers
Indoor vs. outdoor environmental quality (lighting, temperature, noise) (25)	This indicators results from the match of three indicators in literature from supply side sources. In the opportunity scale it takes a low position especially because of a lack in information availability, priority alone on the contrary registers medium-high scores. This KPI involves only quantitative measures. What makes it innovative and complementary to single quality-related items is the comparison between indoor and outdoor environmental conditions. This evidence if showed to workplace users has several indirect benefits from driving their behavior in daily use of the building, to justify indoor physical conditions (thus inciting to better accept them), to educate people sensitivity to environmental sustainability.	**Environmental Quality** Facility Managers Corporate Real Estate Managers Designers

3 Social value and perceptual KPIs

As discussed in Phase 0 of this study, social value in organizational context is usually expressed via the quantification of the relative importance people place on the changes that the surrounding environment undergoes. Social value indeed entails subjective aspects of people wellbeing, and the related ability to take part to decision-making processes that affect them. Consequently, measuring social value encompasses metrics and indicators of perceptual nature. Nevertheless, existing sets of indicators do not privilege user perceptions as an important dimension (Becker, 1990; Tucker & Smith, 2008), indeed common indicators are seldom of qualitative/soft nature (Lavy, et al., 2010a). On the contrary, it is essential to acknowledge the importance of people in the role of workplace users, for example thanks to an enhancement of perceptual performance variables as opposed to cost, as suggested by Fleming (2004).

To reply these warnings, results from this research show that most of the metrics collected under the social value label are actually perceptual and of qualitative nature. Moreover, social value KPIs cover 50% of all the KPIs collected in the system, summing to 16 indicators.

However, Tucker and Smith (2008) observe a subtle difference between user perceptions and customer satisfaction (see **Chapter 1.6**, p. 21). The latter, indeed, corresponds to the end product of user perceptions, because 'satisfaction' is based on the difference between the user's initial expectation and his final opinion. The same concept is confirmed also by Costa (2014). Moreover, it is to be questioned whether workers perception is biased by the well-known "Hawthorne" effect, as named by Elton Mayo. In effect, even the author's professional experience has reported substantial offsets between perceptual data and data derived from other sources, such as observation of behaviors or instrument readings (Tagliaro & Ciaramella, 2016).

Therewith, taking care of user perceptions is a complex task requiring a holistic process to be undertaken, as Bahr, et al. (2016) hint at. Alker, et al. (2014) foster companies to build their own perception survey, the results of which not to be considered in isolation, but to be correlated against financial and physical metrics. Following up to these recommendation, the system of indicators proposed in this research clearly attributes primary importance to user perceptions within a holistic stance, while intersecting these with environmental and financial/organizational indicators. Moreover, Alker, et al. (2014) stress that any investigation of this sort should carefully address health, wellbeing and productivity, which the proposed system does in social value-related KPIs.

Indicators related to social value that are present in the system incorporate impacts at different scales:

(a) City/development scale (for example, *Design for all – Accessibility for disabled*; *Innovation in spaces and equipment - Δ to benchmark; Quality of communication strategies to encourage ethics, health, and safety practices; Multiculturalism – staff composition*);
(b) Building/portfolio scale (for example, *Employee productivity; Effective communication of company culture; Reliability of the maintenance service; Effectiveness of ICT help-desk; Adequacy of space, suitability of premises and functional environment; Engagement, community satisfaction and participation, atmosphere of the community; Image to outside*); and
(c) Individual level (for example, *Psychophysical wellness;* and *Light, acoustics, thermal, and ergonomic comfort*).

Table 6-48 briefly describes each indicator in the final system. The table also shows the users who most likely will control these KPIs in the design, management, and use of the workplace.

Table 6-48. Social KPIs

Metric	Description/notes/comments	Recommendation
Design for All (Accessibility for disabled) (4)	This indicator has been rephrased compared to the one found in literature from the demand side, which sounds only *Accessibility for disabled*. It scores high in the opportunity scale thanks to its maximum priority grade. This indicator is one of the few listed under the social value that does not rely solely on perceptual metrics, but requires a quantitative support to be evaluated, such as number of projects and initiatives undertaken toward the scope of Design for All.	**Building operation and management** Designers Human Resources Managers Facility Managers
Engagement, Community satisfaction and participation, Atmosphere of the community (7)	This indicator joins five indicators from sources that belong to both the demand and the supply side. It scores high in the opportunity scale because it can rely on information availability. This indicator is strictly related to a contemporary increase in sensitivity regarding the necessity for employees to feel part of a community and get involved in place making Alvarez, et al. (2017). Several users can participate to the collection of information feeding this indicators. For instance, even bottom-up initiatives and events organized by employees might be a measure to report for Community participation.	**User attitude** Human Resources Managers Executives Employees Collaborators
Image to outside (9)	This indicator derives from one single indicator in the supply side sources. It scores medium-high in the opportunity scale, since it is based on a good match of priority and information availability. The topic relates to the concept of branding, which is relatively new to the workplace sphere. This is the case again of an indicator that can be participated by several users, even employees and consultants who take part to initiatives and campaigns directed to boost workplace image to the city.	**User attitude** Human Resources Managers Owner Employees Collaborators
Quality of communication strategies to encourage ethics, health and safety practices (11)	This indicator joins three indicators from literature, all of them scouted in the supply side literature. It scores medium-high in the opportunity scale, since it is based on a good match of priority and information availability. However it went through rephrasing in the consultation phase, in order to emphasize the element of communication. Indeed, it is important to highlight that departments involved in measurement and management of this KPI are likely to be also those dealing with communication. Here once more employees and collaborators could be entitled as carriers of particular messages, thus being involved also in managing this KPI.	**Building operation and management** Human Resources Managers Employees Collaborators
Thermal comfort (12)	This indicator corresponds to one single indicator in literature from the demand side. It scores medium-high in the opportunity scale, reporting high priority level but low information availability. This confirms the fact that, even though information on climatic performances is relatively well-established in literature and regarded as important, practices do not follow, at least in the Italian context.	**Environmental quality** Facility Manager Designers
Employee productivity (13)	This indicator matches four indicators in literature, both on the demand and the supply side. It scores medium-high in the opportunity scale, reporting high priority level but scarce information availability. Productivity as well is surveyed as a perceptual measure, which is what Leaman and Bordass (1999) recommend in today's knowledge work environments. Its measurement can be undertaken especially by executives and human resources managers.	**Productivity/Ways of Working** Executives Human Resources Managers

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Table 6-48. (Continued)

Metric	Description/notes/comments	Recommendation
Psychophysical wellness (14)	This indicator derives from the manipulation of several indicators scouted in both demand side and supply side contributions. It also matches indicators that were previously part of both Staff characteristics and User attitude. In effect, its measurement encompasses bridging quantitative and qualitative indicators. Based on Morera, et al. (2017), health is also already incorporated into the concept of wellness. Wellness, indeed, includes three dimensions: physical (i.e. health), psychological (i.e. wellbeing), and social. To this end, medical costs and medical complaints could be also taken into consideration to interpret this indicator. Indeed, in countries where medical costs are covered predominantly by insurances (e.g. the US), lower rates of health problems open up the possibility to ask for lower insurance rates and obtain considerable financial savings. To this end, some companies are already adopting fitness trackers or 'wellness' plans exactly with the end to lowering insurance premiums, as noted by Alker et al. (2014). The significance of this aspect may differ by country and should be verified. For instance, Chwalbińska-Kusek & Olszewska (2015) do not insert Medical costs in their list of parameters, which is drawn directly from the WGBC one (Alker, et al., 2014). This suggest that in Poland, where their study is undertaken, Medical costs are not as much worth of attention, as in other countries. Moreover, Morera, et al. (2017) remind that aging of the population, which involves also aging of the workforce, will lead soon to an increase in the manifestation of chronical diseases. This might affect the workplace that will be asked to adapt in order to host people affected by these kind of diseases and/or disabilities. In addition, this is likely to impact on absenteeism, productivity, and medical issues, without being caused by a low quality of the office physical environment.	**Staff characteristics** Human Resources Managers
Multiculturalism (staff composition) (15)	This indicator is suggested by a Human Resources Manager during interview session, which highlights its very contemporary nature. However, there are different ways of taking care of multiculturalism by measuring staff composition. Some individual traits of people, which have to do with a broad interpretation of 'culture', have been found to be important factors affecting work activity and the human-environment relations in the workplace. Among there are there in particular religion (ACAS, 2005), and personality (Budie, 2016). Those data, at least some of them, are usually retained by the HRM and could therefore be shared with the other stakeholders and matched with other metrics in order to obtain insightful information to drive design, management and use of the spaces. This indicator, by its soft nature, is suitable to be controlled also by employees and collaborators, who might organize initiatives directed toward enhancing cultural diversity.	**Staff characteristics** Human Resources Managers Employees Collaborators
Acoustics comfort (16)	This indicator corresponds to one single indicator in the literature from the demand side. It scores medium in the opportunity scale, reporting high priority level but low information availability. This confirms the fact that, even though information on climatic performances is relatively well-established in literature and regarded as important, practices do not follow, at least in the Italian context.	**Environmental quality** Facility Manager Designer
Light comfort (natural vs. artificial) (17)	This indicator corresponds to one indicator in the literature from the demand side. However through consultation it has been slightly rephrased in order to include the components of both natural and artificial light. This modification emphasizes the importance to users of both lighting sources. It scores medium in the opportunity scale, reporting high priority level but low information availability. This confirms the fact that, even though information on climatic performances is relatively well-established in literature and regarded as important, practices do not follow, at least in the Italian context.	**Environmental quality** Facility Managers Designers

Continue on next page

Table 6-48. (Continued)

Metric	Description/notes/comments	Recommendation
Adequacy of space (survey based data), suitability of premises and functional environment (18)	This indicator merges two indicators from the supply side literature. It scores medium in the opportunity scale, reporting high priority level but low information availability. For sure measurement of this indicator requires a series of activities additional to questionnaire, such as observations that can be performed in different ways. That is why it is important that this indicator is controlled by users with a strategic sight.	**Productivity/Ways of Working** Corporate Real Estate Managers Designers
Ergonomics comfort (qualitative) (20)	This indicators comes from the merges of two supply side indicators. Anyways it was significantly rephrased during consultation. It scores medium in the opportunity scale, both for priority level and information availability. Probably it is among those indicators that are already taken for granted. However ergonomic conditions can be subjected to variations due to changes in work practices, or changes in the physical conditions of each individuals, in addition to obsolescence of furniture and equipment, thus it deserves careful monitoring.	**Environmental quality** Facility Manager Designer
Effectiveness of ICT help desk service, Responsiveness to problems (perceptual) (26)	This indicator joins three KPIs from supply side sources and it has been modified to address specifically ICT issues. It scores low in the opportunity scale, especially due to scarce information availability. It is worth to remark that this indicator is likely to undergo an increase in importance, because of the increase in complexity of IT systems supporting daily work. Moreover, with the new ways of working, ICT is becoming a pervasive tool for performing nearly every single work task. Without reason, indeed, this indicator appears in the Productivity/Ways of Working category. Thus ICT Managers are called in the front line to offer a reliable service to all users.	**Productivity/Ways of Working** ICT Managers
Reliability of the maintenance service (Competence of facility management staff) (27)	This indicator joins a couple of KPIs from supply side sources. It scores low in the opportunity scale, especially due to scarce information availability. This indicator confirms that, beside more quantitative approaches to FM effectiveness (i.e. *Number of FM requests made vs. number of requests met with timing*), people care also of the human touch and soft skills of maintainers, which should be assessed and in turn stimulated in the operators toward continuous improvement.	**Building operation and management** Facility Managers
Innovation in spaces and equipment (∆ to benchmark) (28)	This indicator corresponds to one KPI in a supply side source. Anyways it was better specified during consultation. It scores low in the opportunity scale, due to both scarce information availability and low priority grade. Probably it seems a quite novel and undefined way of measuring workplace performance, However, in a world in constant flux as ours, innovation has been demonstrated to be vital for keeping engagement. Miller, et al. (2014) point out that this is the main reason why 1,600 CEOs of global companies list innovation as their top priority. Thus, it is important to pursue innovation in spaces as equipment as well in a perspective of continuous improvement.	**Productivity/Ways of Working** Designers ICT Managers Facility Managers Corporate Real Estate Managers
Effective communication of company culture (29)	This indicator corresponds to one KPI in a supply side source. It scores low in the opportunity scale, due to both scarce information availability and low priority grade, which is probably justified but its innovative and intangible nature. However, culture is considered as one of the components of the 'work-place', together with the 'work-space' (Ellison & Pinder, 2017). Company culture appears also as one of the core elements of the new world of work, besides HR systems, Workspaces, and IT (Becker, et al., 1995; Methodos, DEGW, & Partners4Innovation, 2015; Manca, et al., 2018). Moreover, company culture determines also the main characteristics of the spatial dimension of the workplace, namely those related to identity, status, and privacy. Therefore, this indicator should be considered as a fundamental one in perspective of the NGW.	**User attitude** Human Resources Managers Executives Owner

6.9 Conclusions on workplace indicators

The main goal of this phase of the research was to define a set of meaningful KPIs shared by all workplace users. The literature review, indeed, revealed several flaws of existing KPI lists to support the design, management and use of NGWs. Most of all, existing KPIs are barely taking into consideration the interrelations of several factors concurring in workplace-making, namely organizational/financial, environmental, and social values. By applying a Delphi method, this investigation helps advancements in research and practice on the topic of key performance indicators.

Answers to the abovementioned questions has been found throughout the development of the Delphi process.

Data/indicators:

- *Relevant indicators that are shared by all workplace users, thus must be monitored over time are 33, and constitute a whole system to manage workplace performance.*
- *These KPIs can be matched onto a matrix of classes and criteria, which identify respectively their thematic affiliation, and their impacts/values.*

Users/process:

- *Workplace performance management encompasses the integration of several competences, thus several workplace users. All the user categories identified in Phase 0 are theoretically involved in performance management to different extents. What is still missing to date is a figure entitled to holistically interpret the indicators collected into the system herewith proposed.*
- *Workplace users who hold an interest in workplace performance and the related KPIs are all the 11 categories previously identified, namely:*
    - *Owner (owner, president, and CEO);*
    - *Active users (Financial Administration, CREM, HRM, FM, Designer, IT);*
    - *Service providers – strategic level (Executives and Managers);*
    - *Service providers – operational level (Employees);*
    - *Indirect service providers – (Consultants, Collaborators, and Internees); and*
    - *Service receivers (Customers and Visitors).*

This piece of research sets a framework of KPIs applicable to workplace design, management, and use. These are shared by a broad panel of users, both at the supply side and at the demand side of the workplace-making process. Properly acknowledging them in their roles and responsibilities, and values and needs has been a fundamental step on which the system has been built up.

The system collects interdisciplinary indicators, thus encouraging overcoming of the specialism of each single field implied, and stimulating the inception of a transdisciplinary (holistic) approach to the workplace.

In all, this supports feed back and forward in the next-generation workplace-making process.

6.9.1 Limits and perspectives for progress in research

The main limit of this study lies on the fact that it applies to only four companies, located in Italy. The small sample under examination, together with the immaturity of the Italian corporate real estate field, might affect the outputs of the investigations and reduce generalizability. Nevertheless, the system shows relevant KPIs in at least one particular geographic context.

At present, further issues emerge, worth to find answer in future research.

1. *Power relations between different user groups in workplace-making.*
   The results of this study do not deepen the mechanisms underpinning the relationship between the demand and the supply side in decision-making processes on workplaces. Some of the outputs (for example those based on the elaborations on Questionnaire 2, **Chapter 6.6**) hint at the fact that the users with the power to make decisions may tend to find costs and real estate value/yield most important. For instance, Owners evaluated cost-related KPIs as the primary category, whereas CFOs considered value/return/yield-related KPIs among the most essentials (**Table 6-40**). Their heavy weight in the balance of power with the other workplace users might risk to hinder the holistic approach fostered by this study. This especially considering the diffused tendency, in practice, to base decisions about workplaces on costs, as several authors underline (Fleming, 2004; Lavy, et al., 2014b; Kämpf-Dern & Konkol, 2017).
   However, the relative importance of each KPI categories resulted overall pretty homogeneous across the different workplace users. Consequently, first of all, it would be interesting to investigate more in-depth the ranking of KPI priority. Indeed, the uniformity of the results herewith obtained might partially depend on a typical downfall of Likert-scales, namely that people are not forced to make a decisive choice. Experimenting with different ways of determining weights might be an intriguing perspective for future researches, for example by using the Analytic Hierarchic Process (AHP) approach.
   Second, other qualitative research strategies might be undertaken with the scope of observing how decision-making about workplace functions in practice, and the potential benefits that a KPI system such as that proposed in this thesis brings when implemented in a corporate environment. To this sake, methods could encompass interviews and questionnaires, but also ethnographic studies such as observations, shadowing, intervention researches, and so on.

2. *Gender differences and their impact on design, management and use of the workplace.*
   How masculine and feminine characteristics might affect the layout, organization and equipment of the workplace is an under-researched topic to date. Most studies on gender differences in the workplace have focused on a few topics, mainly regarding environmental quality. Other aspects that have revealed uneven approaches of men and women to the office space are for instance: effect of foliage plants on task performance and mood (Shibata & Suzuki, 2002); likeliness to close the door of private offices (Goodrich, 1982); and territorial behaviors (Wells, 2000). Also, a recent research lead by Jones Lang LaSalle (Puybaraud, 2017) reveals that, on average, 51% of employees agree that their workspace allows them to work effectively. Nevertheless, this seems true more for men (53%) than for women (50%). Why? What does this difference mean and how can we deal with it? The same research found a significant difference between men and women in the use of third places (i.e. cafés, libraries or coworking spaces) to work. Men work from third places more frequently than women. Why does this happen? To what extent can this trend influence the way we design, manage, and use the workplace?

3. *Social media and their potential for workplace management.*
   Exploring the opportunities offered by social media devoted to collect customer feedback might expand the potential of performance measurement for office buildings. For example, Dalton et al. (2013) experiment with the use of social media and user-review websites to gather user feedback

in the Seattle Public Library. This new source of data is meant as an unconventional approach to post-occupancy evaluation (POE). Results from their study demonstrate that this kind of information is particularly valuable to augmenting traditional POE techniques. The same could favorably be applied, besides evaluation scopes, also in the perspective of performance monitoring over time, and KPI management.

4. *Policies.*
   Alker, et al. (2014, p. 14) argue that a more integrated approach is required to connect existing information to practical applications, financial returns and, in a broader perspective, also policies and standards. In effect, it is worth understanding how policies, both at corporate and national levels, are affecting the evolution of Key Performance Indicators applicable to the workplace. Indeed, workplace quality has a strong social, environmental and economic value at the city/development scale, as well as at the building/portfolio scale. Thus, cities and corporations would benefit from translating the proposed system of indicators at scale into their domains, exactly to drive the evolution of policies and standards.

Anyways, these latter issues go far beyond the scope of this dissertation, but might be explored by the author and others in future research projects.

7 Discussion

WHY (AIM). The chapter recalls the findings presented in the previous sections and elaborates on them. Appropriate demonstration of how the results fill in the gaps scouted at the beginning is provided.

WHAT (CONTENT). ***Discussion*** goes through comments on the innovativeness of the system compared to KPIs in literature, on how different users related to the system, on its function to encourage a transdisciplinary approach to workplace management, and on the emergence of contemporary themes in the KPI system.

Outputs and outcomes talk about the potential benefits for workplace users in applying the proposed system while aiming at improving workplace performance.

