The WCO Guide to:

Utilisation and Occupancy Studies

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Executive summary

The WCO has created this *Guide to Utilisation and Occupancy Studies* to help clients understand when and how to use such studies. The guide aims to demystify the language, process and interpretation of utilisation studies and to help clients make the most of their workplace consultants' expertise.

The guide starts by comparing different types of studies with familiar names and abbreviations such as Time Utilisation Surveys (TUS), Space Analysis and Activity Based Working (ABW). It acknowledges that these studies are usually carried out by clients seeking evidence to support a case for desk sharing and thus cost saving through reduction in the amount of workspace needed to accommodate the same number of people. The guide goes on to describe mainly how utilisation and occupancy studies can help determine the answer to the key question for many clients which is "How many desks do I need?". However, in describing how utilisation studies are carried out and the way the results can be analysed the guide makes a strong case for clients to be aware of the need to delve into the data in more detail to understand how space is used by occupants for different activities at different times of the day, and how personal preferences and changing work habits will impact longer term use patterns.

The guide defines "utilisation" as "the average amount of time different types of spaces are occupied", and contrasts "utilisation" with "occupancy" and other terms commonly used in workplace studies which are also defined. A brief history of utilisation studies shows how techniques have developed from observational studies through different types of automated data collection. From paper to PC monitoring to people tracking the pros and cons of different survey methods are presented so a client can make a judgement, with the help of their consultant, about what will work best for them in terms of cost, scalability accuracy, granularity and invasiveness. Currently the main debate in utilisation studies is around using automated sensors rather than observers and the guide dwells on the advantages and disadvantages of most commonly used automated methods.

The process for set-up, survey and data presentation are described simply with illustrations, and the section on data interpretation explains why utilisation data may not be as simple to understand as it at first appears. This section is especially valuable as it will help a client understand and, better still, explain to the business why certain target utilisation rates have been chosen and why they vary from one division to another, and what that means in terms of number of desks and the need for other flexible facilities, technology infrastructure and cultural working practice changes.

In conclusion:

- In utilisation studies terminologies are often confusing and better definition would be helpful – this guide defines terms and will help the client describe its requirement and understand proposals better.

- The process of undertaking utilisation studies requires choices to be made; in particular about survey methodologies – the guide helps clients understand the pros and cons and what would work best for them.

- Understanding and comparing the data produced by utilisation studies is not straightforward and depends on the parameters and method of the study – the Guide describes how changing the parameters or method impacts on the results and how, for example, desk-share ratios will vary depending on the scale and time periods over which surveys are done.

- Interpreting the data produced by utilisation studies as an indicator of future space provision and staff to desk ratios is ultimately a matter of judgement based on evidence and experience as well as numerical data – the guide discusses factors such as teams and personal choice, technology constraints, variations in work activities and evolving future working practices and draws some conclusions about appropriate utilisation levels for a range of different types of space.

- For the future, as work migrates more and more beyond the walls of the office using mobile devices and ubiquitous connectivity utilisation studies will have to evolve to take account of the whole network of places in which people work. It is possible that by using automatic sensing and real-time data streaming workplace analysts and their clients will be able to answer the questions "Where do people go to work, and why?" and so be able to predict the appropriate mix of workplaces in a portfolio that's both efficient in terms of cost and effective in terms of fitness for purpose.

1.0 Introduction

1.1 Aims of this guide

Due to the current focus of the Corporate Real Estate Executive and Facilities Manager being cost avoidance, and due to the growing popularity of agile and flexible working, the use of utilisation studies to help maximise space efficiency is increasing. Despite utilisation studies being carried out since the 1980s there is no standardisation in the terminology used, survey methodology, data analysis, or presentation of results. The aim of this Workplace Consulting Organisation (WCO) paper is to provide guidance on how to commission and interpret utilisation studies.

At this stage, it is not the intention of the WCO to create a standardised approach to conducting, interpreting and presenting utilisation studies. Many consultancies now offer an occupancy and utilisation study service and many have developed their own unique approach to providing the data that is required by the occupying organisation to allow them to progress further. The guide is more to do with highlighting common variations in approach such that the results from different utilisation studies may be understood and compared.

1.2 Purpose of utilisation studies

Utilisation or occupancy studies, sometimes referred to as Time Utilisation Surveys (TUS) or space observation studies, are survey methods which determine how much the available spaces in a workplace are occupied across the working week. These studies are generally used to provide evidence to support implementing desk sharing as part of an agile or flexible working environment. Implementing desk sharing will in turn release desks, which will reduce the space actually required by the current office population, or the vacated desks may be used to accommodate more occupants in the same space.

A utilisation study helps determine the number of desks that are required to support a mobile workforce, which in turn may inform the design brief and space requirements schedule (space budget) for a new workplace. Alternatively, the studies will indicate the on-going utilisation of the workplace which can help with the management of the workplace and, for example, inform the allocation of desks per business unit or the level of meeting space required. The results of a utilisation study are most often used to provide hard evidence to a business unit on how they use their space and persuade them to use it more efficiently.

In contrast to space analysis, which focuses on the how efficient the space is planned – akin to a 2-dimensional approach, the utilisation study is more concerned with how the space is used over time – in effect a 3-dimensional approach.

Apart from highlighting poor or ineffective utilisation of space, the results of utilisation studies may also provide the basis for understanding and defining the various workstyles of the workforce with the object of providing the most effective environments, tools and support mechanisms for productive working.

More detailed studies, which include an analysis of the work activities, may also be used to determine the type, size and number of a range of work-settings, such as meeting and breakout space, as well as storage, IT and FM provision and support services. An analysis of work activities used to forecast different space needs is often referred to as "activity based working".

2.0 Utilisation and occupancy study terminology

The WCO notes that:

> "*utilisation level usually refers to the average amount of time that different types of spaces are used*"[1]

where the different spaces refers to personal or allocated spaces, for example desks and offices, or common/shared spaces, such as meeting areas and breakout space.

The term "occupied" tends to indicate the amount of time that the space (usually the desk) is simply occupied by a person or not – a binary analysis. Whereas "utilised" often refers to a number of states including the time that the space: i) is physically occupied by a person, ii) appears occupied but no person is actually present, termed "temporarily unoccupied", iii) is being used for active equipment/PCs, or iv) is cluttered and/or not suitable for use. More detailed studies may record the different activities taking place in the space e.g. computer use, telephone operation, face to face meetings.

However, how the terms "occupancy", "occupied", "utilised" and "utilisation" are used is not currently standardised. For example, the term "occupancy study" sometimes refers to different types of workplace surveys including space analysis, or density studies, and occupant feedback surveys such as post occupancy evaluations. Furthermore, in the education sector utilisation is considered the product of frequency and occupancy, where frequency is the percentage of time that a room is in use and occupancy refers to the number of seats occupied as a percentage of the total available[2]. Whilst this approach could also be adopted for meeting rooms in offices, for simplicity the frequency and occupancy data tends to be presented separately.

