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Spacesharing in a Historic University

The concept, limitation and adaptation

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Description

Spacesharing is not entirely a new concept. For a long time, people have been discussing options to utilize space for more efficient work. New buildings are designed and optimized so that they can take advantage of all the space that they have and save costs at the same time. Historic buildings, on the other hand, cannot easily be adapted to this concept. In the previous centuries, architects and builders had different ideals of how they would construct their buildings. They might have predicted the possibility of expansion or the installation of new equipment, but as technology is ever changing, it was impossible to tell precisely how one building could be prepared for the future.

In the case of universities, it is inevitable that they have to acquire modern scientific and networking devices to support education. Easy access to education means a high increase in the number of students, which leads to a significant demand for study places. As many universities were built centuries ago, their antique premises, despite their symbolic architecture, are limited in space and they are fragile under most forms of upgrading. The principles of conservation must be consulted, and there are standards that need to be strictly followed. With exploratory observation in several chosen universities, it has been possible to establish some common practices of equipment installation and modification. There are methods of adapting an old building to this modern era while maintaining their structure and monumental interior. Some can be hidden within the walls or covered up with materials similar to their surroundings. Some can be kept separately so as not to clutter the historical interior.

With the concept of Spacesharing brainstormed and developed in FM Winterschool (February 2016, Stuttgart), it was realized that with the right setup, organization and services, a space can become flexible for multi-hour usage. When adapted to a historic environment, it is essential to take the conservation principles into consideration in order to create a sharable space and, yet, maintain the significant interior of a historic university.

Keywords (subjects)

Spacesharing, historic universities, architectural conservation, construction, equipment installation, modification

Miscellaneous

Contents

List of Figures

List of Tables

1 Introduction

As technologies develop, the appearance of skyscrapers, concrete buildings with modernistic architecture have become more of a common sign. New constructions allow better accessibilities to equipment installation and wiring – which prepare the buildings for technology advancement in the future.

However, let us not forget about the historic constructions that have been playing a significant part in our history. Through ages and wars, there is not a big number of buildings that are still standing. Many of them are reserved as they were, turned into museums with little intervention with the overall structure – apart from light furnishing and humidity/temperature stabilization.

The focus of this work was on universities. We are not talking about newly built campuses with futuristic design, but those that have existed for centuries – for example the University of Bologna in Italy, the University of Oxford in the United Kingdom – or the University of Salamanca in Spain (all established in the 11th century BC). These universities have a significant role in the higher education history, and they are still in continuous operation at the moment – in the 21st century. Their names are well recognized, and their campuses, whose construction dates back to the 15-16th centuries, are famous historical attractions.

Education has advanced very far ever since the building of the historic universities. Nowadays, we need more than just books, pens and blackboards. We write essays on computers, look for information in the libraries' electronic resources, present assignments with projectors. This raises the questions of how all of the electrical equipment could have been installed without damaging the antique structures that have been there for centuries. Moreover, we also need to think about the future and ask whether new technologies can be installed effortlessly. All this focuses on the main concerns and cautions that a facility manager needs to know before utilizing the existing space for extra services.

The concept of "university" nowadays is no longer limited to pure education. It can, frankly said, be considered a form of business. A university nowadays may have

intensive marketing campaigns to attract new students, who, in turn, are attracted by top-class universities with good varieties of courses, services and activities (e.g. sport venues and academic clubs, in-campus events, access to modern machinery and laboratory for sciences and engineering students, opportunities to engage in real-life business experience, etc.)

In addition to students, universities also try to attract sophisticated parties for investments in research and development by involving them in events or renting out their own premises for external activities. This leads to the creation of business relationships and partnerships, as well as sponsorships. However, the question still remains of how this can be done without interfering with education – the main source of income. Universities need to deliver quality education in order to maintain a stable number of students and good reputation. They will have to be able to compromise between two segments with different requirements for equipment, arrangements and usage in their limited existing space. Hence the demand for Spacesharing.

With the concerns and cautions required in the conservation of historic buildings, specifically historic universities, the concept of space sharing is taken to a new level. Hence, the questions to be answered by this bachelor thesis were as follows: What would these universities need to sacrifice in order to apply this concept to their premises, what would be the precautions and limitation if they choose to do this? Should they go with this new trend at all or should they move on with their traditions that existed for hundreds of years?

Based on the author's experience and interest during her studies in Adam Mickiewicz University (which was established in 1919 and carries the original design from that history period), she was captivated by the architectural details and how well the buildings have been maintained throughout all those years, especially with the heavy impact from World War II. Her interest was drawn to a special, recently recovered room that had been left untouched and still embodied the same materials with which it was built with at the beginning of 20^{th} century. However, this particular room is yet now ready for any activities as it needs to be equipped with necessary devices and furniture. With the permission of the Facility Manager of Adam Mickiewicz University (AMU), it is anticipated that a renovation plan would be built for this room based on

architectural conservation principles and the Spacesharing concept. By combining literature reviews, observation of real examples of adapted new technology in historic university buildings and participation in a workshop on Spacesharing, the findings would be linked into a new concept of "Spacesharing practice in historic universities" that could apply to not only this room in AMU, but also any space in a historic university awaiting new purposes. Hopefully, this concept will help facility managers to have a more detailed insight on a how to flexibly adapt their premises so that they would become multipurpose space that could meet a variety of the demands of its users.