Additional ***reflections*** analyze the balance between the general and particular in the level of detail reached by the KPIs, cultural issues potentially implicated, the debate between evaluation and monitoring of building performances, the number of users that have been categorized in the research and the opportunity of enhancing the communication function.

1 Innovativeness of the system compared to KPIs in literature

The system proposed in this dissertation does innovate significantly the extant panorama regarding KPIs for workplace management. In particular, its innovativeness can be verified by answering a few questions.

How many new indicators?

In total, the system accounts for 33 indicators. Five of them are totally new indicators, of which two have been added through initial interviews, one through Questionnaire 1, and one has been added in the subsequent interviews/focus groups.

How many recurrent indicators in literature are considered important?

All the other indicators (28) composing the system have been sourced from items already existing in literature. However, the majority has gone through radical transformation. Even the four most recurrent KPIs in literature (i.e. staff turnover, absenteeism, revenues, and productivity) were demonstrate as not being updated to represent the new ways of working and user needs, thus requiring significant changes in wording and approaches to them.

What makes the new system different from the other lists in literature?

- Integration/holistic approach. The system answers the necessity emerging from literature for aligning different perspectives, not only between FM and customers (e.g. Fleming, 2004; Lavy, at al. 2010; Hinks & McNay, 1999), or CREM and business (e.g. Lindholm & Nenonen, 2006), but among all workplace users as defined in Phase I of this research (i.e. Owners, CFO, CREM, HR, FM, Engineering, IT, Executives, Employees, Collaborators).
- Traditional vs. Non-traditional indicators. As JLL (2017a) contends, changing business environments and new trends in the workplace and workforce lead to the need for innovative metrics. Simultaneously, JLL (2017a) laments the lack of innovative indicators in the most common practices. A combination of traditional (for example, total portfolio size or operating costs) and non-traditional metrics (for example, user experience or employee health and wellbeing) is considered beneficial to capturing workplace performance at best. In the final set, a well-balanced combination of traditional (for example, *Revenue breakdown, Cost of corrective intervention, Operating costs/person*) and novel indicators (for example, *Psycho-physical wellbeing, Multiculturality, People means of transportation, Space utilization – seats in workstations, in meeting rooms, in collaborative space, etc.*) has been reached.
- Existing vs. novel indicators. Nonetheless many indicators were joined to existing ones, it is indisputable that the majority of indicators composing the final system come from consolidated literature and practice. This advocates Becker's (1990) suggestion to start from existing measures, or slightly modify them to fit new purposes as a good way to build up a new performance profile assessment. At the same time, novel KPIs assure the alignment of the proposed tool with the NGW.
- Quantitative and qualitative stances. The system encourages both a quantitative and qualitative approach towards performance management. If several authors lament that indicators are seldom of qualitative/soft nature, whereas the tendency is to convert them in quantifiable data (Lavy, et al., 2010a), and that do not privilege user perceptions as an important dimension (Becker, 1990; Tucker & Smith, 2008), the proposed set presents many qualitative KPIs based on measurement of people's perceptions (for example, *Light comfort, acoustics comfort, Thermal comfort, Ergonomics comfort, Adequacy of space – survey based data, psychophysical wellbeing*). At the same time these soft indicators are balanced with quantitative indicators which provide an objective viewpoint (for example, *Light quality, Indoor air quality, Indoor air climate, Acoustics quality, Indoor vs. outdoor environmental conditions, Resource consumption, Cost of corrective intervention*, and so on). In sum, financial/organizational indicators are all quantitative by their very nature; environmental

indicators are as well mainly quantitative (except for a few that can potentially be both qualitative and quantitative, such as *Accessibility to ICT networks*); social indicators instead are mostly qualitative (except for a few which could be seen through both the lenses, for instance, *Multiculturalism – staff composition*). In fact, the sum of financial/organizational and environmental indicators equals the number of social indicators, thus it can be concluded that an appropriate balance of quantitative and qualitative indicators has been reached.

- Simplicity to manage complexity. The proposed system is relatively easy to deal with in responding to warnings by Jordan, et al. (2009), and Kaplan and Aronoff (1996). Simplicity and flexibility are allowed especially by a restricted number of KPIs, tied to categories and classes. Moreover, this simplicity has been reached and will be maintained not thanks to the bare use of technology, but thanks to the contribution of the same people living this complexity, namely workplace users who participated to this research.

What characteristics define the new system?

The new system addresses some specific characteristics required to KPIs systems by several authors (**Chapter 5.4.2**). Based on the literature, the objectives of Phase II of the research have been established according to the scheme for analysis proposed in **Chapter 5.5.1,** and addressed by following the points listed below:

a. Holistic approach – the initial sources based on which the system is built pertain to different disciplines (organization management, CREM, and FM), moreover interlocutors for consultation cover both the supply- and the demand side of the workplace-making process and a wide range of roles and responsibilities, and values and needs. Consequently the system is suitable to cover workplace overall performance, including organizational goals, job satisfaction, work environment, environmental issues, and non-financial qualitative aspects (Becker, 1990; Lavy, et. al, 2010);
b. Transparency – by involving all different workplace user groups throughout the selection process until verbalization of the single indicators, the system collects KPIs which are easily understandable by a wide range of stakeholders (not only specialists), hence are easily sharable among them (JLL, 2017);
c. Minimization – through user consultation, the system condenses 33 KPIs, thus consistently reduces the number of KPIs available in literature. These few indicators express several aspects of performance assessment (Hinks & McNay, 1999; Jordan, et al., 2009; Lavy, et al., 2014a; JLL, 2017);
d. Proper categorization – KPIs are ordered according to a matrix of criteria, which is confirmed being practical to different professional groups dealing with workplace matters from different viewpoints (Douglas, 1996; Lavy, et al., 2014a);
e. Social, environmental, and economic/financial value – the system classifies indicators by their value and impacts, thus signifying their social impact to represent the corporate social responsibility and community impact, their return on company's sustainability programs and energy use, and their financial impact on the business (JLL, 2017);
f. Meaningfulness – the criteria based on which selection happens are those of importance and priority to different user groups, hence the system confirms having meaning to organizations and decision makers (Becker, 1990);
g. Measurability – KPIs are verified for the availability of the data they incorporate to ensure that information is readily obtainable, and feasible under current industry practices (Gertler, et al., 2011; Lavy, et al., 2014a; Chwalbińska-Kusek & Olszewska, 2015); and
h. Suitability for internal and external benchmarking – showing indicators by opportunity for management expresses both the comparability of KPIs to historical data already gathered within the same company (i.e. measurability), and their importance (i.e. meaningfulness) translated into

the possibility of comparing that performance across business/industry types (Becker, 1990; Lavy, et al., 2014a; Alker, et al., 2014; JLL, 2017).

2 Users

On the supply side of the workplace-making process, user categories that are confirmed as having a pivotal role are corporate real estate managers, facility managers, and owners.

HRM and ICT specialists, who were optimistically forecasted as crucial players by Bell & Anderson (1999), do not seem significant in the analyses that have been performed in this study.

They can be recognized as workplace users, by their roles and responsibilities, and values and needs, which theoretically distinguishes them from those of other users. Still, they demonstrate a low degree of involvement in performance measurement and management. Especially ICT is confirmed to be a key player in the workplace, indeed two indicators specifically refer to its sphere of competence, namely *Accessibility to ICT networks* and *Effectiveness of ICT help desk service*. However, its involvement in the process was definitely partial, not to say that it was marginal. The perception of its role as ancillary to the whole workplace-making process emerges also from the number of ICT representatives who actually participated to the investigation. Moreover, their knowledge level about the KPIs that were proposed was showed to be the lowest among all user categories, even if compared to employees and clerical levels.

Their secluded position can probably be explained by the relative backwardness of the Italian real estate sector. This reason however should be conveniently verified through a cross-country analysis.

On the demand side, surprisingly, collaborators seem pretty familiar with and active in the workplace-making process. This is evident from the level of endorsement they showed in both prioritizing and measuring KPIs. This category of users results almost neglected in the literature. Only Niemi & Lindholm (2010) do recognize other prospective individuals involved in short term organizational objectives as significant workplace users to take into consideration. Hence, this research confirms the necessity for acknowledging this special user category, which indeed is relatively new in the workplace environment.

Finally, what is most interesting is the emerging opportunity for a new user whose mission would be to manage the workplace-making process in an integrated manner. Such a professional promises to go beyond the mere suggestion for joining or juxtaposing different competences, which hints at a multidisciplinary or interdisciplinary approach (Puybaraud & Kristensen, 2015; Appel-Meulenbroek, 2014; Kämpf-Dern & Konkol, 2017; JLL, 2017a). This figure would instead coordinate the work of all the ‘active users’ already existing and operating for their own specialized competences and roles, while offering a true transdisciplinary sight.

3 Transdisciplinarity

The present research demonstrates that a holistic approach is feasible and recognized as mutually beneficial for a broad panel of workplace users, following up on the incentive provided by Fleming (2004), Lavy, et al. (2010) and Bahr, et al. (2016).

The system matches a multiplicity of competences and disciplines engaged in the workplace sphere to different extents, thus it encourages the inception of a novel stream of management based on a transdisciplinary discourse around the workplace.

4 Contemporary themes

Hinks and McNay (1999) say KPIs are contemporary by their very nature. Becker (1990) as well considers that when buildings are constructed at particular points in history and for particular purposes they tend to align to similar principles. Evidence of these statements seems to emerge also in this study.

Here, preferences by participants rewarded, especially, comfort-related indicators, which reflect environmental quality. Thus, strong attention to the 'human component' of the workplace pops up, besides taking 'diversity' into primary consideration.

This evidence is coherent with contemporary trends toward a user-center approach, as recalled by Vischer (2008b), which gives priority to individuals and their perceptions (Tucker & Smith, 2008; Morera, et al., 2017; Slumbers, 2017) within an experience of the workplace (Puybaraud, 2017).

7.2 Outputs and outcomes

The resulting system of indicators is confirmed to be suitable for fine-tuning the next-generation workplaces with the needs of the people that hold a stake in those spaces.

All the participants in the focus groups and interviews declared that a regular integrated oversight on all the indicators collected in the set is necessary, despite it not having been undertaken up to now. Thus, the system that has been created constitutes a significant step forward in encouraging the evolution of current practices.

From now on each company should go through subsequent refinement of the system in order to create a practical tool for their own use. Next steps encompass:

- Definition of the measures populating all the indicators;
- Establishment of punctual methods and techniques for collecting the data and obtaining the measures (for instance, what method, frequency of application, related costs, etc.);
- Entitlement of specific job positions/roles for data collection;
- Entitlement of specific job/positions/roles and definition of specific moments for indicators interpretation and strategic management; and
- Delineation of modes and frequency of distributing and disseminating the indicators in the context of the company by conveying meaningful messages.

Benefits to workplace users

The system addresses the warnings rained in literature (Leaman, 2003) regarding the divide in the construction sector between the perspectives of the supply side and the demand side. Indeed, the system generates a shared platform of information for both the demand side and the supply side users, at least in the workplace domain. This informative platform collects a set of key indicators able to prove that all workplace users can be beneficially involved throughout the whole workplace-making process, thus answering the suggestion by Tucker & Smith (2008).

The system can be used for strategic management purposes.

It helps the **owner, president and CEO** get a general oversight on company trends in relation to spatial dynamics.

It supports **financial administrators** in directing investments and evaluating their respective returns.

It constitutes a tool for **real estate managers** to help them prove how to manage CRE as a strategic resource, which is the “last mile” stressed by Brown (2008). This will help also enhance CREM role in the context of general company strategies, as Lindholm & Leväinen (2006) urge.

It intersects the role of **human resources managers** with many others, thus enhancing its function as a pivotal actor in supporting workers, which Bell & Anderson (1999) foresee as an important evolution of this disciplinary area.

It facilitates **facility managers**’ job, on one hand, by easily reporting their activity to the end-users and facilitating customer feedback collection, and on the other hand, by systematizing end-users’ inputs to be applied in the workplace environment, both of which are pivotal requirements for FM according to Tucker (2014).

It provides the **design, engineering and space planning** area with key information to drive the setup of new spatial projects and not only to evaluate their results one-off but to keep performances under continuous control, as recommended by Preiser, Rabinowitz, and White (1988).

It embeds **information-communication technology** issues in a wide variety of aspects related to the workplace, thus boosting its importance not only as a technical/operational matter but as a grounding feature of the NGW.

It enables m**anagers and executives** to better organize the human resources they direct. This is by systematically controlling for their work effectiveness within a broad context of measurable factors that interact in creating value for the business, which is what Kaplan and Aronoff (1996) deem supremely important.

It allows **employees** to raise their voice while being sure of getting a response, to be informed about workplace performances and the related policies, and to get feedback and feedforward about their actions and behaviors within the office environment, hence helping them correct their attitude when advantageous (Leaman & Bordass, 2007; Miller, et al., 2014).

It introduces **collaborators, consultants and internees** into a cycle of procurement and sharing of a broad spectrum of information, which demonstrates the attention companies devote to individuals, including temporary needs such as their own ones.

In sum, the system offers a substantial support to the design, management and use of the workplace.

Outcomes

The outcomes this system potentially produces mainly regard the idea that all the users involved in the process of workplace-making should spend an effort together on a regular basis toward common objectives.

Kämpf-Dern & Konkol (2017) emphasize that new office environments will never be set up in a definitive arrangement. On the contrary, because of their complexity and their constant change, they require a system of measures that can be continuously monitored to allow for ongoing adaptation and optimization of the environment. This is exactly what the proposed system constitutes of, namely a system of indicators for workplace performance monitoring.

In order for workplace users to take maximum advantage of the system, an evolution of current practices in required.

For instance, some periodical meetings may be scheduled to align all the users, as suggested by Becker and Steele (1990). In their view, on one hand, the support functions (such as maintenance, food service, telecommunications, interior design, security, information services, and so on) could join in ‘service councils’. These councils should meet frequently (for instance, every other week) to share information, discuss common issues, and ultimately explore ways to face all together problems that traditionally would be handled as ‘owned’ by one single function. Besides, ‘tenants councils’ should remit a similar function, representing the collective interest of the occupiers. They would provide a communication bridge between occupants, service function and the building management (Becker & Steele, 1990). The latter ‘active users’ are supposed to: (a) be aware of patterns in whether the premises is being utilized to its full potential; (b) encourage new/different behaviors where it is advisable; and (c) deal with attuning the change of users’ needs over time.

Into perspective, these two main group meetings could both make favorable use of the system that the present research proposes.

The model, when properly utilized, should bolster communication between all the users who hold a stake in the workplace, to their respective extents. Kämpf-Dern & Konkol (2017) remark that workspace objectives and KPIs should become integral part of corporate strategies, as well as monitoring and reporting should become standard practices. To this end, the proposed system will hopefully enable the exchange of information on a regular basis, which is expected to lead to several advantages. A few comparable experiences inspire confidence to this regard. For instance, Kaplan and Norton (1992) give an account of the advantage that one company gained by adopting a daily financial report to improve quality. This translated into powerful feedback and motivation for the operators and boosted their quality and productivity efforts. Kaplan and Aronoff (1996) assert the same principle, by claiming that without effective and ongoing feedback from users to decision makers, any effort towards enhancing the office environment to suit the people who use it is likely to fail.

Last but not least, by implementing a holistic report, like the one proposed in the present dissertation, the effect on employees' motivation and productivity might be even higher than expected.

On one side, a Hawthorne-like effect must be taken into account. Experiments performed by Elton Mayo and F.L. Roethlisberger demonstrated that interpersonal relations between workers and researchers have a strong impact on productivity, as Haynes (2007) mentions. Even if that was the case not of knowledge workers, but of factory operatives, frequent interactions between all workplace users toward a more participative management of the workplace are likely at least to enhance general motivation and engagement.

On the other side, indeed, people who get involved in decision-making stages end up feeling more engaged and willing to positively contribute to those processes because they inhabit responsive environments (Leaman & Bordass, 1993). In effect, the social factors result being more important than the physical factors when it comes to employee satisfaction and productivity (Haynes, 2007). Therefore, the present research attempts to bring together these two components, by proposing a communication channel, as a 'social place' for the workplace to work.

In conclusion, benefits from the implementation of this system are expected to occur not only because the system serves the purpose of enhancing workplace performance, but also because its application *per se* triggers a process for more data collection, on a more regular basis, and in a more common way, which by itself induces constructive interactions among all workplace users.

7.3 Reflections

Balance between the general and particular

An agreement of all the users on a limited number of indicators has been reached through the process undertaken in this research. The same convergence of opinion can be recognized also across companies of different sectors. This responds to authors saying that every company should have its own list of indicators. Indeed, by applying cross-corporate investigations, as Kämpf-Dern & Konkol (2017) suggest, it is possible to reach a good deal.

Consensus is guaranteed especially by making sure that indicators in the system are general enough to be applicable on a wide range of situations. This must be considered not as a flaw, but as a positive quality. Indeed, the proposed set respects the requirement according to which performance indicators should be sufficiently representative of *"common measures of buildings"*, in order to allow for inter-organization and market sector comparisons (Varcoe, 1996).

This fact confirms Becker's (1990) statement about the similarities that emerge when buildings are constructed for particular purposes and at a certain time in history. However, organizations do change over time, and that is why it is important for assessment tools to be treating departments, divisions or other organizational units with a sufficient level of detail. The categorization of workplace users provided in Phase I of the research allows the acknowledgement of different workplace users, to capture their needs and to relate them to the physical environment.

Cultural issues

Cultural issues for sure affect the emergence of contemporary themes over others. This means that the same research may potentially show different results if performed in countries other than Italy.

Aspects related to culture have emerged in some interviews, for example demonstrating that an indicator to grasp multi-culturalism in the workplace might be significant to better manage workplaces. This attention is in line with developments in both research and practice (ACAS, 2005; WGBC, 2013).

In effect, it might be worth expanding this investigation toward cultural differences, which was out of the goals of the present dissertation. Differences can emerge on one hand among different people (for instance, due to multiple nationalities) in the same company, and on the other hand among companies in different countries. Riratanaphong (2014) put some effort in this direction, by comparing performance measurement of workplace change between the Thai and the Dutch cultural settings. It would be interesting to explore similar comparisons in other parts of the world.

Evaluation vs. Monitoring

Some companies' attitude toward this research suggests that the common approach is still more focused on evaluation and rating than on measurement and management, as opposed to what Gertler et al. (2011) observe as a global trend. Often companies' representatives demonstrated the fear of not being good enough, of showing that they lack key indicators, and of being behind other companies in the sample with respect to measurement techniques and management strategies.

This general atmosphere is on one side typical of the Italian context, where people are asked to stand out of the crowd and prove to be the best. On the other side this shows also the influence that evaluation and rating tools have in leading the approach toward performance measurement. Solutions readily available on

the market can be easily mistaken as a panacea for multiple issues. However, it has been largely verified that even buildings with the highest ratings in commercial tools can end up performing badly (Hua, et al., 2014).

Hopefully the proposed system helps all the stakeholders free themselves from a judgmental perspective only finalized to obtain a label. Conversely, stakeholders should be encouraged by the system to care more about the whole workplace-making process, which allows the guarantee of continuous optimal performance, independently from external recognition.

Number of users

User categories emerged from the literature were seven, in accordance with the framework proposed by Olsson, et al. (2010), namely: owner, active users, strategic service providers, operational service providers, indirect service providers, and service receivers. These should be taken as theoretical and high level descriptions liable to further refinement.