As there is no industry standard terminology, caution is required when interpreting utilisation study results. The WCO recommends that for workplaces other than learning environments the following definitions are applied:

- "Occupied" refers to measurement or observation of the time a person is present in the space, regardless of their activity;

- "Utilised" or "in use" refers to observation of when a person is both present or when there are signs of occupancy but no one is physically present;

- "Occupancy level" refers to the number of occupants present in the building, it may be expressed as the peak or average percentage of occupants, typically across a week or possibly across another specified time period;

- "Utilisation level" refers to the average amount of time that the building is in use; the utilisation may be calculated for different types of spaces or floors within the building and may also broken down by how these spaces are used by different departments or grades of people etc.

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[1] *WCO Occasional Paper 2: The WCO Guide to a Glossary of Workplace Terms.* Workplace Consulting Organisation, November 2012.

[2] *UK Higher Education Space Management Project: Promoting Space Efficiency in Building Design.* Space Management Group, March 2006.

Occupancy level provides one overall figure of building occupancy, averaging departments etc. In contrast, the utilisation level refers to time and space use across different areas of the building so usually provides a finer grain of detail than an occupancy level. For example, a building which is provided to accommodate 100 employees but is regularly used by only 80 people would have an occupancy level of 80%. If all 80 people spend their whole working week at their desk then the desk utilisation level would be 80%. However, it is likely that the 80 people will spend some time during the week away from their desk, in meetings or working on other areas, so the desk utilisation would probably be lower than 80%.

Other terms to look out for in utilisation studies are as follows. For further definitions refer to *The WCO Guide to Workplace Terms*[1].

- *Activity Based Working (ABW) –* A term that has come to describe the alignment of observed work activities with work settings or spaces.

- *Alternative work settings –* These are collaborative and individual work settings within which work occurs, e.g. a quiet room for concentrated work, a soft seating area for informal collaboration.

- *Core day –* The core working hours e.g. 09:00-17:30, excluding the lunch period. Often utilisation surveys are carried out from 08:00-18:00 but including measurements outside of the core day will artificially reduce the observed utilisation level.

- *Empty and vacant –* Unfortunately these terms are used differently by different consultants. Quite often "empty" and "vacant" means that the space is unoccupied i.e. it looks in use but there is no one present. However, these two terms sometimes mean that the desk is unallocated or it that it is not suitable for use.

- *In use –* Depending on the consultant, this term may refer to the spaces "occupied" or to the spaces "utilised"; the latter is preferred.

- *Maximum capacity –* A term used to refer to the desk population that could be accommodated in a building within legislative planning constraints dictated by toilet numbers, building services and fire egress.

- *Peak occupancy –* The highest number of people in the building during the (studied) week. It usually includes staff and visitors at desks, in offices and in meeting rooms. Some consultants may refer to peak desk occupancy only.

- *Sharing ratio –* Also referred to as desk sharing, it is the actual or projected number of occupants to desks. The ratio may be expressed as occupants per desk or desk per occupant, for example 10:8 may mean 10 staff per 8 desks (but may sometimes mean 8 staff per 10 desks).

3.0 History and development

3.1 Overview

Utilisation studies have often been confused with time and motion studies, which have been carried out since the 1950s. Time and motion studies are a business efficiency technique used to establish standard times to carry out a work task with a view to improving work methods and systems.

In contrast, the earliest published utilisation study that investigated how space in offices was used over time was carried out in the late 1980s on behalf of IBM to support their SMART workplace project. The original methodology, termed the Time Utilisation Study (TUS), was developed by DEGW. This methodology was adopted and/or developed by other workplace consulting practices, such as AMA Alexi Marmot Associates who developed their own Space Observation Survey (SOS) for IBM and other clients.

Since then a variety of different approaches to studying the use of space and investigating work patterns has evolved. They range from 'cheap and cheerful' responses in questionnaires, field studies using spot checks of desk utilisation once or twice a day, to technologically more sophisticated tools to detect real time utilisation from access systems, chair sensors and RFID tag. There is no single direction of development; clients and their advisors recognise that different approaches are appropriate for different questions, different contexts and different goals.

3.2 Observation studies

IBM's original idea was to observe a range of workspaces in a building a number of times over the working day, so as to be able to build up a pattern of the use of the workspaces. Observations were recorded manually on a paper form and were later entered into a spread-sheet for analysis.

It quickly became clear that this utilisation tool could go beyond measuring just occupancy to describe the work patterns of staff using a given space and the work activities taking place. The amount of solo work or face-to-face interaction occurring in the space, the technologies in use, and crucially, how often workspaces are "temporarily unoccupied" are all recorded. Temporarily unoccupied is when the occupant is elsewhere in the building but the desk is occupied by their belongings; it has since proved of great value in accurately assessing an organisation's capacity for desk sharing. As mentioned, the type of work activity is recorded in some utilisation studies, particularly those being used to explore "activity based working" space models.

Utilisation studies now also include meeting rooms and breakout areas, and as alternative workspaces such as study booths, project rooms, and meeting rooms were introduced, they too have been included. In this way, utilisation surveys have been used to assess the success of a whole workplace, identifying which spaces are under-utilised or are well-used and in short supply.

Since the early paper-based survey, many organisations now collect data using small handheld electronic devices, such as PDAs or computer tablets. Some of these organisations use desk numbers, some use route descriptions, and other use space plans to guide the observers. Recent developments in utilisation surveys include the transmission of data as it is collected, via Wi-Fi or 3G, to a central database. This offers the possibility of monitoring data during the study so that any oddities can be detected and investigated.

At the opposite extreme to these technology-based approaches some organisations are carrying out occasional, one-off counts of how many workspaces are occupied. Such studies, sometimes referred to as a body count or "bed check", provide a crude but still potentially useful indication of workspace occupancy.

3.3   Automated data collection

One disadvantage of the above utilisation surveys is that they rely on regular visits by observers and are carried out for relative short periods of time. Several automated approaches have therefore been developed during the last decade. These methods allow data to be collected more frequently; there is little additional cost for longer studies but the initial set up may be expensive if the system requires the installation of additional sensors and new networks in the building. Some common approaches are described below.

1. *Swipe card/turnstile data* – The simplest means of gauging workspace occupancy is to count people coming into and leaving the building, floor or specific area, using swipe card or turnstile data. These studies provide longitudinal data and require no special infrastructure if relevant security systems are in place. However, they assume all staff are at their desks rather than elsewhere in the building so tend to over-estimate desk utilisation, and there may be inaccuracies if the staff don't swipe in or tailgate. Also the data is not always readily available in a format suitable for analysis.

2. *People counters* – Technology can also be installed to count the number of people using a particular area. Examples include PeopleCounter, marketed by PeopleCube, and I-Count from CountWise. Both these systems use video imaging and shape recognition to count the number of people entering and exiting an area. An alternative approach is to install passive infra-red sensors that recognize and count people via their thermal footprint. Two examples are Johnson Controls' thermal people counters and SensSource sensors monitored by EMS's AttendanceTracker.

3. *IP monitoring* – Computer processing can be used to monitor desk occupancy, by identifying the desk using the computer's IP address. The hours a computer is switched on, or when the computer is being actively used (processing time) can be recorded, using embedded software by, for example, AWA and Asure. These systems require that the computer is attached to a physical network; therefore the location of laptops on a wireless network is not captured. Furthermore, many organisations will not release data that allows an individual's activity to be identified. Other systems are

available which use different types of "presence events", such as Agilquest OnBoard which monitors Voice Over Internet Protocol (VOIP) phone activity.

4. *Sensor systems* – Occupancy measurement systems based on sensors and/or electronic infrastructure have become increasingly popular over the past five years or so. Such approaches use movement sensors, pressure detectors, infrared sensors, temperature monitors or some combination of these, communicating with data loggers via wireless signals. Three examples of these systems are:

- Abintra's Wisenet system, which is based on wireless sensors fitted to each observed space; these sensors continuously monitor occupancy based on a combination of movement and body heat;

- Johnson Controls have developed a desk-mounted device using passive infra-red (PIR) sensors to monitor both movement and body heat;

- Herman Miller's "mote" system, which is based on motion sensors attached to chairs, desk undersides or other work surfaces.

3.4 People tracking

Tangentially related to methods for measuring space use are methods for tracking or monitoring people. These are useful for rather different purposes, most notably the development of workstyles to identify how and where people work. Methods for monitoring people can range from simple but very labour-intensive "people tracking" (observers following and recording the activities and location of particular individuals) to sophisticated automated systems.

The Sentient Computing system developed in the early 2000s by Ubisense, for example, used wireless electronic tags (which people wore or carried) to locate people and identify their use of equipment such as laptops, printers and telephones. However, the installation of the network of sensors was a significant undertaking and this system has not been adopted as a standard means of monitoring space use. However, conceptually similar systems are currently available, such as Hitachi's Business Microscope, in which the staff wear sensors detecting motion and face-to-face interaction, allowing the system to combine occupancy measurements with social network analysis.

An increasingly popular approach to monitoring people is to use self-reporting systems in which people record what their activity and location is at particular times; such methods often use pagers or PDAs/mobile phone technology to "bleep" people when a recording is due. Future developments along these lines are likely to include the use of apps on mobile phones, so that no special hardware is needed. In addition, GPS could be used to provide a better understanding of mobile working when people are away from their office building.

3.5 Preliminary ratio-based modelling

It is important to understand the purpose of utilisation studies and when to administer them. At the early stages of considering agile working, it is worthwhile conducting simple ratio-based modelling to determine the possible outcome of implementing desk sharing, and the associated benefits, before doing any actual monitoring.

Many workplace consultancies now have benchmark data which will indicate the typical utilisation levels (norms) for different functions and industry sectors. Such data can be used to determine indicative desk and space requirements.

3.6 Simulation modelling

More recently, a new approach using computer-based mathematical simulation and yield management taken from the airline and hotel industries has been applied to workspace forecasting. Taking simple staff and workstyle data as input, this produces an estimate of average and peak workstation use by generating multiple scenarios.

For example, Cambridge Architectural Research has validated their *Space Time Simulation* of desk occupancy at nine sites, producing results within a few percentage points of observation. While theoretical, this method is less expensive than observation and has some additional features: i) it provides estimates of the risk of overcrowding or queuing, and ii) can engage occupant management in exploring "what if" questions about workplace change.

4.0 Advantages and disadvantages of utilisation methods

Determining the usefulness and practicality of each method of measuring utilisation is dependent upon a number of factors:

- *cost* – the cost of setting up and completing the study;

- *scalability* – whether the method can be applied as easily to 1,000 as 100 desks and spaces;

- *accuracy* – how well the method reflects the actual occupancy of the space across the working year;

- *granularity* – the level of detail in terms of the frequency of measurement and/or the ability to pinpoint specific spaces;

- *invasiveness* – how much the method interrupts the occupant or infringes on perceived privacy.

The pros and cons of the main methods are summarised in the table below.

| Method	Cost	Scalability	Accuracy	Granularity	Invasiveness	Comments
Paper-based observation studies	🟡	🟡	🟢	🟢	🔴	Paper entry makes a good back-up if copied. Post survey data entry can delay delivery of results
Electronic observation studies	🟡	🔴	🟢	🟢	🔴	Error trapping or monitoring is available. Can be longer and more expensive than paper to set up
Body count or "bed check"	🟢	🟡	🔴	🔴	🟡	"Cheap and cheerful" but cannot be used for workstyle profiling or detailed analysis of work patterns
Swipecard or security data	🟢	🟢	🔴	🔴	🟢	Prone to inaccuracy due to tailgating, the data may not be readily available, and no detail of floor or desk usage
People counters	🔴	🟡	🔴	🔴	🟢	Covers a wide area of space or entrance so no detail of desk usage available or of work activities
IP/PC/VOIP monitoring	🔴	🟢	🟡	🔴	🔴	Lack of PC processing activity does not zero activity plus no data collected on non-desk spaces
PIR sensor systems	🔴	🟡	🟢	🟡	🟡	Expensive to set up but cost-effective for long-term monitoring; occupancy rather activity data only.
People tracking	🔴	🔴	🔴	🟡	🔴	Unreliable as sensors not always carried by occupants; considered obtrusive and privacy infringement.

🟢 = good, 🟡 = okay, 🔴 = poor

Table 1   Summary of utilisation study methods

One drawback of the paper-based approach compared to observation with electronic devices is that post-project data entry introduces delay and errors. Electronic devices allow the data to be automatically entered into a format suitable for analysis when the observation is made. These devices also reduce the possibility of observer error by clearly describing the route and each space to be observed, and more recently by live tracking of the data entry. The downside is that the set-up can be more timely and costly, although more recent systems which take advantage of existing CAD plans have helped reduce the set-up time.

Currently the main debate in utilisation studies is around using automated sensors rather than observers. Sensors are generally more expensive to set up and more expensive overall unless monitoring longer-term - the breakeven point is currently around six weeks. The sensors are non-invasive, i.e. no disruption from observers, so unlikely to change behaviour but may be considered an infringement of privacy if constantly being monitored in secret. The sensors collect binary occupied/not-occupied data so there is no understanding of work activities. Like observation studies all work settings can be monitored and the sensors can offer finer granularity by monitoring shorter time periods, e.g. minutes rather than hourly observations.