Among these, active users constitute a wide group, which includes professionals with different backgrounds and aims, such as: financial administration, corporate real estate managers, human resources manager, facility managers, designers engineers and space planners, and information communication technology resources. Differences among these groups are confirmed not only at a theoretical level, but also when one faces practical issues such as performance management. Here, priority attributed to specific performance indicators and the level of familiarity with certain vocabulary confirm that differences can be appreciated at a more refined granularity level.

Distinguishing workplace users from one another must not be misinterpreted as a way to separate workplace actors into rigid job descriptions. On the contrary, recognizing differences should lead to find the best modalities to pursue integration of complementary competences and roles.

Moreover, all these categories represent their own values and needs in the operation phase of the office building, which they occupy to different extents. Here as well, a careful investigation to characterize different user profiles, transversal to all the abovementioned categories is necessary.

Communication function

Interestingly enough, the communication function emerged as a new potential player in the workplace-making process. Indeed professionals responsible for communication deal with important aspects regarding workplace performance and workplace change. They are in charge of managing the image of the company both inwards, to the employees (for instance, communication of company culture, engagement), and outwards, to clients and the society more in general (for example, image). This function is pivotal in retention and attraction of talents.

In the end, communication managers probably deserve to be recognized for a unique role in the workplace-making process, similar to the user category entitled for building operation, as ‘active users’. Roles and responsibilities for the communication function deserve to be further deepened in future research.

8 Conclusions

WHY (AIM). Conclusions recall the initial research questions and find an answer to them. Also the limits of the investigation and potential developments of this study are outlined.

WHAT (CONTENT). ***Addressing the problem and objective of the research*** is finally possible, while briefly recomposing the context of this study and recognizing its outcomes and impacts.

The research problem was decomposed in a number of issues to be addressed thanks to the application of a multimethod investigative process. The process developed in three subsequent phases, each devoted to deal with interconnected matters, namely: Phase 0. Workplace; Phase I. Users; and Phase II. Data.

Each phase took its own individual research path, with the application of separate methodologies.

Eventually, the three paths composed an integrated framework through which it was possible to ***answer the research questions***, after collecting all the results obtained throughout the subsequent phases of this study.

The ***contribution to knowledge made by this study*** is clear in the definition of workplace user categories and an innovative set of KPIs.

However, some ***limits of the investigation*** consist on the limited number of companies taking part to the research, their consistency in participation, and the geographic context.

Further development of the research can prospectively lead this study to pursue: advancements in the reduction of the KPIs; the population of the system with actual measures; the verification of the system's effectiveness, once this is put into practice; the implementation of additional analyses on the data that have been collected (which were not object of this dissertation); the undertaking of a cross-country comparison; the integration of the system with some evaluation tools; and the expansion of the cross-disciplinary borders.

8.1 Addressing the problem and objective of the research

Due to the recent rise of new ways of working, the workplace has been radically evolving. How is it possible to master its change? Research clearly demonstrated how office buildings have a material impact on the health, wellbeing and productivity of their occupants. Furthermore, there is a big difference between office environments that are simply not harmful and workplaces that significantly enhance the economic, environmental, and social values of companies, by attuning the interactions among businesses, buildings and the people. However, this evidence is not yet translating at scale into design, management and use of office buildings, while is the goal for the next-generation workplace.

On one hand, the multitude of people who make use of the workplace to different extents have not found a clear identification. Most of the time, these people are considered only as a generic group of users, which hinders their involvement in the workplace-making process. On the other hand, the variety of data potentially available about workplace performance have not been systematized. Data come from many sources and get rarely cross-checked into a unified oversight, which reduces their usefulness and obstructs valuable insights.

Based on these considerations, a general problem came up, which translated into the following question:

What data should be kept under control in the design, management and use of next-generation workplaces, for attuning these with the needs of all their different users?

With the aim of bridging this gap, this research provided, first, the identification of different users involved in the workplace-making process and, second, a system for designing, managing, and using the next-generation workplaces through performance indicators that are significant to all these users.

Thus, the main objective of this study has been reached in the output:

To develop and validate a system of key performance indicators that are shared by all workplace users and help attune their respective stakes in next-generation workplaces.

The usefulness of this system lies on the evidence that a more integrated approach is required to connect existing information to practical applications, financial returns and, in a broader perspective, also policies and standards. Hence, the system offers a set of interdisciplinary key-performance indicators, which reflect the economic, environmental and social impact of the workplace.

This model helps set in place a virtuous process, which encourages more data collection, on a more regular basis, and in a more common way. Through its application in the workplace, is it possible to gain new insights useful for driving decision-making and real estate management. Finally, the system inspires an improvement in the relationship between the two most important key components for every organization – people and places.

The innovativeness of this study lays in particular on the interdisciplinary and holistic approach to the process, through which a variety of theoretical and practical fields have been brought together and have collaborated to the creation of a unitary system.

8.2 Answering the research questions

The research problem was decomposed in a number of issues to be addressed thanks to the application of a multimethod investigative process. The process developed in three subsequent phases, each devoted to deal with interconnected matters, namely: Phase 0. Workplace; Phase I. Users; and Phase II. Data.

Findings regarding all these three research domains are synthetized in **Table 8-1**.

Table 8-1. Research questions: Findings and answers

Research questions	Findings and answers
PHASE 0. WORKPLACE	
Q-0A. How is the workplace evolving?	The Next-Generation Workplace (NGW) is going to be characterized by three predominant features: - High diversity; - Data driven projects and processes; and - Trifold impact on economic, environmental, and social values.
Q-0B. How is it possible to fine-tune the next-generation workplace with users' needs?	The best way to guarantee the alignment of the NGW with user's needs is to interpret diversity, data, and values into a unitary system of key indicators for continuous performance measurement and management.
PHASE I. USERS	
Q-1A. Who are the users involved in the process of 'workplace-making'?	There is no one generic user of the office environment, but there are multiple users to be considered throughout the whole workplace-making process. These can be distinguished into seven main categories by their roles and responsibilities, and values and needs: - Owner; - Active users; - Strategic service providers; - Operational service providers; - Indirect service providers; and - Service receivers.
Q-1B. How is the negotiation between 'demand side' and 'supply side' handled?	Active users are those devoted to negotiate between demand side and supply side. Within this user group several specialized areas need to work conjunctly: - Financial administrators; - Corporate real estate managers; - Human resources managers; - Facility managers; - Designers; and - Information communication technology managers.
PHASE II. DATA	
Q-2A. What are key indicators for designing, managing and using the next-generation workplaces?	Key performance indicators (KPIs) for designing, managing and using the NGW are to be scouted from complementary disciplines such as organization management, corporate real estate management and facility management. Literature in these fields presents plenty of indicators suitable to enhance the workplace-making process, by covering 9 thematic areas: - Environmental quality; - Building operation and management; - Space usage; - Business effectiveness; - Costs; - Value/Return/Yield; - Productivity/Ways of Working; - User attitude; and - Staff characteristics.
Q-2B. Which of them can be shared by all workplace users?	33 KPIs has been found to be shared by all workplace users. These respect the following characteristics that are required to indicators for supporting the design, management and use of the NGW: - Holistic approach - Minimization - Transparency - Meaningfulness - Proper categorization - Measurability - Suitability for internal and external benchmarking - Social, environmental and economic/financial value.
Q-2C. How can the social, environmental and economic value of the next-generation workplace be enhanced?	The social, environmental, and economic value of the NGW is manageable through a system of 33 KPIs which intersect their impacts with 9 different thematic areas. This system needs to be appropriately operated with a view to continuous performance management. A competent expert is required, who can holistically read the integrated information provided through the system.

8.3 Contribution to knowledge made by this work

By answering the research questions into a unified and coherent framework, this research has provided some contribution to extant knowledge to several extents.

A first contribution (Phase 0) corresponds to the proposal of an overarching interpretation of the next-generation workplace (NGW). The inception of new ways of working has generated relevant alterations in the human-workplace relations that need to be properly managed. The literature addresses these current issues offering a wide range of standpoints. Though some systematization was missing in order to acknowledge the multitude of elements that are going to interplay in the NGW. This research meets this opportunity by offering an original oversight on the NGW domain. This results from the combination of three forces that need to be kept together in the workplace-making process: (a) software and hardware diversities; (b) data and indicators; and (c) values and impacts.

A second progress (Phase II) includes the acknowledgment of the main users involved in the workplace-making process. Either calling those stakeholders, actors, end-users, occupiers or clients, prevailing contributions on users still miss comprehensiveness, which occurs mostly because the built environment and real estate sectors are typically supply-driven. Consequently, no framework existed to categorize workplace users while analyzing in-depth their values and needs, and roles and responsibilities. Based on a multiple case study analysis, the elaborations performed in the context of this work allowed to overcome these limitations. Hence, workplace users has been acknowledged through a demand-driven lens. This made it possible to categorize them according to both their roles and responsibilities in the relations between the demand and the supply side, and their strategic/operative values and needs.

In conclusion, a third advancement (Phase III) entails the elaboration of a system of performance indicators for strategic design, management, and use of the workplace. Many authors elaborate on workplace performance assessment offering several perspectives with their analyses. The main gaps in the related business, FM and CREM literature as being identified as: (a) overlaps of indicators, metrics and measurements, without real integration; (b) lack of a holistic perspective matching organizational, environmental and social impacts; (c) deficiency in the involvement of all the users. By the application of a Delphi method, this study contributes to resolving the aforementioned deficiencies. The final system succeeds in combining the business, FM and CREM perspectives into a coherent and integrated list of performance indicators. These indicators reflect the organizational, environmental and social values of the workplace in a holistic framework. The framework has been created thanks to the involvement of all workplace users involved in the workplace-making process. Thus, the final system innovates the state-of-the-art by matching diversities, data and values.

8.4 Limits of the investigation

Research development has faced a few choices (for instance, boundaries definition), constraints (among which, availability of time) and difficulties (mostly in the interaction with people) at times, which translate into limits of the present investigation.

- A limited number of companies has been included in the study (five overall, three in Phase I and four in Phase II). This field is still at an explorative stage thus a small number of companies is not necessarily reductive to reaching the abovementioned research objectives. However, it is clear that involving a larger panel would increase generalizability of the results.
- Companies' willingness and consistency to take part in all the research phases undermined at times methodological solidity. Indeed one company quit participation in Phase II, thus entailing the need to find a substitute. In order to mitigate the risk that discontinuity in participation would affect the results, two companies in place of one have been involved in Phase II. However, one of the two new companies showed resistance at some point and many participants dropped out of interviews and Questionnaire 2. Probably joining the investigation in progress resulted in a lack of bonding with the research aim, which is understandable. Moreover, a Delphi technique requires a prolonged series of interactions between participants and researchers, which is difficult to evaluate at the very beginning of the process in terms of effort for the companies over time. It must be acknowledged that many factors can intervene in the meantime to obstruct companies from participation during the whole Delphi development, despite good intentions.
- Geographic context also played a role and might have created misunderstandings and misalignments. The literature in the field of workplace, corporate real estate, and facility management is most of all conducted by Anglo-Saxon authors, or anyways exists only in English. Unfortunately though Italian companies tend to work still in Italian, and in any case asked to submit questionnaires and interviews in the national language. Translation in Italian of all the indicators has been especially challenging. Precautions has been taken to assure the best translation possible, on one hand to maintain the original English meaning, and on the other to make each indicators fully understandable by Italian native speakers. Cross-reviews by different interlocutors both familiar and non-familiar with the field of workplace management were performed. However, translation always alters the initial meaning and is subject to the translator's sensitivity.

All these limits are suitable to be overcome, by extending the duration of the study. Prolonging the investigative phase could at least allow to enlarge the number of companies. Not only a larger sample increases the generalizability of the results, but also this way, even though a few companies would drop out the research in progress, the effect of abandonment would not be so relevant on the whole. Moreover, expanding the geographic context in Anglophone countries, could result in the bypass of the translation phase. Alternatively, if this were done in a multiple-language environment across several different countries, the inevitable translation discrepancies would be distributed more uniformly over the whole sum of indicators.

8.5 Further development of the research

This study reached a certain advancement of the subject, based on the objectives that were established at the very beginning of the research project. Nonetheless, some room for improvement and development is left. Continuation on the lines of this research could bring several progresses.

Further reduction

The final list of indicators is still somewhat long. An additional passage that might be faced for further narrowing down the list of indicators would consist of checking for the characteristics that effective KPIs must have according to the literature. Indeed, this research has addressed only a few of these characteristics, while others have been omitted in its scope. Verifying whether they apply to the short list of indicators can be done by asking different workplace users to rate the shortlisted KPIs according to the recommended characteristics in the literature.

Population of indicators with measures

The study would naturally proceed with populating the indicators. KPIs coming out from this investigation are indeed still general and need to be further specified. Most of them express an interest of all workplace users in certain themes, but these are not explained in terms of measures and metrics, which in turn are necessary for successful performance management.

However, translating indicators into actual measures makes sense if it is done on each single company. In effect, each company has its own established practices, its own technologies, and its own objectives. For instance, one company might be already measuring *Thermal comfort*, by sending every six months a brief questionnaire to employees via email which is prepared by the facility management department, whereas a second company might be already measuring the same indicators through interviews undertaken every year by the human resources management. For a third company measuring thermal comfort might be not feasible now but in plan in the near future through the implementation of a mobile application. Thus the latter company might want to concentrate current efforts in measuring different indicators while leaving *Thermal comfort* aside for future more extensive application of the system.

This future step would lead to a separation of different experiences parallel to each company. This progress can start from the 'opportunity diagram'.

Verification of effectiveness

Some studies proceed further with verifying the list of indicators. Completion of this kind of study encompasses an experiment by applying the resultant model of indicators in real life cases. This has not been feasible within the present research, mainly because of time constraints.

In fact, the final set of indicators could potentially be verified through subsequent phases: (a) setting target levels for the performance profile (Becker, 1990, p. 298); (b) assessing of actual building performance (Hinks & McNay, 1999). However, time is needed to appreciate variations in the KPIs' trend, which was not available within the time frame available to the present research. Indeed, verification would require observing KPIs' variation over a time range of minimum 6 months, better 1 year. This process is clearly too long to follow up within a PhD duration of 3 years. It is not excluded though to bring verification forth in at least two of the companies (i.e. those where a workplace change is still to come) and perform verification over the next few years.

Broader analyses

This research mainly focused on analyzing KPI categories and user categories. However, interesting analyses could be developed also with respect to other user characteristics such as gender and age. These were only briefly checked as a back office stage of the work, but left at a raw stage of analysis because they did not regard the core topic of this thesis. By enlarging the sample, data could show interesting trends.

Attention could be directed also to industry type. In this study different industries were involved to make sure the sample was unbiased and generalizable. Scores across them appeared always coherent. However, by enlarging the sample, specific KPIs, certain categories, or classes could prevail on others depending on business industry.

Cross-country comparison

The investigation has been conducted only among Italian companies. Results for sure reflect the geographical localization of those companies, as also Chwalbińska-Kusek & Olszewska (2015) realize in their study of the Polish market.

In effect, the Italian real estate sector must be considered relatively underdeveloped, especially if compared to the geographic areas where studies about building performances were born and are mainly undertaken, such as Anglo-Saxons, Northern European, and German.

Expanding the research by providing a comparison between the Italian context and other international contexts can be a way to highlight eventual differences and to outline potential developments, to what concerns both KPIs and workplace users. In fact, researches addressing a comparison between the experiences of different countries all over the world are not numerous at all. Van Meel (2000) proposes an interesting contribution to the topic by talking about the historical evolution of design and cultural aspects. Riratanaphong's (2014) research concerns a cross-country study on performance measurement of workplace change. Except these two efforts, no other important and extensive studies of this sort are known by the author.

Back and forth evaluation and monitoring

This piece of research can be used as a starting point to implement a new part of the Building Rating Value system – BraVe, patented by the Gesti.tec Laboratory of Politecnico di Milano. The tool is currently devoted to evaluation of overall building performances, with a specific section dedicated to office buildings. However the tool takes an explicit real estate perspective, and does not take into account the people and the business components. An additional module could be joined to the existing one aiming at the evaluation of workplace performance in a more holistic way, hence based on the system of KPIs proposed in this research.

This passage toward evaluation would entail the possibility for companies to enter a systematic benchmarking process. Anyways, attention should be put on not distorting the initial intent of the system. Scope of the system indeed is that of continuous monitoring and management, different and only complementary to that of evaluation and certification practices.

Augmenting cross-disciplinarity

This study mentions several disciplines that deal with the workplace and face the human-environment relations to different extents, among which architecture, engineering, interior design, ergonomics, real estate, facility management, sociology, psychology. Nevertheless, the investigation was developed within the boundaries of mainly three of them: business management, corporate real estate, and facility management. Future research could take into consideration more extensively the human-environment relations literature, with the benefit of including a larger range of disciplines, starting from human ecology, environmental psychology, and organizational psychology and management. Possibly, it would be interesting to explore also the emerging role of neurosciences in this field.

9 Final thoughts and recommendations

WHY (AIM). This section recalled the originality of the outputs, together with their impact at broader social, environmental and economic scale. This conclusive overview on the whole path potentially leads to recommendations on how to make best use of the results of the study.

WHAT (CONTENT). ***Advancements in research and practice*** is foreseen, based on the results that have been obtained in this research.

As for ***recommendations*** in the potential application of the system, two main suggestions are briefly described, namely a KPI dashboard, and a reward system.

Finally, ***Q&A***s propose the answers to three questions that could be easily raised when reading the thesis. These refer to the generalizability, statistical analysis, and aid offered by the system to architectural projects.

9.1 Advancements in research and practice

For what concerns the **academic advancements**, this research leads to:

- The systematization of workplace users;
- The organization of interdisciplinary key performance indicators for workplace design, management, and use into a unified system;
- The collection of Italian practices in the field; and
- The enlargement of the stock of knowledge about human-environment relations.

Institutions and research groups potentially interested in the research results could be: Universities collaborating in the Usability Research Project (for example, the Aalto University – Finland); Departments focalizing their studies on real estate matters (for example, the Department of Architecture, Building and Planning at Eindhoven University of Technology – The Netherlands); Research groups focusing on buildings in use and workspace studies (for example, the International Workplace Studies Program, Cornell University – New York, US).

A system, such as the one herewith created, which is able to compound the complex relationship between the office space, the people and organizational performance can directly feed innovative workplace strategies. These may be implemented in a wide range of **practical applications**, such as in:

- Supporting workplace management of existing office buildings, by facilitating the work done in the office environment, educating clients and users to a new way of using the workplace, and eventually enhancing the buildings' value;
- Helping to set Workplace Change Management strategies for companies that are keen on switching to a smart working model;
- Setting up communication campaigns for gaining competitive advantage (in terms of staff retention, talent attraction, etc.); and
- Foster corporate real estate management scopes – due diligence on new spaces; rent review on existing spaces; fit-out guidance on refurbished spaces.

Among the stakeholders that can be interested in the results of the present research from an economic/business point of view, are there: Executive chiefs, Human Resources leaders, designers, builders, commercial brokers, Facility Managers, Project managers, and anyone who has a role in creating the spaces we work in today and for tomorrow.

9.2 KPI Dashboard

The system of indicators would take advantage of relying on an effective visualization platform. Effective visualization indeed would ease monitoring progress and stimulate participation of all workplace users.

Visualization could be represented on a scorecard or a dashboard for ease of readability by all workplace users. An inspiring example of a similar application is reported by Epstein & Rejc Buhovac (2014). They show the case of a leading home improvement retailer in Europe and Asia (i.e. Kingfisher), that has implemented a performance evaluation system to measure the business progress of its nine operating branches against 50 targets. The branches complete a questionnaire twice a year and average scores for each are uploaded on their website every six months. Thus the dashboard is periodically populated with updated data which show ongoing trends compared to a track record and allows to check at a glance where the company performs best and were improvements are urgent.