The recent trend of monitoring PC processing as a proxy for utilisation is being met with mixed views. Whilst the system is non-invasive, as it does not require observers or sensors, it is nevertheless perceived by some as an infringement of privacy. This is because the system monitors an individual's work activity rather than occupancy. As a consequence many companies will not actually release the data in a form where individual desks can be analysed, and only the utilisation of groups can be calculated. Of course, just because a desktop PC is not being used, it does not mean the desk is not in use. As the system is based on IP addresses, it cannot pick up visitors and consultants etc using different system or laptops. Furthermore, only desk utilisation is monitored whereas spaces such as meeting rooms are not. Like the sensors, the system offers more regular data sampling. The WCO has no data on costs but it is suspected that like sensors it is more expensive to set up and therefore more suitable for longer-term desk monitoring.
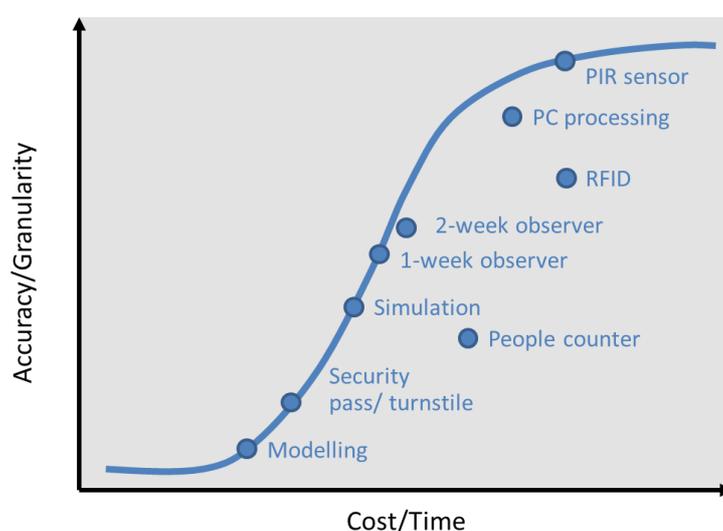
Figure 1   *Indicative benefits versus cost of utilisation study methods*

Figure 1 illustrates the relationship between cost and set-up time against accuracy and granularity for the various utilisation methods. Automated methods can offer more frequent and categorical measures of occupancy at a cost. However, their accuracy and granularity is reduced if the researcher is interested in measuring work activity rather than simply presence.

Advocates of Activity Based Working (ABW) argue that observing occupancy levels alone is not sufficient for informing the design of new working environments or create new space elements that support users and their activities in different and better ways. If the activities are known then new ways of supporting different activities with adapted environments (activity blocks) and better integrated ICT equipment can be proposed. ABW practitioners would say that activity measurements are necessary to conceive new office solutions whereas occupancy monitoring is more useful for managing existing solutions.

However, whilst ABW is recognised for its sophisticated and practical analysis, it is not without its criticisms. ABW consultants calculate how many of each of the new space elements are required for each different group in line with their activity profile. Many consultants do not adopt such as rigid approach and would estimate the space elements based on observation, benchmarks and discussion with the occupants. A key criticism of both ABW and utilisation studies is how observation of current activities can be used to predict the space requirements of future occupants who may have undergo changes to their workstyle (e.g. adopted home-working), attitude to work, and their organisational culture. However, in ABW studies the actual conception of the activity blocks is discussed with the occupants to provide a useful indication on how much the activity blocks are used compared to needed in the future.

5.0 Set-up and process

The following guidance covers setting up an observation type study as this is the most common set up procedure. Setting up automated systems involves hard-wiring the sensors, tethering them to a receiver/transmitter, and interpreting the data using specialist protocols and software.

The first step of an observation utilisation study is to agree on the scope with the client representative:

- groups and locations – agree the building, floors, zones, types of spaces, teams etc which are to be monitored;

- survey period – the survey length may vary from a high-level indicative one-day survey to several weeks; however consultants such as AMA Alexi Marmot Associates have verified that a survey over a single week provides data as robust as that collected over two or three weeks; thus most observation surveys today are usually carried out over one 'busy' week avoiding holidays, conferences, year end and known quiet periods etc;

- core working hours – the analysis and corresponding calculated utilisation figure should reflect the core work hours, as data in non-core working hours will artificially reduce the utilisation figure; however a survey from say 08:00 to 18:00 may be required to demonstrate the core hours;

- the number of measurements per day – this may be every two hours, hourly, or even twice hourly for observation studies but typically every 10 minutes for automated data;

- level of identification of the occupants – for example department, team or grade/role, which will influence the type of results that can be generated;

- data to be collected – for example occupancy, work activity, number of people, technology.

Prior to carrying out the survey a communication will need to be made to the building occupants:

- discuss with the client (and labour/union representatives in some countries or organisations) the way the privacy is guaranteed and the way results are not related to individual people but to groups and their activities in order to define their needs for a better working environment;

- agree with the client on the content of the communication that has to be given to all users in the measurement zone;

- distribute the communication before any action on the floor happens.

Once the scope is agreed and the communication made then the observation route (or sensor locations) can be determined:

- obtain space plans showing the furniture layout and check the accuracy of the plans;

- with a client contact mark up the plans showing where each department or team is located;

- where practical determine the grade/role of each occupant and link it back to their desk;

- determine the best (most efficient) route for the observers to take and either mark it on the plan(s) and/or programme it into the hand held devices; note that most observers can visit 200-300 spaces (desks, offices, meeting rooms etc) in one hour;

- check the measurement route and add measurement points that were not on the plans, change departmental names that were not correct, and change the route if any obstacles;

- programme any electronic devices to allow the data for each observation point to be captured;

- train the observers and familiarise them with the route – explain the purpose of the measurements, how to interpret what they see, how to register it, how to use the hand held devices, tablets or drawings etc;

- conduct a dummy measurement route with the observers, improve on their accuracy and speed;

- commence measuring for one or two weeks.

During the measurement period the following procedures are recommended:

- handheld electronic devises can help prevent data errors but like paper methods will need cross-checking;

- where possible upload the data each evening, copy and collect paper-based surveys, and check the accuracy of the data and any errors associated with particular routes or observers;

- when data is not correct then contact the data collector to verify his/her interpretation and if needed repeat the first day after the end of the measurement period;

- spot check the observers during the survey period;

- ensure there is a process for dealing with observers who do not show up; some survey companies have a consultant or supervisor on stand-by whereas others use two observers, per route each day, who can cover each other.

6.0   Data analysis and presentation

6.1   Analysis

Whether an observation or automated study, the survey results are likely to be automatically generated using spread-sheet (or database) macros or similar. The utilisation and activity results required may include:

- overall, average, occupied and utilised for open plan desks, offices, meeting rooms and other spaces;

- average and peak utilisation levels or range of activities during a whole week, day, half-day, or hourly all usually shown in tables and graphically;

- average daily pattern/profile created by overlaying the hourly results for each day;

- the average utilisation broken down by building, floor, department or grade;

- the utilisation of each individual workspace, usually colour-coded on a space plan or presented as a stacked bar chart sorted by occupied or utilised;

- the number of seats occupied per meeting compared to the utilisation of meeting rooms;

- maximum number of people in the building, including desks and meeting spaces.

Some studies also include:

- usable vacancy:
  - vacancy of workplaces during complete days, half days, two hours periods,
  - vacancy of meeting rooms during two hour of one hour periods;
- the number of people involved in communication:
  - on workplaces,
  - in management meeting settings,
  - in meeting rooms (bookable, non-bookable);
- the maximum number of simultaneous meetings of different sizes (number of participants);
- the length of meetings, also in relation to the number of participants;
- usage or specific equipment e.g. extra screens on workplaces, projectors, smart-boards etc.

6.2   Reporting

The utilisation consultant and client should agree on the output required, as the requirement may vary depending on how the utilisation data will be used and who it will be presented to. The utilisation report will usually inform on:

- current use of space;
- scope for improvement including potential sharing ratios;
- recommendations for the number, size and type of desks;
- size and quantity of meeting rooms;
- type, size and location of breakout space;
- comparisons across floors, buildings, departments, roles etc.

With access to more client information, those reports can be expanded to address:

- recommendations for specific problem (under-utilised) spaces or teams;
- relationship between access control data and observed findings, plus how to use access control data as a proxy for utilisation;
- relationship between room booking system data and observed meeting room findings with recommendation on improvements;
- change management programmes to help people use their space differently and in a more agile way.

Two levels of reporting on desk utilisation may be provided. The first is to demonstrate graphically simply and clearly how the space is being used for each of the space types, e.g. desk, office, meeting rooms and breakout spaces, across the building. This information is mostly used for modelling space requirements or initialising a change management process with departments. The second level is to provide the results of individual desks. This data is used to demonstrate particular under-utilised areas within departments that may be targeted by the facilities team.

As with most presentations of information, understanding utilisation study reports is easiest when it is presented in tabular and graphic form, supported by a minimum of text. There follow some examples of how information can be presented to show how the space is being used for each of the space types.

Figure 2 shows how a simple bar chart (or a series of pie charts) might be used to show the utilisation, or the various observed work activities, across floors, departments or roles.
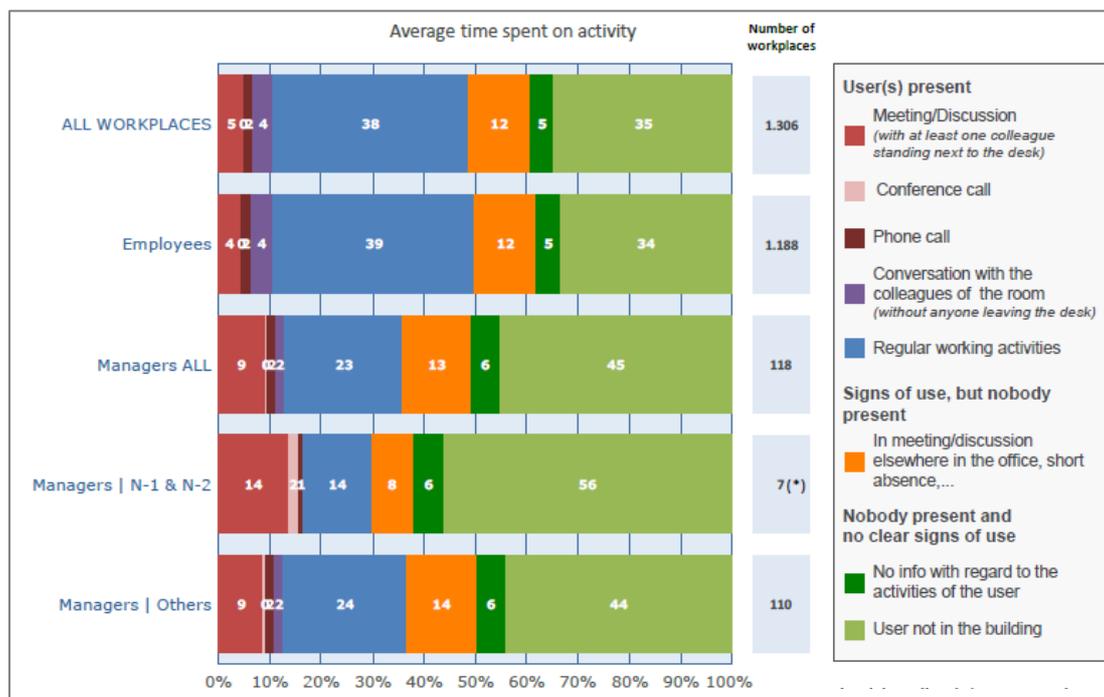

Figure 2 *Bar chart showing work activities by role*

Some consultants prefer to show the utilised (or occupied) desks across each day of the survey period using a line graph (Figure 3).
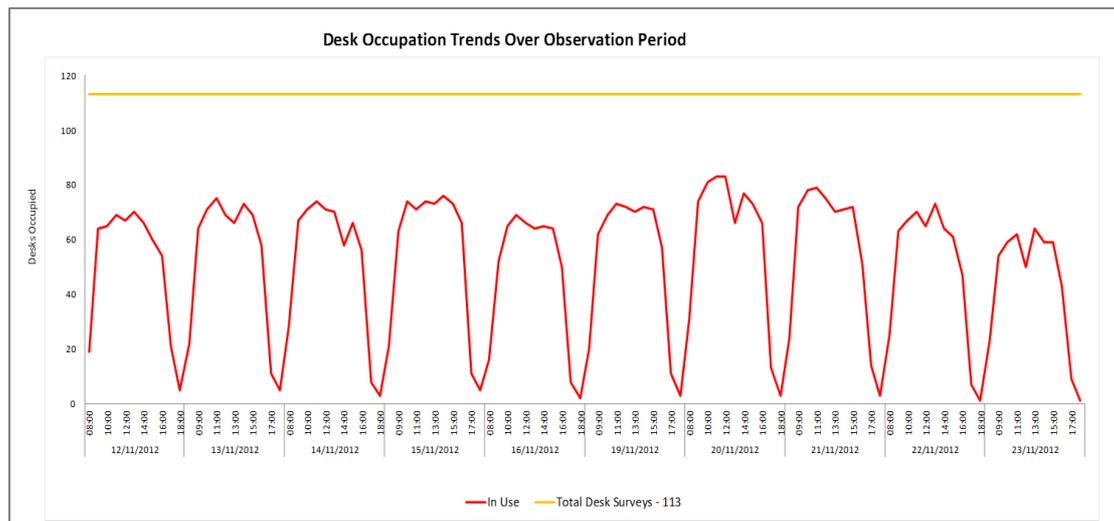