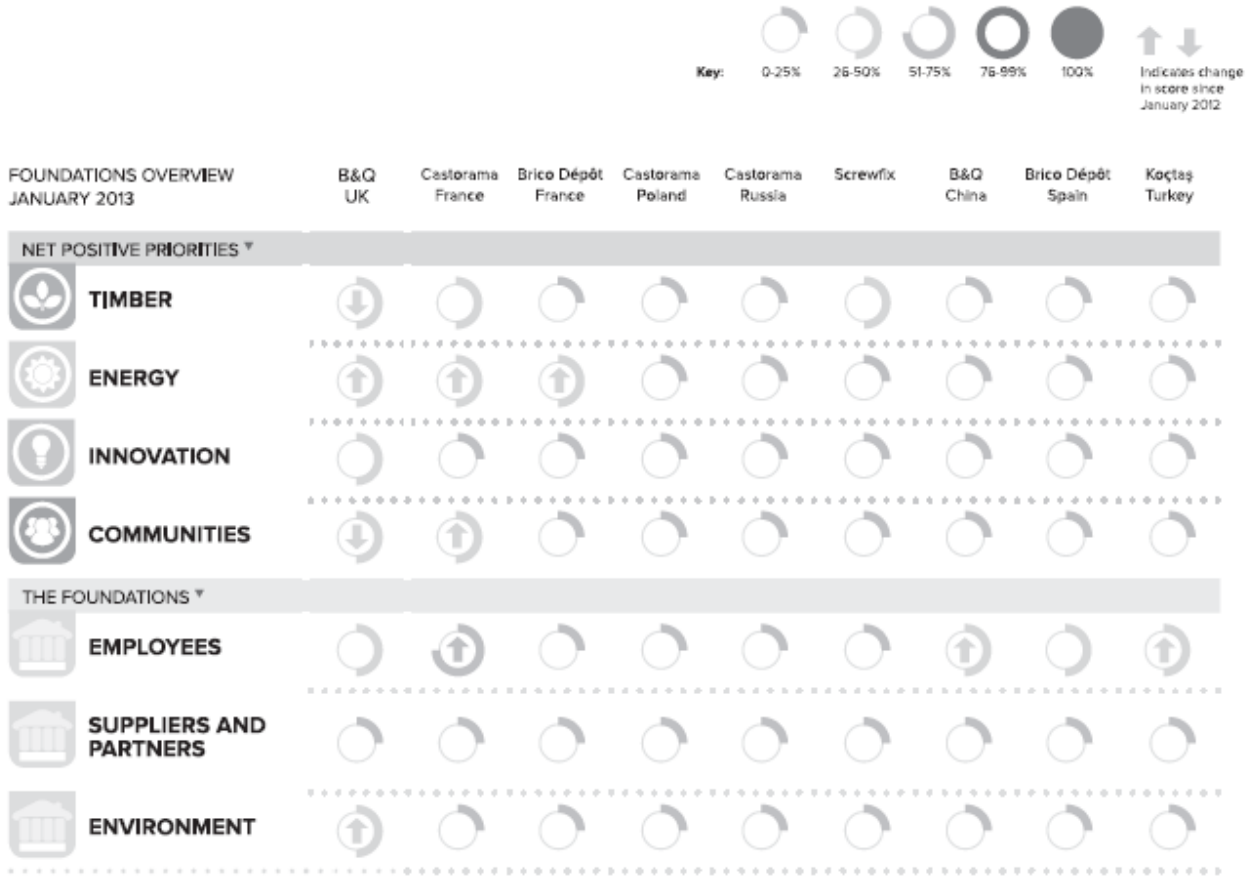

Figure 9-1. Kingfisher's monitoring of Operating Company performance (Epstein & Rejc Buhovac, 2014, p. 126)

9.3 Reward systems

Besides the implementation of an effective visualization platform, strategies encouraging all users to make better use of the workplace thus enhancing performance would be highly recommendable.

Some companies have put in place incentive systems in order to commit employees to actively contribute in the improvement of performances. Among the many examples, we can cite Alcoa, a company producing aluminum (Epstein & Rejc Buhovac, 2014). Alcoa in 2012 set sustainability targets in three different areas: CO2, safety, and diversity of workforce. The fulfillment of these targets was tied to 20% of the variable compensation. At the end of the year the targets were successfully met.

9.4 Q&As

1) *To what extent can this KPI system be universal and to what extent instead it needs personalization by each company that applies it?*

The general validity of the set has been verified throughout the whole process, from opinion convergence in the first questionnaire, to people's opinions in the focus groups/interviews, to the last questionnaire.

For sure the system, as it appears now, reached the highest possible level of generalization. In order to put it into operation, it needs tailoring by each company. To this extent it can be assimilated to any management software, which is made of a standard architecture that requires adaptation to each single reality.

2) Has statistical analysis been taken into consideration?

The Delphi method is a qualitative strategy; hence it does not imply statistics. The choice of this method is justified because of the immaturity of the subject of investigation. Indeed, one can measure the state of maturity of scientific research on a topic by observing whether the topic itself is investigated mainly through quantitative or qualitative methods (von Krogh, 2012). Qualitative analysis is required to understand the nature and dynamics of the observed phenomenon and thus to identify relevant variables to be included in quantitative analyses. Qualitative research is indeed exploratory and serves the purpose of building up general frameworks by identifying the main variables and the relationships among them through the collection of descriptive information and opinions. Accordingly, qualitative methods provide insights into a new phenomenon, help develop ideas and hypotheses, and suggest correlations for prospective quantitative research.

Moreover, statistical analysis has been considered not applicable because of the small number of participants in the questionnaires. Questionnaire involved a theoretical population of 40 people, with an effective sample of 39 in Questionnaire 1, which dropped to 26 in Questionnaire 2. These numbers are not sufficient to assure statistical validity.

However, statistics might be interesting to apply in future explorations, when the subject reaches more solidity and it is worth a more quantitative approach. Intriguing matters to explore may regard, for example: (a) the correlation between workplace users (with data such as age/generation, gender, or category) and preference of certain categories of indicators; (b) the correlation between different types of companies (such as by size, industry, or life-cycle stage) and preference of certain categories of indicators.

3) How can the system support external designers and architects in developing workplace projects?

It is true that the system is primarily directed to support supply- and demand side relationships internal to companies. However, results from its application are useful also to manage relations with external suppliers, such as designers who are involved in workplace projects. For instance, Brown (2008) observes that the design of contemporary offices aims to contribute to team work and to minimize negative impacts, but it often fails to reach these goals. One reason for this failure, he argues, lies on the lack of data available to answer this question. Therefore the present research aims at collecting valuable data to verify if design objectives have been met.

The external project team could theoretically have access to the system to grasp a general overview of how the current workplace is actually performing. In first place, this would help set objectives for the architectural project, and support decision-making. In a second stage, the system would be applicable to verify the offsets of the same indicators once the project has been constructed. Results could suggest to the project team possible corrective actions in the 'up-to-speed' phase of the building. Moreover, post-occupancy results and continuous monitoring over time would create the opportunity for designers to consolidate their expertise on concrete data, which might be useful for projects to come.

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11 People

11.1 The author

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Focus: Corporate real estate management; Workplace management and strategies. The

Approach: She aims to outline and implement innovative strategies, methods and tools suitable to collect useful data for fine-tuning office buildings performances with users' needs.

Background and activities:

- Master's Degree in Architecture
- Research and consulting activities for companies that are facing a workplace change and need advisory on strategy and process management
- Coordinator of the Research Group on Collaborative Spaces (RGCS) – Milan Chapter

11.2 Supervisor

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Focus: Real estate management; Facility Management; Technical and Financial Management of Organizations.

Approach: He is operating primarily within the sphere of organizational problematics related to the real estate and construction sector. More recently he has focused on aspects related to valuation methods in building surveying and workplace management.

Activities:

- Fellow of the Royal Institution of Chartered Surveyors
- Coordinator of Gesti.Tec Lab research group and Vice-coordinator of the PhD program in the Department of Architecture, Built Environment and Construction Engineering at Politecnico di Milano
- Independent member for some Italian real estate investment funds

11.3 Tutor

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Focus: Architecture, building science and behavioral science.

Approach: Dr. Hua has been conducting research on methodology for post-occupancy evaluation (POE); interaction between occupants and building systems and resulted influence on building performance; and impact of workplace concepts on behavioral and organizational outcomes. She is also studying strategies to engage and motivate multiple stakeholders in sustainable building practice and in resilience building efforts in multiple building markets in the U.S., Japan, and China. It is her goal to inform the design, delivery, operation, management and re-engineering of built environments and building sector policy-making to enhance the quality of built environments and support health and performance of their occupants, and to mitigate the building sector's impact on global climate change. As an Appointed Member of the China Green Building Council, Dr. Hua has been actively promoting sustainable building policy, practice, and education in China. She is playing an active role in promoting sustainable campus research and practice both in China and internationally.

Activities:

- Director of the International Workplace Studies Program, Cornell University
- Faculty Fellow, David R. Atkinson Center for a Sustainable Future, Cornell University;
- Faculty Fellow, Cornell Institute for Healthy Futures;
- Appointed Member, China Green Building Council;
- Executive Director, Built Environment Research and Innovation Collaborative (BeRIC).

11.4 Reviewer 1

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Focus: How Corporate Real Estate (CRE) should be managed and how location, building and workspace design choices add value to driving forces of the users (e.g. productivity of employees, innovativeness of organizations, knowledge sharing, flexibility).

Approach: Innovative methods of studying and measuring buildings and their usage, among which spatial network analysis techniques and Bayesian belief networks. Results are always placed within the larger framework of alignment between CRE strategy and corporate strategy.

Activities:

- Editor of the Journal of Corporate Real Estate (JCRE)
- Member of the editorial board of the Corporate Real Estate (CRE) Journal
- Board member of the European Real Estate Society (ERES)
- Board member of the Dutch Society for RE researchers (VOGON)
- Founder and chair of the Transdisciplinary Workplace Research (TWR)

11.5 Reviewer 2

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Focus: Managing property to meet business outcomes, particularly when property is not an organization's core business. The physical aspects of property act as 'containers' for organizational workplaces and work settings. This expertise spans such discipline areas as corporate real estate management, facility/facilities management and real estate asset management and locates all of these within strategic business management.

Approach: Qualitative research in different areas, such as Property and life cycles, Corporate real estate management practices, People in managing property to meet business objectives.

Activities:

- Editor of the Journal of Corporate Real Estate (JCRE)
- Member at Corenet Global
- Best paper award from the Pacific Rim Real Estate Society Conference

12 Appendix

12.1 Questionnaire about activities and work processes

1. In a "**typical working day**" spent at the office, how much time do your employees dedicate to the activities listed in the table below?
   Do you think the activities that you carry out, as head of your department, are very different from the ones of the employees. If yes, please weigh the percentage of time you dedicate to the activities listed in the table below.

Activities	% Employees	% Head	/100%
Concentration, pc, writing, reading			/100%
Printing, paper handling, storing, filing			/100%
Phone			/100%
Conference call			/100%
Video conference			/100%
Presentation			/100%
Meeting/talking			/100%
Learning			/100%
Laboratory			/100%
TOTAL	**100**	**100**	**/100%**

2. What is your role as head of your function/department? Can you explain the main activities that you do together with the employees? Coordination, work assignment, coworking, validation of results, other…

3. Do you think the typical working day you represented before will be subject to **change/evolution** in the near future? If yes, how do you see this evolution?
   E.g. paperless work, more necessity for videoconferencing, more duties outside the office, more time dedicated to learning, other...

4. Is there a specific regulation according to which your activity requires mandatory **archiving** of documents?
   How many times a days is it necessary for your employees to access the archive (dedicated room for storing important documents)? Do you see this necessity increasing/decreasing in the future?

5. Which of the following **activities** do you normally carry out individually? Which ones on the contrary do you normally carry out in team?

Activities	Individual	Collective
Concentration, pc, writing, reading		
Printing, paper handling, storing, filing		
Phone		
Conference call		
Video conference		
Presentation		
Meeting/talking		
Learning		
Laboratory		

6. How many people are usually involved in the activities you defined as "**collective**"?

7. During your typical working day at the office do you always need a high level of **confidentiality/privacy** or is this necessary only in specific moments?
   Which activity requires more privacy? Are there some activities that require confidentiality/privacy even towards colleagues working within your same function and/or your company?

Activities	Extra-privacy outward	Extra-privacy inward
Concentration, pc, writing, reading		
Printing, paper handling, storing, filing		
Phone		
Conference call		
Video conference		
Presentation		
Meeting/talking		
Learning		
Laboratory		

8. Talking about the way you use the workplace, which of the following statements better represents your employees' tendency to **mobility**?
   - ☐ They perform all/most of their tasks/job in a single workplace and **rarely** use other spaces inside the office building
   - ☐ They perform most of their tasks/job in a single workplace, but use **also** other spaces inside the office building
   - ☐ They perform some tasks in their dedicated workplace, but **very often** use other spaces inside the office building
   - ☐ They **always** use different spaces and rarely perform their job in a single workplace without moving inside the office building
   - ☐ They normally use different spaces inside the building and often work **also outside** the office building (in other sites of the company, from home, at clients' sites, etc.)

9. From the list below, please check [√] the activities that are very **important** for your job.
   Then, assess how much the workplace you currently work in is able to **support** those important activities.

		The workplace I work in supports this activity					
		Strongly disagree	Disagree	Disagree somewhat	Agree somewhat	Agree	Strongly agree
√	**Activities**	**-3**	**-2**	**-1**	**+1**	**+2**	**+3**
	Individual work at the desk						
	Individual work NOT at the desk						
	Routine individual tasks						
	Reading						
	Collaboration in focused activities						
	Collaboration in creative activities						
	Formal meetings						
	Scheduled meetings						
	Informal social relations						
	Confidential discussions						
	Private conversations						
	Phone calls						
	Meditation/contemplation/creative thinking						
	Knowledge transfer						
	Conference call						
	Video conference						
	Sharing of documents/materials						
	Use of technical tools/equipment						
	Relaxing and having a break						
	Meetings with large groups of people						
	Hospitality for visitors/clients/collaborators						

10. Do you usually host **external consultants or collaborators** in your workspaces?

√	**Frequency**	**Number of consultants/collaborators**
	Only occasionally (1-2 times/month)	
	Regularly (3-5 times/month)	
	Very often (> 2 times/week)	
	We permanently have external consultants/collaborators that need a workstation near to ours	

11. How often do you have **meetings**?
    Can you quantify the mean duration of your meetings?
    What kind of meetings do you usually have (one-to-one, small groups 4-6 pers., large groups > 10 pers.)?

12. Do you think your meetings are generally adequate for duration and frequency or are they too long/frequent?
    Do you think formal meetings are always necessary or could some of them be better replaced with fast and more informal encounters in a different space and time?

13. Can the number of employees typically present in the office guarantee the possibility of informal/causal encounters or is it better to schedule formal meetings in order to have all of them together?

14. Do the meeting usually involve employees of your same function/department?
    Do you often have meetings also with employees of other functions/departments?

15. Do you have preferential contacts with other functions/department via phone, email and so on?

16. Is it probable/desirable that these contacts will intensify in the future?

17. Can you list a few (2-3) functions/departments that you are more strictly related to?

18. Can you assess the level of importance you attribute to the following statements?

	I think it is important...					
	Strongly disagree	Disagree	Disagree somewhat	Agree somewhat	Agree	Strongly agree
Statement	**-3**	**-2**	**-1**	**+1**	**+2**	**+3**
… that my workplace provides me with different spaces/sites among which I can choose to carry out my daily activities						
… that my workplace supports ideas/knowledge sharing within the group of colleagues						
… to have the possibility of using technologies and tools that allow me to work in different spaces inside the office building						
… to have the possibility of using technologies and tools that allow me to work in different spaces outside the office building (in the open air, at home, during commuting, etc.)						
… that the company culture encourages me to work in more mobile/flexible ways						
… to have technical assistance or tools that help me work in more mobile/flexible ways						

12.2 Use of different type of space

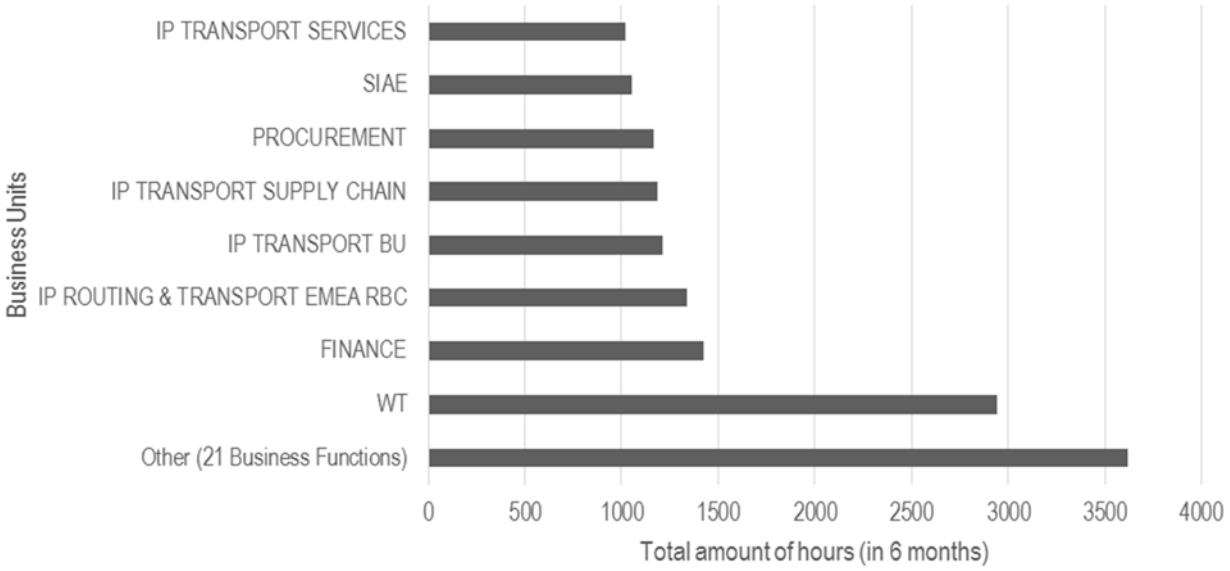

Figure 12-1. Reservation of meeting rooms by business unit – total amount of hours (Source: Co No 1)