Figure 3 *Line graph showing utilisation across survey days*

Sometimes the data across a two week survey period may be combined to create a one week average, often referred to as a weekly profile (Figure 4). Stacked charts are better than line graphs for showing the "occupied" and "temporarily unoccupied" percentages.
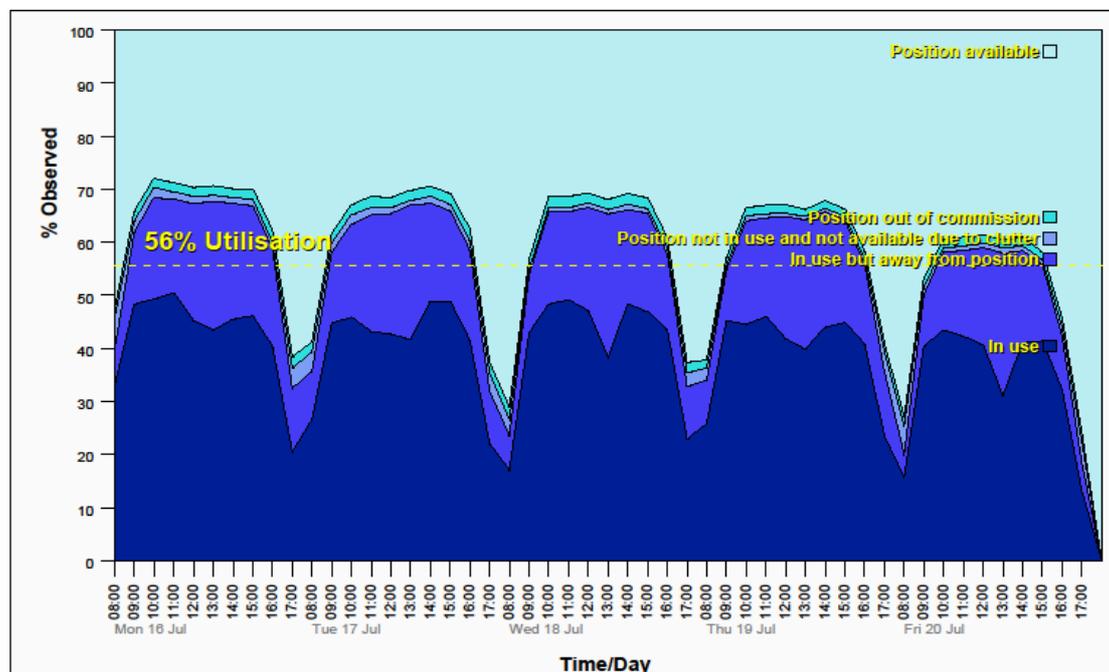

Figure 4 *Stacked chart showing utilisation averaged across one week*

The data collected across the survey period may also be averaged to create a daily profile (Figure 5). The core day (usually between 10am and 4pm) can be more easily identified from the daily profile.
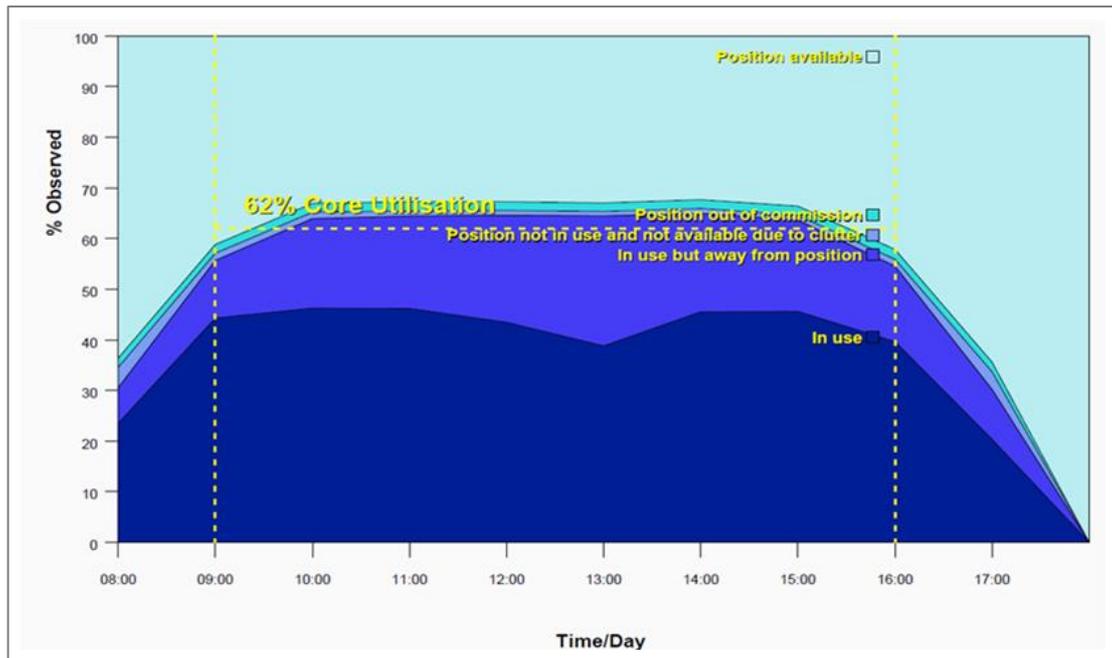
Figure 5 *Stacked chart showing utilisation averaged across one day*

A "traffic light" indicator approach is usually used for displaying individual desk utilisation (Figure 6). Alternatively mini pie charts may be used to indicate the "occupied", "temporarily unoccupied" and "unoccupied" states of each work-setting.
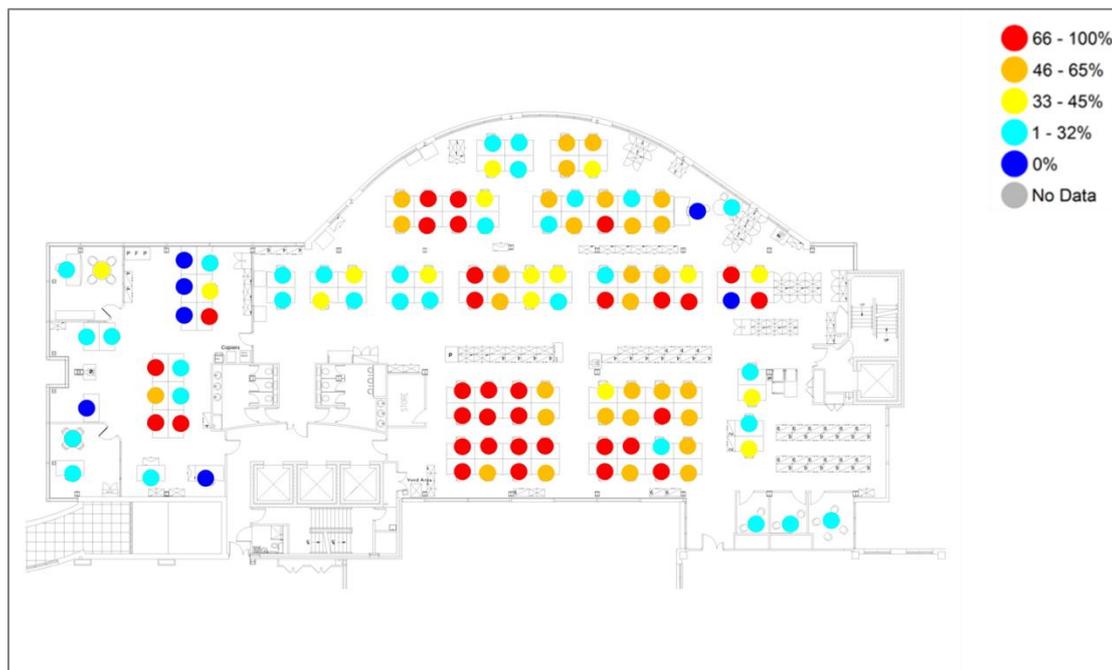
Figure 6 *Traffic light map showing individual desk utilisation*