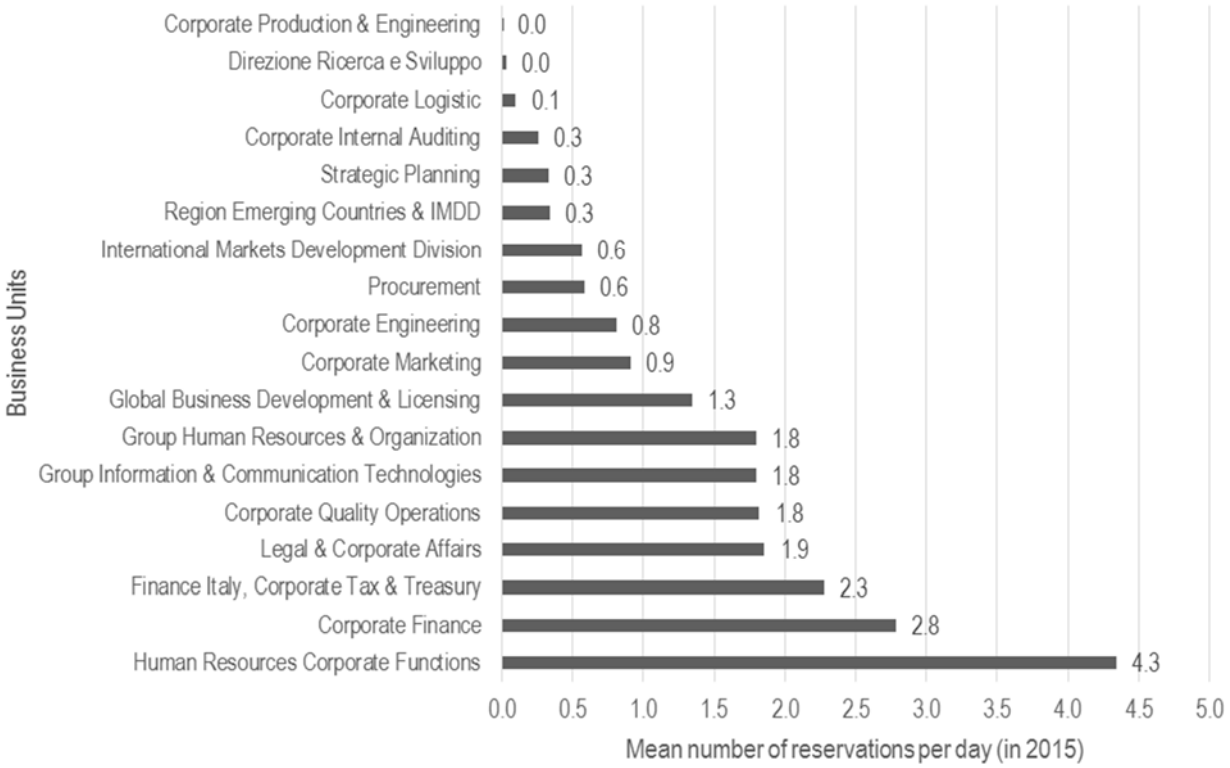

Figure 12-2. Reservation of meeting rooms by business unit – mean number per day (Source: Co No 2)

12.3 Use of workstation

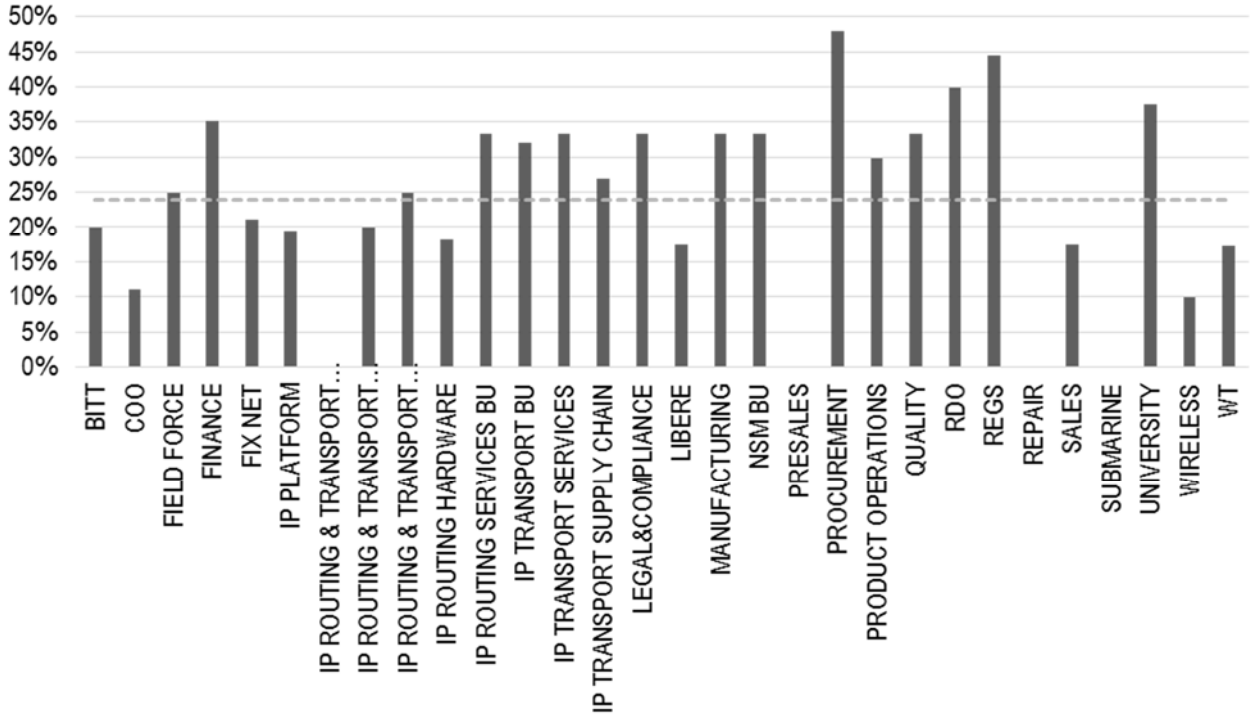

Figure 12-3. Personalization of workstations by business unit (Source: Co No 1)

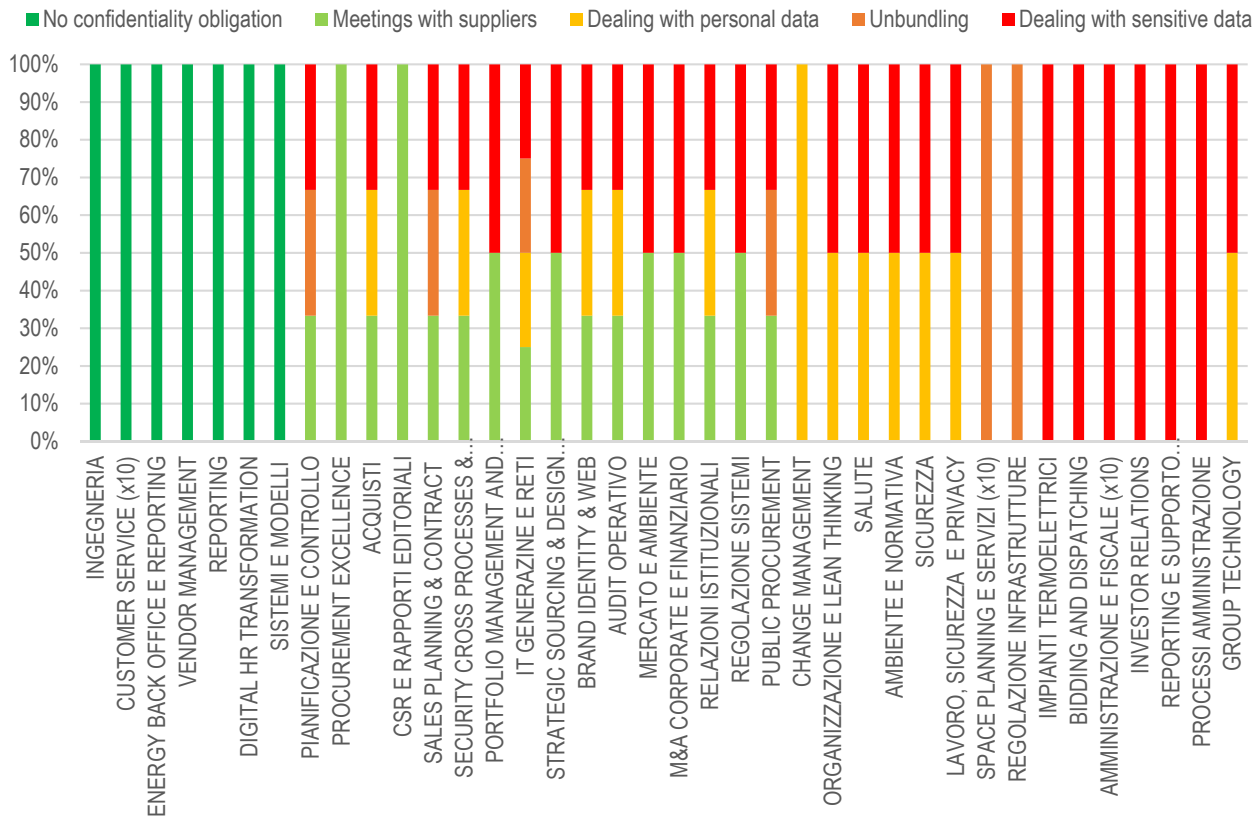

Figure 12-4. Necessity for confidentiality by business unit (Source: Co No 3)

12.4 Nature of work

Table 12-1. Classification of the type of activity carried out by business unit (Source: Co No 2)

Inter-function teams	Intra-function teams	Individual Work	Operative/Mobile Work
Region Europe			
		Finance Italy, Tax & Treasury	
Group ICT			
Corporate Finance		Corporate Finance	
Legal & Corporate Affairs		Legal & Corporate Affairs	
	Region Emerging Countries		
Procurement (suppliers)			
	Corporate Marketing		
		R&D Portfolio Management (Controllo Gestione) (Scientific Information)	R&D Portfolio Management (Site Management)
HR Corporate Functions		HR Corporate Functions	HR Corporate Functions (General Services)
	Corporate Internal Auditing		
	Strategic Planning		
		Global Business Development & Licensing	
	International Markets Development		

Table 12-2. Classification of the type of activity carried out by business unit (Source: Co No 3)

Inter-function teams	Intra-function teams	Individual Work	Operative/Mobile Work
Ambiente, salute e sicurezza			
Affari regolatori e mercato		Affari regolatori e mercato	
	BU Mercato		
	Amministrazione, finanza e controllo		
	Internal Audit		
Affari legali e compliance		Affari legali e compliance	
Comunicazione esterna e media relations			
BU Generazione e Trading			
	Group Security		
	Group ICT		
Risorse umane, organizzazione e change management			
Supply chain			
Rapporti istituzionali e territoriali			

12.5 Interactions with externals

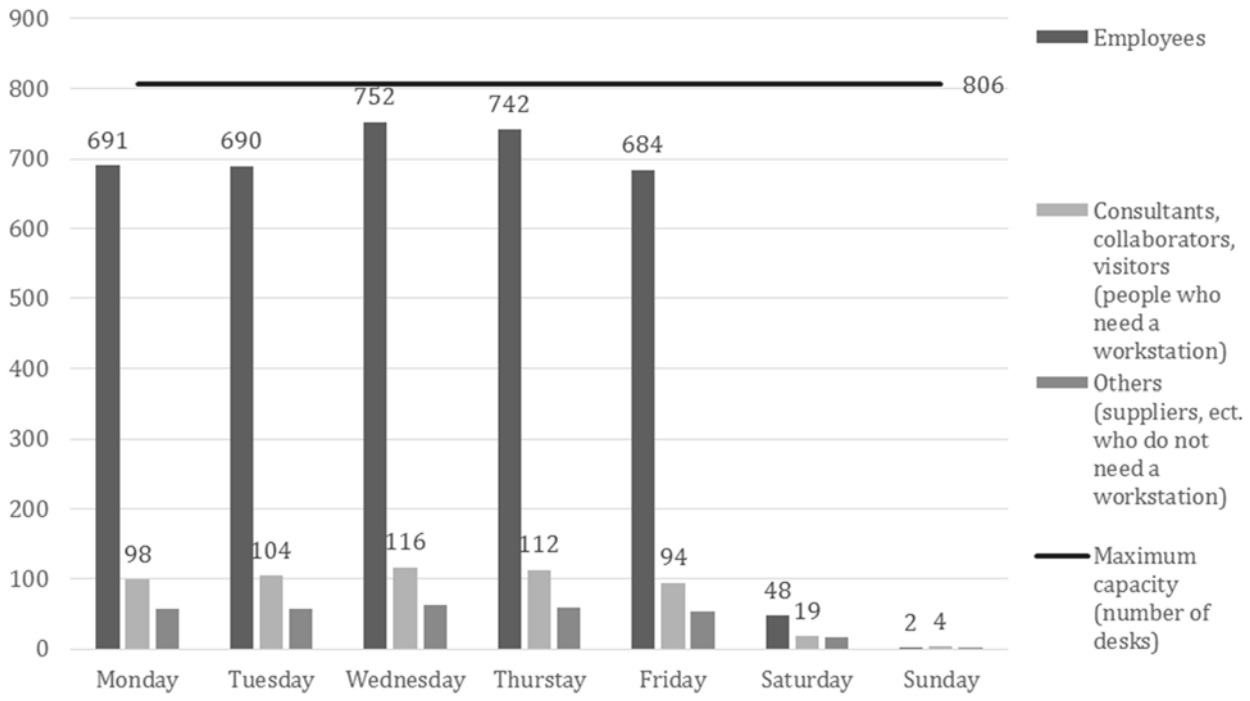

Figure 12-5. Mean number of accesses per week by need for workstation (Source: Co No 2)

Figure 12-6. Mean frequency of interaction with consultants by department (Source: Co No 2)

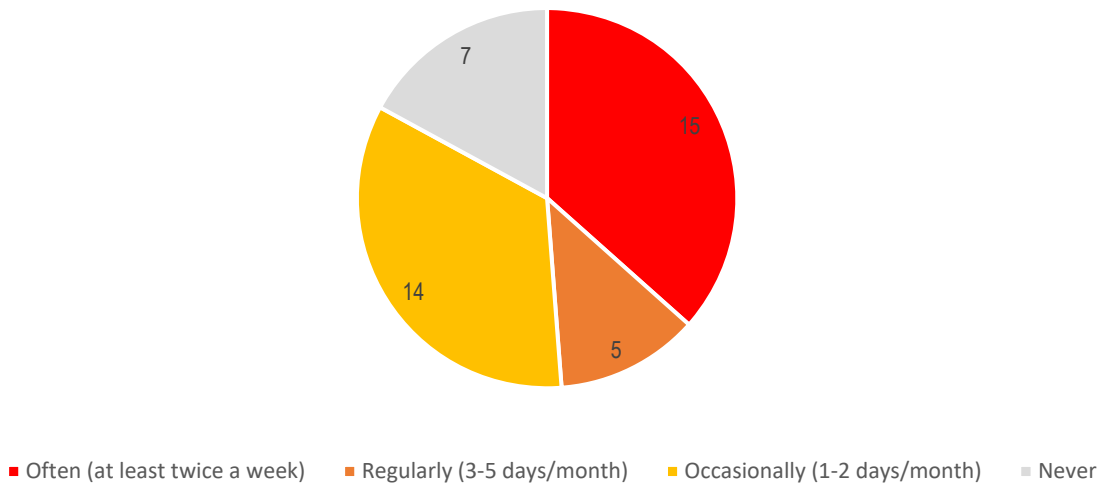

Figure 12-7. Number of business units by mean frequency of interaction with consultants (Source: Co No 3)

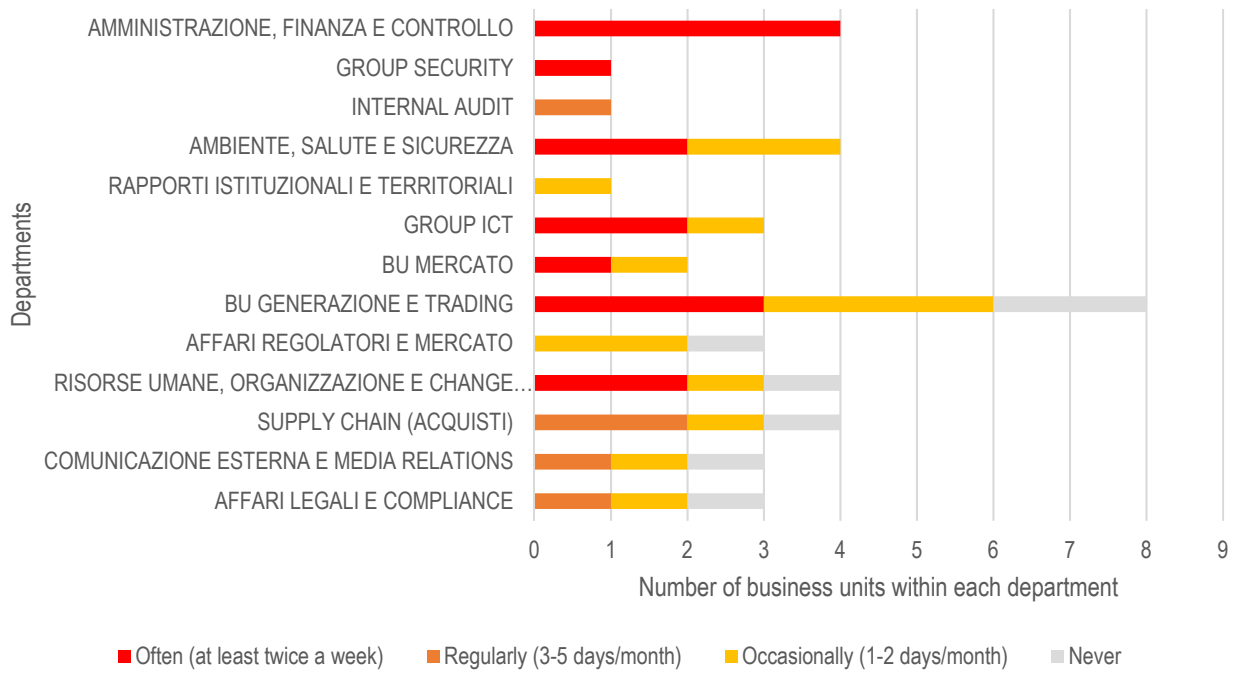

Figure 12-8. Mean frequency of interaction with consultants in different business units by departments (Source: Co No 3)

12.6 Quotes from interviews and focus groups

Table 12-3. Different viewpoints users have on the workplace (Telecommunications company [1]; Pharmaceutical company [2]; Utility company [3]; N = Needs; V =Values)