Meeting room utilisation data needs to be able to demonstrate the percentage utilisation of the room and how well the seating in the room is being used. This may be demonstrated by a vertical bar chart or a line graph (Figure 7).
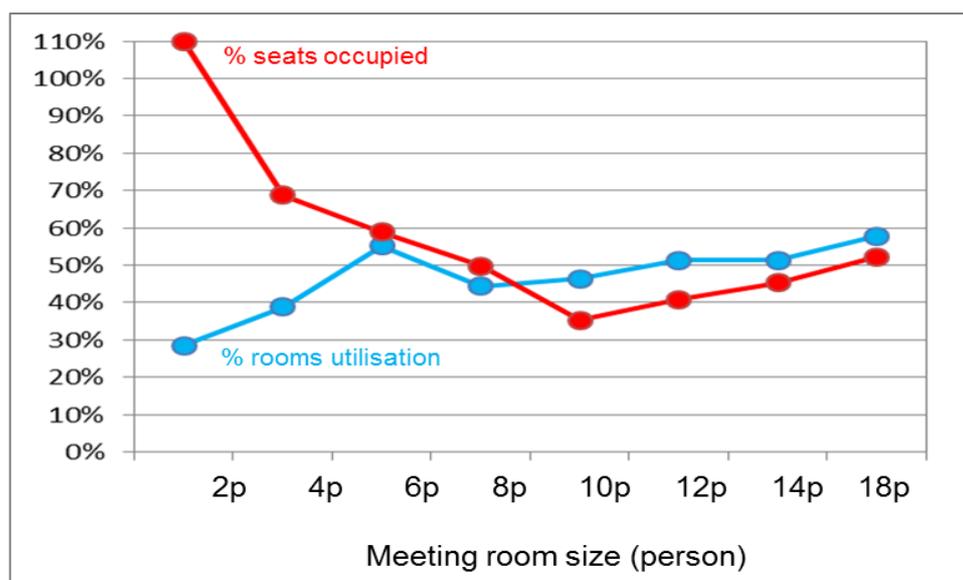
Figure 7 *Line graph illustrating meeting room use and seat utilisation*

ABW involves further analysis and presentation than standard utilisation studies. The following additional analysis steps are usually required:

1. *Measurements of activities –* First of all the activities in the office are measured during a busy week. Each measurement point and its associated data are stored separately from the others, to have the widest possibilities for queries and composition of groups afterwards. In parallel, organisational needs and specific needs of users are defined through interviews.

2. *Translation of the measured activities –* The collected data needs to be "transformed" into a more extended set of data that allows for factors that cannot be measured in an objective way such as confidentiality and concentration. The needs of the organisation, captured through other methods such as interviews, need to be taken into account.

3. *Definition of the way to use activity blocks -* Next, activity blocks that represent the needs and activities of the users are created. Activity blocks that represent a range of different activities are used for efficiency and allow higher occupancy to be achieved. An activity block matrix is usually created which shows which work activities are supported by the activity blocks.

4. *Calculation of a customised activity based concept –* Using a matrix, the necessary number of blocks of each type is specified. The dimensioning is based on the maximum needs for the different activities. In this way a correct composition of activity blocks for the different user groups is achieved. The result is an office environment that is dimensioned taking into account the needs of the organisation, with the associated increase in efficiency of space usage.

7.0 Interpretation of results

7.1 Key purpose

One of the key uses of utilisation studies is to determine the number of desks (open-plan and offices) required by a population of building occupants who may occupy the building for different periods of time. For example, it is often found that a Finance department (or business) spend much of their time, working 09.00-17.30, at their desk processing data, whereas a Sales team (or business) are out the office meeting potential customers and are expected to spend little time at their desk. So if implementing agile working, the Finance department are likely to be provided with more desks per member of staff than the Sales team. Utilisation studies are also used to help determine the number of desks that are required in the future if the working practices change, such as introducing flexible working hours (flexi-time etc) or home-working.

7.2 Interpretation precautions

At a basic level it might be assumed that in an organisation where desks are occupied 50% of the time, desk sharing could be implemented at two occupants per desk, so the number of desks could be halved or the number of occupants doubled, to achieve an occupancy level of 100%. Unfortunately, utilisation data cannot be used in this simplistic way for a number of reasons, explained below.

1. *Average and peak use –* The utilised or occupied figure is based on the average number of spaces occupied at any one time over the study period. So the utilisation level could be due to different spaces being occupied at different times of the day. For example, the same two desks out of ten being vacant all day would create the same utilisation level as two different desks per hour being vacant i.e. 80% utilised. Clearly two desks vacant all day is more useful and manageable than a number of different desks being vacant for the odd hour; otherwise it would be expected that occupants pack up their belongings whenever they leave the desk for one hour or more which is unpractical. Averaging all spaces over time is considered by some as a fundamental flaw of the utilisation study. Analysis which shows the number of spaces free for a full half-day, or for several contiguous hours, helps avoid the risk of basing desk numbers on a large number of occasionally vacant desks. Many consultants, and clients, prefer to use peak utilisation figures rather than average utilisation to determine desk requirements.

2. *Teams and choice –* In most organisations, the occupants prefer to sit near to their colleagues. An overall utilisation figure will not account for the variation in utilisation between teams (as described in the example above). Thus, basing the number of desks on the overall utilisation may not offer the occupant the choice of sitting near to their colleagues. In some organisations, this is not an issue and sitting with other team members is encouraged. The size of the team also affects the availability and choice of desks. For example, a team of 10 sharing 8 desks offers less choice and availability than 100 occupants sharing 80 desks. Rounding errors in the utilisation and desk modelling of smaller groups will also affect the required desk numbers. The

desk numbers should therefore be based on a departmental breakdown rather than an analysis across the whole organisation.

3. *Individual variation –* Even within teams there will be staff who are expected to be in the office each day and those whose roles allow them to work more flexibly. To reduce the level of change management required, it may be decided that staff in the office for say four and five days per week are provided with an allocated desk. If so then this will then affect the desk sharing ratios for each department (especially smaller ones), and the associated number of desks required.

4. *Time variation –* Most utilisation studies are carried out for a relatively short period of time compared to the full working year, and as such is always a sample study. Such studies may miss seasonal variations in the number of contractors employed or busy periods etc. The utilisation study should always be carried out a representative time of the year. However, it is always worthwhile building in additional capacity to allow for unexpected peaks. This can be accounted for by assuming a target utilisation of say 80% rather than expecting a full 100%.

5. *Core Hours –* Utilisation studies are often carried out from 08.00 until 18.00 hours across the whole working day. Some organisations may be early starters, leaving early, and others, possibly due to location or shifts, may prefer later starts. Similarly, it is expected that the occupants leave their desk for lunch. A utilisation figure based across the full day may therefore be misleading. It is better to determine what the "core working day" is and based the analysis on this period of time.

6. *Reserved spaces –* As mentioned it is unlikely that occupants will pack up their belonging if they only intend to leave their desk for one hour. The key question is what is an acceptable time for being away from the desk without packing up? Many utilisation studies include a "temporarily unoccupied" category, when the desk appears occupied but no one is present. A high percentage of this category sometimes indicates high internal mobility (people in meetings) but it can also indicate that issues with PCs (too slow to boot) or heavy paperwork. The utilisation researcher needs to determine how much grace is given to those desks temporarily unoccupied.