Owner [O] / CEO [CEO] / President [P]	Building operation/Active users [HRM] / [CREM] / [FM] / Space Planning [SP] / Engineering [En]	Executives [Ex] / Managers [M]	Employees [E]
SPACE USAGE, AVAILABILITY AND FLEXIBILITY			
"For our company it is important to overcome the silos-like organizational structure, and move forth to integrating people and spaces, toward the maximization of communication, efficiency and creativity" [2V-O] "There are a few departments that need protected spaces because they treat sensitive data, so privacy is not a problem of how long my phone calls are, but of what topics I am talking about" [2N-CEO] "We are looking for cross-sector work environments" [3V-P] "Everybody entering our company should breathe an atmosphere of momentum into the future" [3V-CEO] "We need places/paths for facilitating chance encounters between people" [3N-CEO] "In the current layout we work too enclosed, on the contrary we aim at opening up to integration for the best development of people" [3N-P]	"We are going to accommodate 200 more people after the merge, so we need to understand if they will fit in these spaces, or we should rent out external facilities. In terms of business effectiveness this is not recommendable" [1N-CREM] "Our values for the near future spin around flexibility and adaptability, with the objective to optimize space usage and investments in technological and human resources" [2V-En] "Proximity between business functions must be planned accurately. Some functions would highly benefit from been closer to each other" [2N-En] "I think our spaces should be opened to the city in the future, such as the restaurant" [3V-FM] "We need to adapt to the fact that all the tasks that can be automated will disappear, but these will be replaced by more brain-intensive work, entailing reflection and creativity" [3N-HRM] "In a long-term perspective, if today I need 10 people in a job position with low added value, tomorrow I'll need only 7 people in the same position, and I can free space up" [3V-CREM]	"I would like shared spaces for the people who work in my group, with the availability of quiet rooms, meeting rooms, and specific rooms for conference calls and video conferences. My activity instead is more brain-intensive and requires more meditation and concentration, thus I would prefer an enclosed office for myself" [2N-Ex] "At home I do all the things that I can't do in the office. At home I concentrate, I develop ideas and thoughts." [2N-Ex] "At the weekend I always have half a day to process emails" [2N-Ex] "I usually prepare presentations at home during the evening or the weekends" [2N-Ex] "Today we waste a lot of time just going back and forth our different sites. This leads to inefficiencies and inefficacies in everyday activities" [2N-Ex] "What I am trying to do with my team is to standardize our activity, consequently I foresee an increase in concentration work at the desk" [3V-Ex] "For sure a percentage of our meetings could be done in spaces other than traditional meeting rooms" [3N-M]	"On some days there is not enough room for everybody, teleworking does not fit in properly" [1N-E] "I thought flexible space meant a more flexible management of work. I thought I would really be able to work from home, but this is not happening now" [1N-E] "Flexibility is not fully exploited because work stations are personalized", "Moving on is a cultural issue: there are actually a lot of paper documents around, so desks appear occupied", "I feel out of place sitting at work stations that have been «marked» by other people", "We are all creatures of habit. I leave a lot of stuff on the desk so that other people generally avoid taking my place", "In the end we always use our same work station" [1N-E] "The values and feelings that the new building should inspire to me are: community, ecology, and respect for employee wellness" [2V-E] "I am happy about this office building because it is close to the train station and to the city center. However we are a bit isolated from the other company sites, which entails frequent travels back and forth" [2N-E] "I miss welcoming break areas where to take a coffee or have lunch with colleagues" [3V-E] "Our break areas are too tight and far from our offices" [3V-E] "Collaborative spaces are lacking in this company", "There is a scarcity of meeting spaces" [3N-E]

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Table 12-3. (Continued)

Owner [O] / CEO [CEO] / President [P]	Building operation/Active users [HRM] / [CREM] / [FM] / Space Planning [SP] / Engineering [En]	Executives [Ex] / Managers [M]	Employees [E]
FUNCTIONALITY, LOOK AND FEEL			
"We must be eager for innovation through the implementation of both material and immaterial technologies" [2V-CEO] "We talk about 'visibility' in terms of the willingness to open up our company to the outside. We want this to happen on one hand toward the scientific community both at a local and a global scale; on the other hand toward the surrounding context, being it cultural, productive, and social." [2V-O] "This is an opportunity for us to give a sign of discontinuity" [3V-CEO] "If open plan layout also for executives seems too extreme, transparency might be a good compromise, but a strong cultural message" [3V-P] "We need physical elements that enhance our corporate culture" [3N-P]	"Abroad, game rooms with table tennis and table football are not a scandal, people stop by at the end of the day for unwinding, but they keep talking about work in an informal way" [1V-HRM] "We want to make sure that employees are satisfied with the new workplace" [1V-HRM] "We want to boost creativity and efficiency of our people" [2N-HRM] "A key issue regards security of both data and people" [2N-HRM] "Our employees should feel their intellectual property is protected, as well as their physical safety is safeguarded" [2V-HRM] "We need to provide not only spaces to our people, but also services, such as a kinder garden, a laundry, a doctor" [3V-FM]	"In the previous open-plan setting we were too dispersed and there was scarce contact with each other. Now the arrangement of the workstations allows for fruitful interactions" [1V-M] "We have to rethink our spaces besides our communications strategies" [2V-Ex] "In the hypothesis of enlarging the smart working policy, it is necessary to make the office space more attractive. You need to get out of home as if you went to meet people in a lively square, at a good bar, at your favorite gym. There must be some green, art pieces, something that changes periodically, something alive" [2N-Ex] "As we take the chance of lunch time to meet up, we would need some informal area to build up relationships" [2N-Ex] "The environment is not very lively, it is a bit gray" [2V-Ex] "Recreational areas are very few, we are pretty austere" [2V-Ex] "The current spaces are too segmented" [2N-Ex] "I like morning briefings with my team. I think stand-up areas would be appropriate to accommodate these brief exchanges" [3V-Ex] "I need some reserved spaces to meet privately with my managers" [3N-Ex]	"I like it here", "it is a 100 million times better than in the past", "everything is much more efficient" [1V-E] "The company image has gained a lot" [1V-E] "I always receive compliments from guests" [1V-E] "We were told we were going to the new premises so we would all be equal, 'Break down the barriers, no more status quo!', then it turns out not to be true" [1V-E] "There is a problem of equality, actually there are closed offices for colleagues who could integrate with everybody else" [1V-E] "The new layout improves interaction among colleagues and helps us feel more part of a team" [1V-E] "The areas with the nicest views of the landscape outside are dedicated to equipment and machinery, that's a shame" [1V-E] "Interactive spaces are more effective and help the employees interact with the systems" [2V-E] "Having round tables in the meeting rooms would be nice" [2N-E] "We would like to personalize our offices" [3V-E] "I would like more lively and stimulating workspaces" [3V-E] "We often experience communication difficulties with each other because of our office layout" [3N-E]

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Table 12-3. (Continued)

Owner [O] / CEO [CEO] / President [P]	Building operation/Active users [HRM] / [CREM] / [FM] / Space Planning [SP] / Engineering [En]	Executives [Ex] / Managers [M]	Employees [E]
FILING, PAPER HANDLING AND CLEAN DESK			
"We definitely have to go toward the Zero-paper. We could start by taking away the printers from private offices" [2V-O] "A clean-desk policy is convenient for us, because it educates people to respect each other" [3V-CEO]	"Everything is dematerializing, even if some functions have to consult papers and journals, thus we have been thinking to create a library" [2N-En] "In the near future an evolution of the regulations will happen. Today we still have some restrictions to preserving paper documents. Soon we'll be able to implement a paperless policy" [3N-HRM]	"Switching to a clean desk policy is a cultural transformation we should undertake: until there is so much paper documents around of course all the desks will seem proprietary" [1N-Ex] "Dematerialization is a must, it is necessary to pull people especially from my generation; the youngest are already used to the cloud, etc." [2V-Ex] "I picture a future where paper will be reduced even more, in the next years paper handling will disappear" [2V-Ex] "Paper takes space, I would prefer occupying the same space with a coffee machine, because it helps me talk to people" [2V-Ex] "We are storing a lot of useless paper documents that we will finally get rid of once we'll be forced to give up our huge shelves and pack out stuff into a locker" [2N-Ex] "The quantity of paper we produce is inversely proportional to the hours of work we produce" [3V-Ex] "My team would potentially live happy with no paper at all" [3V-M]	"I realized so much paper was not necessary" [1V-E] "I realized I didn't need to keep lots of things" [1V-E] "I really struggled to get everything into a locker the size of the one I had when I was doing my national service" [1N-E] "There used to be a lot of room for paper before, now there is much less and lots of stuff had to be thrown away" [1N-E] "We can avoid personal printers and have only centralized ones" [2N-E] "Appropriate storage areas are necessary to us" [3N-E]

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Table 12-3. (Continued)

Owner [O] / CEO [CEO] / President [P]	Building operation/Active users [HRM] / [CREM] / [FM] / Space Planning [SP] / Engineering [En]	Executives [Ex] / Managers [M]	Employees [E]
ENVIRONMENTAL QUALITY			
"Intelligent consumption of resources is most of all a sign to the outside" [3V-P]	"There are a few malfunctioning that we'll be solved over time, such as air-conditioning, brise soleil" [1N-FM] "High building quality means environmental sustainability, which guarantees people wellbeing along with a responsible use of energy and resources" [2V-En]	"I have seen in other companies common green areas used not only as break areas but as proper workspaces. It's intriguing for us" [2V-Ex]	"Lighting in the work settings is very important. Lighting in my area is excellent" [1V-E] "The brise soleil move at random" [1N-E] "Some of the meeting rooms are off-limits… they are not used because they are too cold" [1N-E] "Not all the meeting rooms are properly soundproofed, you can hear a lot from the outside" [1N-E] "Eco-sustainability is a priority to me" [2V-E] "I would like to use car-sharing or bike-sharing to come to the office" [2V-E] "Green areas are fundamental both for the employees' wellbeing and for the image of the company. Moreover plants and greenery have also a nice esthetical function since the new building is going to face the highway" [2N-E] "We need more natural light" [3N-E] "There is a lot of noise in some open plan areas" [3N-E] "We often experience ventilation problems" [3N-E]
EQUIPMENT			
"We are looking for innovation through the introduction of new technologies both material and immaterial" [2V-CEO] "I do not believe that everything will become virtual, however digitization is a must" [3N-P]	"We are taking care of communication problems related to flexibility. We will be soon switching to only mobile phones and devices, and get rid of fixed IT equipment." [1N-FM] "In many of our departments there is an increasing use of long distance communication. In parallel we need to develop out technologies" [2N-HRM] "Rooms with evolved technical support are totally inefficient here for the needs of my team. We need an upgrade" [3N-FM]	"Video conferences will increase for sure in the future, we should invest on the supporting technologies" [2N-M] "It would be useful to implement an internal social media, which could in part replace physical encounters" [2N-Ex]	"Screens in the mid-size meeting rooms for 12 people are too small" [1N-E] "It would be cool having an ecology station in the building" [2V-E] "We could interact with the building through phone apps, and book the meeting rooms this way" [2N-E] "We cannot do telework" [3N-E] "We need a desk, a desktop computer, and a mobile phone" [3N-E]

12.7 Indicators collected from literature

Table 12-4. Indicators by source and category

Source and description	Indicators by category
(JLL, 2017a) *This online source reports results from a survey JLL undertook of real estate executives. They denounce a lack of data and metrics to enhance strategic value-add to organizations. Thus, the source aims at helping RE executives choose metrics that really matter to different stakeholders (e.g. CEOs). In order to do so, they propose a list of real estate measures linked to some exemplary business goals or objectives.*	Provide long-term value for stakeholders: - Ability for business leadership to leverage real estate data to make decisions - Ethics, health and safety practices - Effective risk management Shed low margin business units: - Portfolio reduction target - Building flexibility into the overall portfolio Acquire emerging companies that extend product offering: - Quality of portfolio analysis and impact on decision making - Speed and agility to rebrand, co-locate or dispose of duplicative assets Help customers: - Workplace impact on research and product development breakthroughs - Employee productivity Drive growth: - Location analysis - Speed to market of store openings - Customer experience Drive innovation: - Employee engagement scores - Talent attraction and retention rates
(Chwalbińska-Kusek & Olszewska, 2015) *The white paper is directed to investors, business leaders, tenants and real estate agents. This paper explains how businesses can measure the impact of their buildings on their people, by adapting the overall organizational measurement framework proposed by the WGBC to the Polish market. The paper gives a precise definition to all the indicators and explains in detail how to measure them.*	Financial/organizational metrics: - Absenteeism - Staff turnover - Revenue breakdown - Medical complaints - Physical complaints Physical metrics: - Indoor air quality - Light quality - Acoustic quality - Spatial configuration Perceptual metrics: - General perception of the building and its location - Indoor air climate - Light comfort - Acoustics comfort - Office design and layout - Overall satisfaction - Engagement
(Alker, et al., 2014) *This report provides businesses (i.e. building owners, occupiers and advisors) with a high-level framework of the impacts office buildings have on employee health, wellbeing and productivity. This framework makes light about how to measure organizational outcomes against building features and people perceptions. Thus, the framework proposes a list of health, wellbeing and productivity outcome metrics suitable to informing business decision-making.*	Financial/organizational metrics: - Absenteeism - Presenteeism - Staff turnover/retention - Revenue breakdown - Medical costs - Medical complaints - Physical complaints - Task efficiency and deadlines met Direct measures or evaluation/assessment: - Indoor air quality and ventilation - Thermal comfort - Lighting and day-lighting - Noise and acoustics - Interior layout and active design - Biophilia and views - Look and feel - Location and access to amenities Self-reported attitudes (perceptions): - Physical health - Psychological health - Productivity

	- Office environment - Organizational culture
(Lavy, et al., 2014a, 2014b) *The two papers elaborate on previous studies by narrowing down the core performance indicators and establishing equations to measure them.*	- Condition index - Replacement efficiency indicator – REI - Maintenance efficiency indicator – MEI - Functional index – FI (i.e. space utilization) - Absenteeism - Indoor/outdoor environmental quality - User perception (Post Occupancy evaluations)
(Lavy, et al., 2010a) *The paper aims at opening the way for a holistic performance assessment starting by the identification and classification of KPIs for facility performance measurement. The authors denounce the deficiency in proper categorization of indicators, whereas categories urge in order to support practical application by FM practitioners. Identification of KPIs is conducted through an extensive literature review. Subsequent classification is inspired to literature and verified through interviews to industry representatives. Four categories result: financial, functional, physical, and survey-based. The final list of KPIs is arranged according to purpose, description units of measurement, and source of the indicators.*	Financial metrics: - Operating costs - Occupancy costs - Utility costs - Capital costs - Building maintenance cost - Grounds-keeping cost - Custodial and janitorial cost - Current replacement value - Deferred maintenance, and deferred maintenance backlog - Capital renewal - Maintenance efficiency indicators - Facility condition index - Churn rate and churn costs Functional metrics: - Productivity (turnover, absenteeism, occupants' satisfaction) - Parking - Space utilization (survey-based data) - Employee or occupant's turnover rate - Mission and vision - Adequacy of space (survey-based data) Physical metrics: - Building Performance Index (BPI – quantitative) - Building physical condition (qualitative) - Property and real estate - Waste - Health and safety - Indoor Environmental Quality (IEQ) - Accessibility for disabled - Resource consumption – energy, water, materials - Security - Site and location Survey-based metrics: - Customer/building occupants' satisfaction with products or services - Community satisfaction and participation - Learning environment, educational suitability, and appropriateness of facility for its function - Appearance
(Jordan, et al., 2009) *Based on the premise that performance analytics nowadays has become the new field of competitive excellence, the authors recommend CRE executives to take the same approach. The authors state that first it is necessary for CREM to identify customer's needs. They elaborate an operational dashboard as an example of a scorecard linking business objectives with key performance metrics. The paper concludes by saying that CRE metrics should be focused not much on real estate performance, but rather on CRE team performance in using*	Transaction management: - Transaction quality score - Critical date management - Savings tracker Lease administration: - Rent processing - Schedule adherence - Data accuracy - Critical date reporting Facility management: - Work order completion - Cost savings tracking - Energy management - End-user satisfaction Project management: - Schedule adherence - Budget management - Change order activity - Capital plan attainment Occupancy planning: - Space utilization

the real estate assets to reach organizational objectives.	- Churn cost - Accurate reporting Account management: - Key stakeholder satisfaction - Budget adherence - Talent management
(Lindholm & Nenonen, 2006) *This paper examines a few CREM performance measurement tools, methods and practices, with the goal to systematize them into a practical toolbox for corporate real estate and workplace management.* *By proposing this toolbox, the authors try to overcome the downsides of traditional approaches to corporate real estate. Indeed, they criticize traditional approaches that are based on the use of lagging indicators representing previous years' results, and that therefore work well only with the purpose of cost control.* *Their paper analyses in greater detail the Balanced Scorecard (BSC) approach, being it the most broadly known and adapted system. In sum, the paper presents the most popular CREM measures (or indicators) composing CREM BSC systems.*	Financial perspective: - Financial results - Return on assets - Value of properties (book- or market-value) - Amount of sold properties - Vacancy rate - Amount of leased vs. owned properties - Amount of rented properties Learning and growth perspective: - Professionalism and expertise of CREM staff - Competence of the staff - Average age - Level of education - Reward systems and motivation - Atmosphere of the community - Training and development days - Absenteeism - Turnover - Amount of R&D activities Business process perspective: - Square feet per employee - Occupancy costs - Operative costs (maintenance, energy, etc.) - Transaction costs - Return on assets - Sustainability objectives (waste, energy consumption, etc.) - Effectiveness of projects/investments (budgeting, scheduling, targets) - Business units' satisfaction with CREM performance Customer perspective: - Customer satisfaction (with workplace and facilities among internal and external customers) - Customer satisfaction with services - Customer satisfaction with CREM department (hospitality, quick reactions, results, information, etc.) - Cost-quality ratio - Cost-quality ratio of facilities services
(Lindholm & Leväinen, 2006) *The goal of this paper is to provide CREM with a tool suitable to show the adding value of real estate to corporate officers. Through interviews to corporate real estate executives, the authors come out with a list of potential performance measures where CREM can select from. From this list, each firm can select the performance measures that better fits their own strategies and matches with information availability.*	Reduce cost: - Occupancy cost - Space per employee - Whether workplace standards are used - Percentage of space occupied - Operational space vs. non-operational space - Owned and leased space - Persons per seat - Number of moves per year - Cost of underutilized space - Real estate cost per CRE employee - Total CREM operating expenditures vs. budget Increase value of assets: - Real estate cost of acquisition vs. returns/IRR - Lease vs. construction or ownership cost - Aging reports for leases - Real estate holding costs - Number of building quality audits - Real estate return on investment - Real estate return on equity - Business return on real estate assets - Sales or revenue per square foot/meter - Space (square feet/meter) per unit of revenue - Market capital vs. book value - Percentage of surplus assets sold - Time to dispose of properties vs. plan

	- Cost of disposal of property vs. savings - Time to clear buildings vs. plan - Number of development projects for obsolete properties - Status of risk management activity (contaminated sites) Increase flexibility: - Percentage leased vs. total space - Length of lease terms - Use of virtual and flexible workplaces Increase innovations: - Number of teamwork settings - Number of workstations per employee Promote marketing and sales: - Distance to required transportation modes for customers - Distance to customers - Use of company logos and colours in workplace design - Image rating based on building attributes - Energy consumption - Number of energy audits - Environmental sustainability of buildings Increase productivity: - Employees' opinions on how well the workplace supports their productivity - Distance employees commute - Distance between company sites and businesses - Time wasted with interruptions (due to open space layout) - Percentage shared service - No loss of business due to real estate service failure - Real estate spending as percent of gross margin - Real estate spending as percent of total operating expenses - Time used on RE project vs. time budgeted for projects - Money used on RE project vs. money budgeted for projects - Amount of real estate advice given to other business units - Number of service providers/service level agreements - Number of transactions/projects/leases per - FTE employee - CRE employee qualifications - Employee turnover - Number of steps/time for real estate approval process - Use of audits for service providers Increase employee/internal client satisfaction: - Distance to required transportation modes for employees - Employee satisfaction with work environment - Quality of indoor environment (lightning, temperature, noise) - Workspace (size, shape) - Amount of nearby amenities for employees - Range of services offered by CREM - Employee/internal customer satisfaction with responsiveness of CREM - Employee satisfaction with CREM staff skills - Employee satisfaction with CREM information sharing - CREM response time to requests - Competence of CREM staff - Investment in training per CREM employee
(Hinks & McNay, 1999) *The paper describes the method applied by the authors to derive a bespoke short list of semi-qualitative KPIs for facilities management. This list is set with the goal of managing the quality of the in-house facility management service within the premises department of a financial services company, and the quality of external service providers. The authors apply a Delphi technique pursuing a few goals: (a) to select a short list of*	Business benefit: - Value for money - No loss of business due to failure in premises services - Suitability of premises and functional environment Equipment: - Equipment provided meets business needs - Correction of faults Space: - Effective utilization of space Environment: - Satisfactory physical working conditions - Provision of safe environment - Energy performance Maintenance/services: - Management of maintenance - Reliability

important KPIs; (b) to prioritize the KPIs that appear in the list; (c) to rate FM performance; (d) to develop a management-by-variance tool. They propose the use of the tool to FMs both as a single view snapshot to check for critical performance levels, and as a system to assess trends in performance.	- Effectiveness of help desk service - Standards of cleaning Change management: - Effective communication - Quality of end product - Responsiveness of PD to changes/requirements - Achievement of completion deadlines - Completion of projects to customer satisfaction General: - Responsiveness to problems - Customer satisfaction - Management information - Professional approach of premises staff - Competence of staff
(Kaplan & Norton, 1996) *The book explains how to implement the Balanced Scorecard. They categorize performance measures in four areas: financial, customer, internal business, and learning and growth. Each company must build its own scorecard, nevertheless some measures recur across companies in the financial, customer knowledge, and learning and growth areas.*	Financial perspective: - Return-on-investment/economic value added - Profitability - Revenue growth/mix - Cost reduction productivity Learning and growth perspective: - Employee satisfaction - Employee retention - Employee productivity Customer perspective: - Market share - Customer acquisition - Customer retention - Customer profitability - Customer satisfaction
(Becker, 1990) *The book deals with conception, expression, and management of control by facility managers.* *The book treats the concept of quality in buildings, over the planning, design and management processes.* *At first, the author discusses the evolution of facility management toward a more active service function in modern organizations. Later, he talks about some processes for creating quality facilities, from strategic planning to managing the change processes. Subsequently, the author presents new approaches to space planning and management, along with new techniques for appraising buildings and measuring the effectiveness of the FM function.* *In sum, the book presents innovative ways of thinking about how to plan, design and manage complex office environments, with a specific attention to continuous monitoring of building performance.*	Financial issues: - Asset value of real estate portfolio - Income from leases and disposals - Expenses of real estate occupancy - Construction costs - Energy costs - Maintenance costs Organizational issues: - Changes in workforce size - Need to relocate employees - Ability to attract/retain staff - Security - Communication of status - Informal communication - Image to outside Information Technology: - Networking IT - Changing location of cables - Protecting equipment - Electrical power capacity - Telecommunications Space use efficiency: - Rentable or usable/gross - Space/employee - Space/unit of income - Renovations required - Turnaround time - Change orders - Response time - Disruption Performance/productivity: - Quality of work - Quantity of work - Absenteeism - Innovation

12.8 Indicators erased from analysis

Table 12-5. List of erased indicators by source

#	Source	Indicator as in the source
1	(JLL, 2017)	Ability for business leadership to leverage real estate data to make decisions
3	(JLL, 2017)	Effective risk management
4	(JLL, 2017)	Portfolio reduction target
6	(JLL, 2017)	Quality of portfolio analysis and impact on decision making
50	(Alker, et al., 2014)	Office environment
68	(Lavy, et al., 2010)	Capital renewal
81	(Lavy, et al., 2010)	Property and real estate
93	(Jordan, et al., 2009)	Transaction quality score
98	(Jordan, et al., 2009)	Data accuracy in lease administration
106	(Jordan, et al., 2009)	Change order activity in project management
110	(Jordan, et al., 2009)	Accurate reporting in occupancy planning
117	(Lindholm & Nenonen, 2006)	Amount of sold properties
166	(Lindholm & Leväinen, 2006)	Percentage of surplus assets sold
171	(Lindholm & Leväinen, 2006)	Status of risk management activity (contaminated sites)
188	(Lindholm & Leväinen, 2006)	Percentage shared service
194	(Lindholm & Leväinen, 2006)	Amount of real estate advice given to other business units
207	(Lindholm & Leväinen, 2006)	Range of services offered by CREM
229	(Hinks & McNay, 1999)	Responsiveness of PD to changes/requirements
234	(Hinks & McNay, 1999)	Management information
235	(Hinks & McNay, 1999)	Professional approach of premises staff
240	(Kaplan & Norton, 1996)	Cost reduction productivity
272	(Becker, 1990)	Change orders
274	(Becker, 1990)	Disruption

12.9 Classification of indicators collected from literature

Table 12-6. Financial/organizational, perceptual and physical metrics

Categories **Sources**	**ECONOMIC IMPACT**	**ENVIRONMENTAL IMPACT**	**SOCIAL IMPACT**
(JLL, 2017a)	Provide long-term value for stakeholders: - Ability for business leadership to leverage real estate data to make decisions - Ethics, health and safety practices - Effective risk management Shed low margin business units: - Portfolio reduction target - Building flexibility into the overall portfolio	Acquire emerging companies that extend product offering: - Quality of portfolio analysis and impact on decision making - Speed and agility to rebrand, co-locate or dispose of duplicative assets	Help customers: - Workplace impact on research and product development breakthroughs - Employee productivity Drive growth: - Location analysis - Speed to market of store openings - Customer experience Drive innovation: - Employee engagement scores - Talent attraction and retention rates
	Financial/Organizational metrics	*Physical metrics*	*Perceptual metrics*
(Chwalbińska-Kusek & Olszewska, 2015)	- Absenteeism - Staff turnover - Revenue breakdown - Medical complaints - Physical complaints	- Indoor air quality - Light quality - Acoustic quality - Spatial configuration	- General perception of the building and its location - Indoor air climate - Light comfort - Acoustics comfort - Office design and layout - Overall satisfaction - Engagement
	Financial/Organizational metrics	*Physical metrics*	*Perceptual metrics*
(Alker, et al., 2014)	- Absenteeism - Presenteeism - Staff turnover/retention - Revenue breakdown - Medical costs - Medical complaints - Physical complaints - Task efficiency and deadlines met	Direct measures or evaluation/assessment: - Indoor air quality and ventilation - Thermal comfort - Lighting and day-lighting - Noise and acoustics - Interior layout and active design - Biophilia and views - Look and feel - Location and access to amenities	Self-reported attitudes (perceptions): - Physical health - Psychological health - Productivity - Office environment - Organizational culture
	Financial	*Functional/physical*	*Survey-based*
(Lavy, et al., 2014a, 2014b)	- Condition index - Replacement efficiency indicator – REI - Maintenance efficiency indicator – MEI	- Functional index – FI (i.e. space utilization) - [Absenteeism] - Indoor/outdoor environmental quality	- User perception (Post Occupancy evaluations)
(Lavy, et al., 2010a)	- Operating costs - Occupancy costs - Utility costs	Functional: - Productivity (turnover, absenteeism, occupants' satisfaction)	- Customer/building occupants' satisfaction with products or services - Community satisfaction and participation

Appendix

Categories **Sources**	**ECONOMIC IMPACT**	**ENVIRONMENTAL IMPACT**	**SOCIAL IMPACT**
	- Capital costs - Building maintenance cost - Grounds-keeping cost - Custodial and janitorial cost - Current replacement value - Deferred maintenance, and deferred maintenance backlog - Capital renewal - Maintenance efficiency indicators - Facility condition index - Churn rate and churn costs	- Parking - Space utilization (survey-based data) - Employee or occupant's turnover rate - Mission and vision - Adequacy of space (survey-based data) Physical: - Building Performance Index (BPI – quantitative) - Building physical condition (qualitative) - Property and real estate - Waste - Health and safety - Indoor Environmental Quality (IEQ) - Accessibility for disabled - Resource consumption – energy, water, materials - Security - Site and location	- Learning environment, educational suitability, and appropriateness of facility for its function - Appearance
	Transaction management *Lease administration*	*Facility management* *Project management* *Occupancy planning*	*Account management*
(Jordan, et al., 2009)	Transaction management: - Transaction quality score - Critical date management - Savings tracker Lease administration: - Rent processing - Schedule adherence - Data accuracy - Critical date reporting	Facility management: - Work order completion - Cost savings tracking - Energy management - End-user satisfaction Project management: - Schedule adherence - Budget management - Change order activity - Capital plan attainment Occupancy planning: - Space utilization - Churn cost - Accurate reporting	Account management: - Key stakeholder satisfaction - Budget adherence - Talent management
	Financial perspective *Learning and growth*	*Business process perspective*	*Customer perspective*
(Lindholm & Nenonen, 2006)	Financial perspective: - Financial results - Return on assets - Value of properties (book- or market-value) - Amount of sold properties	Business process perspective: - Square feet per employee - Occupancy costs - Operative costs (maintenance, energy, etc.) - Transaction costs	Customer perspective: - Customer satisfaction (with workplace and facilities among internal and external customers) - Customer satisfaction with services

Appendix

Categories **Sources**	**ECONOMIC IMPACT**	**ENVIRONMENTAL IMPACT**	**SOCIAL IMPACT**
	- Vacancy rate - Amount of leased vs. owned properties - Amount of rented properties Learning and growth perspective: - Professionalism and expertise of CREM staff - Competence of the staff - Average age - Level of education - Reward systems and motivation - Atmosphere of the community - Training and development days - Absenteeism - Turnover - Amount of R&D activities	- Return on assets - Sustainability objectives (waste, energy consumption, etc.) - Effectiveness of projects/investments (budgeting, scheduling, targets) - Business units' satisfaction with CREM performance	- Customer satisfaction with CREM department (hospitality, quick reactions, results, information, etc.) - Cost-quality ratio - Cost-quality ratio of facilities services
	Value of assets *Cost*	*Flexibility* *Marketing & sales* *Innovations*	*Productivity* *Employee/internal client satisfaction*
(Lindholm & Leväinen, 2006)	Reduce cost: - Occupancy cost - Space per employee - Whether workplace standards are used - Percentage of space occupied - Operational space vs. non-operational space - Owned and leased space - Persons per seat - Number of moves per year - Cost of underutilized space - Real estate cost per CRE employee - Total CREM operating expenditures vs. budget Increase value of assets: - Real estate cost of acquisition vs. returns/IRR - Lease vs. construction or ownership cost - Aging reports for leases - Real estate holding costs - Number of building quality audits - Real estate return on investment - Real estate return on equity - Business return on real estate assets - Sales or revenue per square foot/meter - Space (square feet/meter) per unit of revenue - Market capital vs. book value - Percentage of surplus assets sold - Time to dispose of properties vs. plan	Increase flexibility: - Percentage leased vs. total space - Length of lease terms - Use of virtual and flexible workplaces Increase innovations: - Number of teamwork settings - Number of workstations per employee Promote marketing and sales: - Distance to required transportation modes for customers - Distance to customers - Use of company logos and colors in workplace design - Image rating based on building attributes - Energy consumption - Number of energy audits - Environmental sustainability of buildings	Increase productivity: - Employees' opinions on how well the workplace supports their productivity - Distance employees commute - Distance between company sites and businesses - Time wasted with interruptions (due to open space layout) - Percentage shared service - No loss of business due to real estate service failure - Real estate spending as percent of gross margin - Real estate spending as percent of total operating expenses - Time used on RE project vs. time budgeted for projects - Money used on RE project vs. money budgeted for projects - Amount of real estate advice given to other business units - Number of service providers/service level agreements - Number of transactions/projects/leases per - FTE employee - CRE employee qualifications - Employee turnover

Appendix

Categories **Sources**	**ECONOMIC IMPACT**	**ENVIRONMENTAL IMPACT**	**SOCIAL IMPACT**
	- Cost of disposal of property vs. savings - Time to clear buildings vs. plan - Number of development projects for obsolete properties - Status of risk management activity (contaminated sites)		- Number of steps/time for real estate approval process - Use of audits for service providers Increase employee/internal client satisfaction: - Distance to required transportation modes for employees - Employee satisfaction with work environment - Quality of indoor environment (lightning, temperature, noise) - Workspace (size, shape) - Amount of nearby amenities for employees - Range of services offered by CREM - Employee/internal customer satisfaction with responsiveness of CREM - Employee satisfaction with CREM staff skills - Employee satisfaction with CREM information sharing - CREM response time to requests - Competence of CREM staff - Investment in training per CREM employee
	Business	*Space and maintenance*	*Change and general management*
(Hinks & McNay, 1999)	Business benefit: - Value for money - No loss of business due to failure in premises services - Suitability of premises and functional environment	Equipment: - Equipment provided meets business needs - Correction of faults Space: - Effective utilization of space Environment: - Satisfactory physical working conditions - Provision of safe environment - Energy performance Maintenance/services: - Management of maintenance - Reliability - Effectiveness of help desk service - Standards of cleaning	Change management: - Effective communication - Quality of end product - Responsiveness of PD to changes/requirements - Achievement of completion deadlines - Completion of projects to customer satisfaction General: - Responsiveness to problems - Customer satisfaction - Management information - Professional approach of premises staff - Competence of staff
	Financial Perspective	*Learning & Growth Perspective*	*Customer Perspective*
(Kaplan & Norton, 1996)	- Return-on-investment/ economic value added - Profitability - Revenue growth/mix - Cost reduction productivity	- Employee satisfaction - Employee retention - Employee productivity	- Market share - Customer acquisition - Customer retention - Customer profitability - Customer satisfaction
	Financial *Organizational Issues*	*Information Technology* *Space Use Efficiency*	*Performance/Productivity*

Appendix

Categories **Sources**	**ECONOMIC IMPACT**	**ENVIRONMENTAL IMPACT**	**SOCIAL IMPACT**
(Becker, 1990)	Financial: - Asset value of real estate portfolio - Income from leases and disposals - Expenses of real estate occupancy - Construction costs - Energy costs - Maintenance costs Organizational issues: - Changes in workforce size - Need to relocate employees - Ability to attract/retain staff - Security - Communication of status - Informal communication - Image to outside	Information Technology: - Networking IT - Changing location of cables - Protecting equipment - Electrical power capacity - Telecommunications Space use efficiency: - Rentable or usable/gross - Space/employee - Space/unit of income - Renovations required - Turnaround time - Change orders - Response time - Disruption	- Quality of work - Quantity of work - Absenteeism - Innovation

12.10 Interview template

Interviews are set to scout among the case studies if any tactical tools, as defined in Lindholm and Nenonen (2006), can grasp valuable data to include as KPIs for monitoring purposes.

1. Have you ever used any of the following rating tools?
    a. Gallup Workplace Audit Q12
    b. Leesman Index (LMI)
    c. Building Use Studies Methodology (BUS)
    d. Indoor Environmental Quality Survey (IEQ)
    e. WELL Building Standard
    f. The Great Place to Work
    g. Have you ever used any other certification tool?

2. When? How many times?

3. Do you think any indicators collected through this tool might/should be regularly monitored and introduced as a KPI? Which ones?

4. Have you ever performed a post-occupancy evaluation, a building-in-use study, or any other building performance analysis to support workplace management or workplace change?

5. When? How many times?

6. Do you think any indicators collected through these methodologies/tools might/should be regularly monitored and introduced as a KPI? Which ones?

12.11 Lists of indicators submitted through Questionnaire 1

Table 12-7. Indicators by category

ID	Indicators by category	#
BOM	**Building operation and management**	
BOM-1	Accessibility for disabled	
BOM-2	Aging reports for leases, Length of lease terms	
BOM-3	Building Performance Index (BPI – quantitative)	
BOM-4	Changing location of cables	
BOM-5	Competence of staff	
BOM-6	Correction of faults	
BOM-7	CREM response time to requests	
BOM-8	Deferred maintenance, and deferred maintenance backlog	
BOM-9	Effectiveness of help desk service, Response time, Responsiveness to problems	
BOM-10	Electrical power capacity	
BOM-11	Energy management, Energy consumption, Energy performance, Number of energy audits	
BOM-12	Ethics, health and safety practices (Health and safety, Provision of safe environment)	
BOM-13	Facility Condition Index	
BOM-14	Maintenance efficiency indicators (MEI)	
BOM-15	Networking IT	
BOM-16	Number of building quality audits	
BOM-17	Number of development projects for obsolete properties	
BOM-18	Number of service providers/service level agreements	
BOM-19	Number of steps/time for real estate approval process	
BOM-20	Number of transactions/projects/leases	
BOM-A	Paper consumption and use	
BOM-21	Protecting equipment	
BOM-22	Reliability	
BOM-23	Replacement efficiency indicator – REI	
BOM-24	Resource consumption (energy, water, materials), Sustainability objectives (waste, energy consumption, etc.), Environmental sustainability of buildings	
BOM-25	Security	
BOM-26	Standards of cleaning	
BOM-27	Telecommunications	
BOM-28	Time to clear buildings vs. plan	
BOM-29	Time to dispose of properties vs. plan	
BOM-30	Time used on RE project vs. time budgeted for projects	
BOM-31	Use of audits for service providers	
BOM-32	Waste	
BOM-33	Work order completion in facility management	
	Total number of indicators	**34**
BE	**Business effectiveness**	
BE-1	Achievement of completion deadlines	
BE-2	Budget adherence in account management	
BE-3	Budget management	
BE-4	Capital plan attainment in project management	
BE-5	Critical date management	
BE-6	Critical date reporting in lease administration	
BE-7	Effectiveness of projects/investments (budgeting, scheduling, targets)	
BE-8	Key stakeholder satisfaction in account management	
BE-9	Market share	
BE-10	No loss of business due to real estate service failure	
BE-11	Profitability	
BE-12	Revenue growth/mix	
BE-13	Schedule adherence in lease administration	
BE-14	Schedule adherence in project management	
BE-15	Speed and agility to rebrand, co-locate or dispose of duplicative assets	
BE-16	Speed to market of store openings	
BE-17	Task efficiency and deadlines met	
BE-18	Turnaround time	
	Total number of indicators	**18**

CO	**Cost**	
CT-1	Capital costs	
CT-2	Churn costs	
CT-3	Construction costs	
CT-4	Cost of disposal of property vs. savings	
CT-5	Cost of underutilized space	
CT-6	Cost savings tracking in facility management	
CT-7	Cost-quality ratio	
CT-8	Cost-quality ratio of facilities services	
CT-9	Custodial and janitorial cost	
CT-10	Groundskeeping cost	
CT-11	Investment in training per CREM employee	
CT-12	Lease vs. construction or ownership cost	
CT-13	Medical costs	
CT-14	Money used on RE project vs. money budgeted for projects	
CT-15	Occupancy costs, * Occupancy cost/person, * Occupancy cost/sqft, * Occupancy cost/total revenues	
CT-16	Operating costs (maintenance, utility, energy)	
CT-17	Real estate cost per CRE employee	
CT-18	Real estate holding costs	
CT-19	Real estate spending as percent of gross margin	
CT-20	Real estate spending as percent of total operating expenses	
CT-21	Rent processing	
CT-22	Savings tracker	
CT-23	Total CREM operating expenditures vs. budget	
CT-24	Transaction costs	
	Total number of indicators	**24**
EQ	**Environmental Quality**	
EQ-1	Acoustic quality, noise and acoustics	
EQ-2	Acoustics comfort	
EQ-3	Indoor air climate	
EQ-4	Indoor air quality and ventilation	
EQ-5	Indoor/outdoor environmental quality (lighting, temperature, noise)	
EQ-6	Light comfort	
EQ-7	Light quality, Lighting and daylighting	
EQ-8	Satisfactory physical working conditions (qualitative)	
EQ-9	Thermal comfort	
	Total number of indicators	**9**
PW	**Productivity/Ways of Working**	
PW-C	Accesses to the premises (number of accesses/business units/month)	
PW-1	Adequacy of space (survey based data), suitability of premises and functional environment	
PW-2	Amount of nearby amenities for employees, Location and access to amenities	
PW-3	Amount of R&D activities	
PW-4	Biophilia and views	
PW-5	Churn rate, need to relocate employees, number of moves per year	
PW-6	Customer acquisition	
PW-7	Customer profitability	
PW-8	Customer retention	
PW-9	Customer satisfaction, completion of projects to customer satisfaction	
PW-10	Distance to customers, Distance to required transpostation modes, Distance between company sites and businesses	
PW-11	Employee productivity	
PW-12	Employees' opinions on how well the workplace supports their productivity	
PW-13	Equipment provided meets business needs	
PW-14	Informal communication	
PW-15	Innovation	
PW-16	Interior layout and active design, Office design and layout	
PW-17	Learning environment, educational suitability, and appropriateness of facility for its function	
PW-18	Location analysis, Site and location	
PW-19	No loss of business due to failure in premises services	
PW-20	Number of teamwork settings	
PW-21	Organizational culture, Mission and vision, Communication of status	
PW-D	People internal and external mobility (resident vs. mobile)	
PW-22	Quality of end product	
PW-23	Quality of work	
PW-24	Quantity of work	
PW-25	Renovations required	