7. *Future usage –* Utilisation studies are based on the current working practices (workstyle) and how the space is currently used. Adjustments need to be made for the intended future workstyle and any factors that may affect it such as flexible working practices, relocation, new technology etc. The utilisation figure may be adjusted if evidence is collated to determine how it might change. Case study data indicates that after implementing desk sharing, the utilisation of a workspace initially increases but then gradually reduces; this is possibly because the occupants become more use to remote working, plan their week better, and gradually realise they do not need to be in the office so often as they originally thought. Another reason for the lower occupancy may be that people start clearing their desk more quickly once they have adopted a new workstyle based on less paper and more digital

information; so clearing doesn't take time anymore and is carried out naturally even for short absences.

8. *Reality check* – The utilisation study represents hard data and an indication of the desk sharing ratios and corresponding desk numbers required. The practicality will depend upon the enabling technology, attitude of managers and staff, occupational hygiene, job role etc. The conclusions drawn from utilisation studies are only part of a process and should be verified by the organisation's senior management.

7.3 Calculating desk numbers

The BCO's report *Making Flexible Working Work[3]*, which offers guidance on how to implement flexible working, states that:

The utilisation figure is used to calculate the 'desk-share ratio' and the corresponding number of desks required to meet a target utilisation figure, typically set at 80% to allow some contingency.

$$\text{Desks Required} = \text{Number of desks observed} \times \frac{\text{Observed \% utilised}}{\text{Target \% utilisation}}$$

When the "utilised" figure entered in the equation includes both the occupied and temporarily unoccupied desks, then the resulting number of desks estimated as required is quite conservative. More often just the number of occupied desks is entered when used with an 80% target utilisation. Or alternatively a 100% target utilisation is used with the percentage observed utilisation (occupancy and temporarily unoccupied). Some consultants may compare the peak utilisation with a 100% target utilisation. As discussed earlier, the results from this type of analysis are an indicator of the possible number of desk required to accommodate the building population but they need to be verified with the business. Also such calculations assume that desk sharing is not already in place at the time of the survey, and each member of staff has an allocated desk.

The desk sharing ratio can be calculated simply by dividing the accommodated number of people by the number of required desks and expressing it as a ratio to 1 or 10 desks e.g. 15:10 people to desks. Case study evidence indicates the following relationship between utilisation and desk sharing ratios across a whole building:

- Utilisation = <50%, share ratio = 10:6 or higher, worthwhile and achievable
- Utilisation = 50%-70%, share ratio = 10:7-10:8, worthwhile but needs effort
- Utilisation = >70%, share ratio = 10:9, achievable but needs additional effort

Occupiers may wish to implement desk sharing mostly to save space, and as such will be looking for high share ratios and maximum return on effort. For others, implementing desk sharing may be more to do with enhancing collaboration and cross-team fertilisation of ideas and sales etc. For such organisations the

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[3] Burt K, Oseland N A, Marks K and Greenberg B, *Making Flexible Working Work,* British Council for Offices (BC)), 2010.

flexibility of using desk throughout the building may be more important than high desk sharing ratios *per se*.

The equation above can be applied at different levels. It is not uncommon to run the calculation for different departments, or floors. The share ratios and corresponding desk numbers can then be calculated for each department to allow any differences in the level of mobile workers. Note that running a calculation at the department level will not create as many desk savings as the same calculation across a building – this is due to rounding errors and economies of scale.

More utilisation studies are now reporting the utilisation of individual desks, sometimes shown on a space plan (or heat map). This allows pockets of under-utilised space to be explored. Another relatively new form of analysis is arranging the individual utilisation to show the proportion of occupants who are at their desk for <30%, 30%-70% and 80%+ of the time or similar grouping. This allows mobility profiling to be carried out, for example determining the proportion of static versus highly mobile staff to be determined. This analysis may be carried out at the building or departmental level.

Many of the issues described earlier in this section are relevant to all work settings observed, regardless of whether they are open plan desks, private offices, meeting rooms or breakout spaces. However, for meeting rooms the target utilisation is more realistically around 65%, if assuming 10.00-16.00 usage and excluding early Monday and Friday afternoons. For larger spaces, such as restaurants or auditorium, the number of seats occupied as a percentage of the seats available is more useful than whether the space as whole is occupied or not.

Utilisation data often represents spaces free for an hour period anywhere in the building. It may be considered impractical for an occupant to pack up their belongings each time they leave the desk for an hour or so. Therefore presenting the number of desks free for a half-day (3-4 contiguous hours) or a full day may be more useful when considering managing agile working spaces. Such a conservative utilisation figure would be compared with a 100% target utilisation to determine the number of desks required.

So far this section has focussed on using utilisation data to model the number of desks required, but the data can also be used to model the type, size and number of meeting spaces, including meeting rooms, informal meeting spaces and breakout. The observed utilisation of the meeting spaces can be compared against a realistic target, e.g. 60%, to calculate the number of rooms required. Comparisons with the number of books meetings will help determine whether a perceived lack of meeting rooms is actually due to a lack of spaces or over-booking (without cancellation). More interestingly, comparing the time that various meeting rooms are in use against the number of seats occupied when they are actually used (or simply the most common meeting group size) allows the size of meeting rooms to be determined. Similarly, if data is collated on the use of the staff restaurant then the results can be used to model the overall number of seats, and possibly table size, required.

In most cases, the utilisation study is part of a process for developing a new working environment. It may be used up-front and input to a workplace strategy or a design and space planning brief, or be used during implementation as part of the change management phase. The results from the utilisation study may be used in combination with property standards, storage audits, IT strategy, FM strategy and HR policies.

8.0 Conclusions

This *Guide to Utilisation and Occupancy Studies* is intended to help clients understand when and how to use such studies. It has tried to demystify the language, process and interpretation of utilisation studies and concludes with a number of observations:

- In utilisation studies terminologies are often confusing and better definition would be helpful – this guide defines terms and will help the client describe its requirement and understand proposals better.

- The process of undertaking utilisation studies requires choices to be made; in particular about survey methodologies – the guide helps clients understand the pros and cons and what would work best for them.

- Understanding and comparing the data produced by utilisation studies is not straightforward and depends on the parameters and method of the study – the guide describes how changing the parameters or method impacts on the results and how, for example, desk-share ratios will vary depending on the scale and time periods over which surveys are done.

- Interpreting the data produced by utilisation studies as an indicator of future space provision and staff:desk ratios is ultimately a matter of judgement based on evidence and experience rather than a strictly numerical conclusion – the guide discusses factors such as teams and personal choice, technology constraints, variations in work activities and evolving future working practices and draws some conclusions about appropriate utilisation levels for a range of different types of space.

- For the future, as work migrates more and more beyond the walls of the office using mobile devices and ubiquitous connectivity utilisation studies will have to evolve to take account of the whole network of places in which people work. It is possible that by using automatic sensing and real-time data streaming workplace analysts and their clients will be able to answer the questions "Where do people go to work, and why?" and so be able to predict the appropriate mix of workplaces in a portfolio that's both efficient in terms of cost and effective in terms of fitness for purpose.

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