PW-26	Space utilization (survey based data)	
PW-B	Space utilization (workstations, meeting rooms, each type of space)	
PW-27	Space/unit of income	
PW-28	Time wasted with interruptions (due to open space layout)	
PW-29	Training and development days	
PW-30	Use of company logos and colors in workplace design	
PW-31	Use of virtual and flexible workplaces	
PW-32	Workplace impact on research and product development breakthroughs	
	Total number of indicators	**35**
SU	**Space usage**	
SU-1	Amount of leased vs. owned properties, Owned and leased space, Amount of rented properties, Percentage leased vs. total space	
SU-2	Building flexibility into the overall portfolio	
SU-3	Parking	
SU-4	Persons per seat, Number of workstations per employee	
SU-5	Rentable or usable/gross	
SU-6	Space per employee (e.g. square feet per employee)	
SU-7	Space utilization (e.g. Functional index – FI, Percentage of space occupied, Operational space vs. nonoperational space, Effective utilization of space)	
SU-8	Spatial configuration, Workspace (size, shape)	
SU-9	Vacancy rate	
SU-10	Whether workplace standards are used	
	Total number of indicators	**10**
SC	**Staff characteristics**	
SC-1	Absenteeism, presenteeism	
SC-2	Average age	
SC-3	Changes in workforce size, Full Time Equivalent (FTE) employees	
SC-4	Competence of staff	
SC-5	Distance employees commute, Distance to required transportation modes for employees	
SC-6	Employee turnover	
SC-7	Level of education	
SC-E	People means of transportation (private vs. public)	
SC-8	Physical health	
SC-9	Professionalism and expertise of CREM staff, CRE employee qualifications, Competence of CREM staff	
SC-10	Psychological health	
SC-11	Revenue breakdown (sales or revenue per square foot/meter, square foot/meter per unit of revenue)	
SC-12	Talent management, Talent attraction and retention rates	
	Total number of indicators	**13**
UA	**User attitude**	
UA-1	Appearance, look and feel	
UA-2	Effective communication	
UA-3	Employee satisfaction with CREM information sharing	
UA-4	Employee satisfaction with CREM staff skills	
UA-5	Employee/business units/internal customer satisfaction with CREM department performance (hospitality, responsiveness, quick reactions, results, information, etc.)	
UA-6	Engagement, Community satisfaction and participation, Atmosphere of the community, Reward systems and motivation	
UA-7	General perception of the building and its location	
UA-8	Image rating based on building attributes	
UA-9	Image to outside	
UA-10	Internal and external customers/end users/building occupants' satisfaction with workplace and facilities, products or services, Customer experience	
UA-11	Medical complaints	
UA-12	Overall employee satisfaction	
UA-F	Perception of colors	
UA-G	Perception of privacy	
UA-13	Physical complaints	
UA-14	User perception (Post Occupancy evaluations)	
	Total number of indicators	**16**
VRY	**Value/Return/Yield**	
VRY-1	Business return on real estate assets, return on assets	
VRY-2	Current replacement value	
VRY-3	Financial results	
VRY-4	Income from leases and disposals	
VRY-5	Real estate cost of acquisition vs. returns/IRR	
VRY-6	Real estate return on equity	

VRY-7	Real estate return on investment	
VRY-8	Return-on-investment/economic value added	
VRY-9	Value for money	
VRY-10	Value of properties (book or market value), Asset value of real estate portfolio, Market capital vs. book value	
	Total number of indicators	**10**
	Total number of indicators	**169**

12.13 Questionnaire 1

DEMOGRAPHIC DATA

- Your gender
- Your age
- You make use of the company's building as: [drawn from Phase I analysis of workplace users]
    - Owner/President/CEO
    - Office financial administration
    - Designer/architect/engineer involved in building design or revamp
    - Corporate Real Estate Management
    - Facility Management
    - Human Resources
    - ICT Department
    - Executive/Top manager in other departments of the same company
    - Employee/Clerical in other departments of the same company
    - Consultant/Collaborator/Internee
    - Other (Visitor, Customer) > *Define your role as a user of the building*

"IMPORTANCE: SELECTING PERFORMANCE INDICATORS" – on the long list built up from literature (168 indicators)

NB: The requirement for selection is that the indicators should be of mutual interest, as in Hinks & McNay (1999). The ones considered of local interest should be discarded (and then potentially treated internally by separate departments).

1) How important are to you the following indicators?
    - Essential (Hinks & McNay, 1999) ●●●
    - Desirable (Hinks & McNay, 1999) ●●○
    - Of tertiary importance (Hinks & McNay, 1999) ●○○
    - I do not know, I do not understand this indicator
2) *Do you have any additional indicator/metric in mind that you would like to suggest as essential?*

12.14 Indicators discussed in the focus groups/interviews

Table 12-8. Indicators rated as essential by more than 23 people (Italian)

Categoria	ESSENZIALE > 20	Voti	N.
Qualità dell'ambiente	COMFORT DELL'ILLUMINAZIONE (SOGGETTIVO)	37	43
Operatività e gestione dell'edificio	ACCESSIBILITÀ AI DISABILI	36	
Qualità dell'ambiente	COMFORT ACUSTICO (SOGGETTIVO)	36	
Operatività e gestione dell'edificio	ETICA, SALUTE E SICUREZZA FISICA (SALUTE E INCOLUMITÀ DELLE PERSONE, SALUBRITÀ DELL'AMBIENTE)	35	
Qualità dell'ambiente	COMFORT TERMICO (SOGGETTIVO)	35	
Qualità dell'ambiente	CONDIZIONI FISICHE DI LAVORO SODDISFACENTI (QUALITATIVO)	34	
Qualità dell'ambiente	QUALITÀ DELLA LUCE, ILLUMINAZIONE E LUCE DIURNA (OGGETTIVO)	34	
Operatività e gestione dell'edificio	CONNETTIVITÀ IT	33	
Operatività e gestione dell'edificio	COMPETENZA DEL PERSONALE (ADDETTO ALLA GESTIONE DEL BUILDING)	32	
Qualità dell'ambiente	CLIMA DEGLI AMBIENTI INTERNI (OGGETTIVO)	32	
Qualità dell'ambiente	QUALITÀ DELL'ARIA INTERNA E VENTILAZIONE (OGGETTIVO)	32	
Operatività e gestione dell'edificio	AFFIDABILITÀ (DEL SERVIZIO DI MANUTENZIONE)	30	
Qualità dell'ambiente	QUALITÀ DELLA PERFORMANCE ACUSTICA, RUMORE E ACUSTICA (OGGETTIVO)	30	
Costi	COSTI DI ESERCIZIO (MANUTENZIONE, UTENZE, ENERGIA, ECC.)	29	
Qualità dell'ambiente	QUALITÀ DELL'AMBIENTE INTERNO ED ESTERNO (ILLUMINAZIONE, TEMPERATURA, RUMORE) (OGGETTIVO)	29	
Produttività e modi di lavorare	ADEGUATEZZA DELLO SPAZIO (BASATO SU QUESTIONARI), IDONEITÀ DELL'EDIFICIO E FUNZIONALITÀ DELL'AMBIENTE DI LAVORO	29	
Operatività e gestione dell'edificio	EFFICACIA DEL SERVIZIO DI HELP DESK, TEMPO DI RISPOSTA, CAPACITÀ DI RISPOSTA AI PROBLEMI	28	
Operatività e gestione dell'edificio	TELECOMUNICAZIONI	27	
Produttività e modi di lavorare	ADEGUATEZZA DELL'ATTREZZATURA A DISPOSIZIONE RISPETTO AI BISOGNI DEL BUSINESS	27	
Operatività e gestione dell'edificio	STANDARD DI PULIZIA	26	
Efficacia del business	GESTIONE DELLE SCADENZE RILEVANTI	26	
Atteggiamento degli utilizzatori	ENGAGEMENT, SODDISFAZIONE DELLA COMUNITÀ E PARTECIPAZIONE, ATMOSFERA DELLA COMUNITÀ , SISTEMA DI RICOMPENSE E MOTIVAZIONE DEI DIPENDENTI	26	
Produttività e modi di lavorare	PRODUTTIVITÀ DEI DIPENDENTI	25	
Caratteristiche del personale	SALUTE FISICA	25	
Caratteristiche del personale	SALUTE PSICOLOGICA	25	
Atteggiamento degli utilizzatori	COMUNICAZIONE EFFICACE	25	
Atteggiamento degli utilizzatori	IMMAGINE VERSO L'ESTERNO	25	
Atteggiamento degli utilizzatori	SODDISFAZIONE GENERALE DEI DIPENDENTI	25	
Operatività e gestione dell'edificio	SICUREZZA (VIDEOSORVEGLIANZA, TELECONTROLLO, ANTINTRUSIONE, ANTIEFFRAZIONE, ECC.)	24	
Efficacia del business	EFFICIENZA NELL'ESPLETAMENTO DI COMPITI E RISPETTO DELLE SCADENZE	24	
Produttività e modi di lavorare	NESSUNA PERDITA DI FATTURATO CAUSATA DA INADEMPIENZA DEI SERVIZI ALL'EDIFICIO	23	
Utilizzo dello spazio	NUMERO DI PERSONE PER POSTAZIONE, NUMERO DI POSTAZIONI PER DIPENDENTE	23	
Operatività e gestione dell'edificio	Correzione degli errori (malfunzionamenti)	22	
Produttività e modi di lavorare	Innovazione	22	
Utilizzo dello spazio	Spazio per dipendente, Metri quadri per dipendente	22	
Atteggiamento degli utilizzatori	Percezione della privacy	22	
Operatività e gestione dell'edificio	Consumo di risorse (energia, acqua, materiali), Obiettivi di sostenibilità (rifiuti, consumo di energia, ecc.), Sostenibilità ambientale degli edifici	21	
Efficacia del business	Rispetto delle scadenze nel project management	21	
Produttività e modi di lavorare	Utilizzo dello spazio (postazioni di lavoro, sale riunioni, ogni tipo di spazio)	21	
Utilizzo dello spazio	Parcheggio	21	
Caratteristiche del personale	Assenteismo, Presenza	21	
Caratteristiche del personale	Competenza del personale	21	
Caratteristiche del personale	Professionalità ed esperienza del personale della funzione di gestione immobiliare (Real Estate), Qualifica dei dipendenti di Real Estate, Competenza del personale di Real Estate	21	
Valore/Ritorno/Redditività		0	

Table 12-9. Indicators suggested by participants (Italian)

Operatività e gestione dell'edificio	* Numero di richieste avanzate vs. numero di richieste evase con timing	1	**6**
Operatività e gestione dell'edificio	* Numero di audit mensili	1	
Operatività e gestione dell'edificio	* Response time	1	
Operatività e gestione dell'edificio	* Resolution time	1	
Operatività e gestione dell'edificio	* Costo per intervento in correttiva	1	
Altro	* Applicazione e analisi di tecniche di valutazione dei servizi di tipo TNPS (Transactional Net Promoter Score)	1	

12.15 Focus group/Interviews

"CATEGORIZATION, CLASSIFICATION AND DEFINITION" – on the shortlist of performance indicators pulled up from Questionnaire 1

1) Do you agree or not agree with the proposed categorization of the KPIs? If not, please suggest how you would pursue this issue. [derived from Lavy, et al. (2010a)]
   The nine categories can be described as follows:
   1. Building operation and management: contains metrics related to maintenance, security and safety, energy and resource management, and data related to the premises' daily functioning.
   2. Business effectiveness: expresses the efficiency and effectiveness of the business activity.
   3. Costs: collects all cost-related data.
   4. Environmental Quality: has to do with physical parameters, both quantitative and qualitative, identifying environmental conditions.
   5. Productivity and ways of working: describes how people carry out their daily activities, their workstyles, and the adequacy of the spatial environment to their needs.
   6. Space usage: takes into consideration physical parameters of the space as well as the way it is utilized.
   7. Staff characteristics: embraces demographics and other objective/quantitative information related to company's personnel.
   8. User attitude: includes subjective/qualitative measures about internal employees' and external customers' impressions, feelings, and engagement with respect to their daily work, the company more in general, the location of the office building and its image.
   9. Value/Return/Yield: embraces indicators involving financial results of the company.

2) Do you agree or not agree with the proposed classification (social, environmental, economic impact) of the KPIs? If not, please suggest how you would pursue this issue. [derived from Lavy, et al. (2010a)]
   The three classes can be described as follows:
   - Economic-financial/organizational indicators have an overriding impact on the economic activity of the company (e.g. building value, business value, market power) and have a direct influence on the financial objectives and organizational values of the company.
   - Environmental indicators have an overriding impact on the physical environment (e.g. sustainability, land consumption, use of resources) and have a direct influence on the environmental objectives/values of the company.
   - Social indicators have an overriding impact on the people/workers (e.g. wellbeing, satisfaction, quality of life) and have a direct influence on the social objective/values of the company.

3) Are there indicators in the list that you deem useful to rephrase for more clarity, or that you think could be erased because they are not of interest for all workplace users?

Appendix

	Classe – Impatto/Valore		
Categoria	**Economico-finanziario/organizzativo**	**Ambientale**	**Sociale**
Qualità dell'ambiente		• Comfort dell'illuminazione • Comfort acustico • Comfort termico • Condizioni fisiche di lavoro soddisfacenti (qualitativo) • Qualità della luce, illuminazione e luce diurna *(quantitativo)* • Clima degli ambienti interni *(quantitativo)* • Qualità dell'aria interna e ventilazione *(quantitativo)* • Qualità della performance acustica, rumore e acustica (quantitativo) • Qualità dell'ambiente interno ed esterno	
Operatività e gestione dell'edificio		• Accessibilità ai disabili • Etica, salute e sicurezza fisica (Salute e incolumità delle persone, salubrità degli ambienti) • Connettività IT • Competenza del personale *(addetto alla gestione del building)* • Affidabilità • Efficacia del Servizio di help desk, Tempo di risposta, Capacità di risposta ai problemi • Telecomunicazioni • Standard di pulizia o Sicurezza (videosorveglianza, telecontrollo, antintrusione, antieffrazione, ecc.) - Numero di richieste avanzate vs. numero di richieste evase con timing - Numero di audit mensili - Response time - Resolution time	
Utilizzo dello spazio		o Numero di persone per postazione, Numero di postazioni per dipendente	
Efficacia del business	• Gestione delle scadenze rilevanti o Efficienza nell'espletamento dei compiti e rispetto delle scadenze		
Costi	• Costi di esercizio (manutenzione, utenze, energia, ecc.) - Costo per intervento in correttiva		
Valore/ritorno/redditività			
Produttività e modi di lavorare		• Adeguatezza dell'attrezzatura a disposizione rispetto ai bisogni del business	• Adeguatezza dello spazio (basato su questionari), idoneità dell'edificio e funzionalità dell'ambiente di lavoro • Produttività dei dipendenti o Nessuna perdita di fatturato causata da inadempienza dei servizi all'edificio
Atteggiamento degli utilizzatori			• Engagement, Soddisfazione della comunità e partecipazione, Atmosfera della comunità, Sistema di compensazione e motivazione dei dipendenti • Comunicazione efficace • Immagine verso l'esterno • Soddisfazione generale dei dipendenti
Caratteristiche del personale			• Salute fisica • Salute psicologica - Applicazione e analisi di tecniche di valutazione dei servizi di tipo TNPS (Transactional Net Promoter Score)

"METHODS AND TECHNIQUES FOR DATA COLLECTION"

1) Which of the following techniques you think is more effective and efficient for gathering the data the following indicators incorporate (you can comment on more than one): [list drawn from Becker (1990), except *]
    - **Observation**: Causal observation, chatting; Systematic observation; Indirect observation – looking for traces of behavior, e.g. how people arrange furniture, how people are dressed, how people use equipment, and so on; Plan analysis – detailed analysis of plans to determine the amount of available space, distance and proximity between different functional areas or other paths within the building
    - **Interviews and questionnaires**: Interview – individual or group (i.e. focus group), formal (i.e. with a predefined list of questions) or informal (i.e. simply asking people about their views on the same topic, but without set questions); Surveys – questionnaires (either short or long, open-ended or closed-ended questions)
    - **Instrument readings and archival logging**: Instrument readings – temperature and humidity controls, computerized reports of number and location of phone calls, motion sensors that indicate whether a room is occupied, badges or proximity card readers that print out who has entered a particular location and at what time; Archival data and logging – cost and personnel data, e.g. why people joined or left a firm, cost of furniture and equipment, cost of consultants and contractors, work-related grievances/complaints, absenteeism, turnover, health problems; Computer logging and inventory – reservations of spaces such as meeting rooms or conference rooms
    - *** Person-integrated devices**: Mobile phone apps, trackers (geo-location inside and outside the building; fit bit data, e.g. steps per day, heart rate, sleeping hours; apps that ask for feedback, e.g. car to go, enjoy, tripadvisor, yelp, fourthsquare)
    - *Other*

"FREQUENCY OF DATA COLLECTION AND REPORTING"

1) How often do you think the following indicators should be measured? [suggested by Becker (1990)] How often do you think the following indicators should be reported to all workplace users? [suggested by Becker (1990) and Jordan et al. (2009)]
    - In real-time
    - More than once a day
    - Daily
    - Weekly
    - Monthly
    - Periodically (every quarter/semester)
    - Yearly
    - Ad-hoc
    - Pre-post move/refurbishment
    - *Other*

“GENERAL QUESTIONS”

1) **Roles, responsibilities and competences:** Do you think these indicators should be controlled by a new and different professional or do you believe that a periodical meeting between all those in charge for data collection would be enough to keep the building performance under control?

2) **Longevity:** How long do you think the selected list of indicators should reasonably last? Do you think the same process carried out to set up the list we have discussed should be carried out on a regular basis to verify the list of indicators and potentially update it in relation to the emerging needs? If yes, how often?

3) **Communication:** What way is the most effective to distribute information on these indicators in an integrated way to all workplace users (e.g. periodical brochure available to internal and external people, interactive maps on the intranet, annual meeting, videos to circulate on screens all around the building, mobile notification, etc.)?

12.16 Questionnaire 2

"PRIORITIZATION" – process suggested by both Hinks and McNay (1999) and Becker (1990)

2) Attribute a level of priority from 1-low to 7-high to the indicators listed below.
3) Do you want to add any indicator to the list?
4) Do you want to add any comments?

"MEASUREMENT"

1) Does your company currently measure the indicators listed below?
    - YES, MY DEPARTMENT TAKES CARE OF THE MEASUREMENT
    - YES, BUT THE MEASURMEENT IS NOT IN CHARGE TO MY DEPARTMENT
    - NO
    - I DO NOT KNOW
2) Do you want to add any indicator that your company already measures?
3) Do you want to add any comments?