As the AMU premise and its conditions were intended to be used as the base for this thesis, a qualitative case study method was used in a combination with grounded theory. The integration of these two methods has been studied by Halaweh, Fidler and McRobb (2008, 6-7) by comparing different approaches of other authors who implemented this combination in their studies. They studied Yin (1994) – one of the experts in the case study research method – and contradicted it with several others resulting in the statement that Yin's (1994) evaluation measures of tests and criteria are only suitable for positivist quantitative research. Thus, it is better to apply Lincoln and Gruba's (1985) criteria for qualitative research, which includes credibility, transferability, dependability and conformability. Halaweh et al. (2008, 8) also used this research to illustrate how case study and grounded theory can be integrated into a research methodology. (See Appendix 1)

Based on this model, the thesis author started with a general research topic, conducted literature reviews in order to explore this knowledge area, and formed the specific research questions for this topic. More literature reviews were then conducted in order to visualize how the case study should be researched and what its protocols would be. Data was collected after this stage, mostly through observation and pattern checking, then processed via grounded theory coding. As a conclusion, a prototype was proposed for the chosen case study target and for discussing possible development based on this research.

However, as time and resources did not allow, the grounded theory approach was applied in order to introduce the common practices in the adaptation historic

universities and generalize the concept of Spacesharing and, consequently, to suggest a possible implementation in AMU as a potential case study. Hopefully, this concept will attract sufficient interest in transforming an old empty room into a representative of Spacesharing.

2 Preliminary literature review

2.1 Historic building definition

A building can be considered historic based on the year in which it was built, historic events that it witnessed at the location and the function that it has served throughout that time. The Burra Charter notes that a historic building has to have cultural significance which exists in "objects at the place or associated with it; in other places that have some relationship to the place; and in the activities and traditional and customary practices that may occur at the place or that are dependent on the place." (ICOMOS 2013, 5). It also mentions that this cultural significance is accessed based on several values that can be acknowledged in a building. These values can be aesthetic, historic, scientific, social and spiritual values. (ibid, 2). The Department for Culture, Media and Art (UK) has established the "Principles of Selection for Listing Buildings" to evaluate buildings based on their time of erection, which can be seen in Table 1 below:

Table 1: Principles of age and rarity for registering HBs in England (DCMA, 2010)

Buildings' age or date of erection	General principles for registering HBs
Before 1700	Buildings that contain a significant proportion of their original fabric are listed
From 1700 to 1840	Most buildings are listed
After 1840	Because of the greatly increased number of buildings erected and the much larger numbers that have survived, progressively greater selection is necessary
Less than 30 years	Listed only if they are of outstanding quality and under threat

The Department for Communities and Local Government (DCLG), UK, emphasizes that a historic building has to satisfy two statutory criteria:

- **Architectural interest**: *To be of special architectural interest a building must be of importance in its architectural design, decoration or craftsmanship; special interest may also apply to nationally important examples of particular building types and techniques (e.g. buildings displaying technological innovation or virtuosity) and significant plan forms;*
- **Historic interest:** *To be of special historic interest a building must illustrate important aspects of the nation's social, economic, cultural, or military history and/or have close historical associations with nationally important people. There should normally be some quality of interest in the physical fabric of the building itself to justify the statutory protection afforded by listing. (DCLG 2007, 3)*

As for educational institutions in the UK, there is a large number of schools from the 18th to the early 20th century that are refurbished and adapted for continued use. These schools play an important part in their communities – as a significant contribution to their history, as "they demonstrate how education was brought within the means of us all – and many are architecturally imposing" (Harwood 2010, 89). Harwood has established the following criteria for the listing of schools as historic:

- Schools built before the reorganization of 1830s are already listed (if survive in original form
- Schools built before 1870s are considered if in good quality and well preserved
- Schools from the 1920s have stricter threshold for listing, which means passing the assessments for external design and internal features
- Schools built post-war (1948-51 and later) have very strict selection criteria since many were built during this time (ibid, 83-86)

Historic educational buildings are evaluated based largely on their architectural quality and intactness as well as historic interest (Historic England 2011, 8). Nevertheless, despite such high thresholds for listing, Harwood (2010, 83) states that "even the humblest school is worthy of consideration if it retains its original form, and especially if it retains internal fittings", and that "all schools have some interest and, whether listed or not, they can be adapted for continued educational service or put to new use".

2.2 Architectural conservation and why it matters

According to Jokilehto (1986, 8), there are two approaches to the treatment of ancient monuments – "conservation" and "restoration". Conservation, according to Venice Charter 1964, is defined as keeping a traditional setting as it is, without new construction or modification. Restoration, on the other hand, allows reconstruction under a strict condition that all modifications need to respect the original material and the *"balance of its composition and its relation with its surrounding"* (The Venice Charter, 1964). Restoration is also defined in the Heritage Conservation Terminology (LeBlanc, 2009) as "*All actions taken to modify the existing materials and structure of a cultural property to represent a known earlier state.*"; and in the Burra Charter 2013 as *"…returning a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new materials".* However, Jokilehto (1986, 8-9) also mentions an ongoing argument whether "restoration" is considered as a suitable treatment for ancient monuments. Contradicting the goal of treatments – which is to maintain the monuments' authenticity – restoration allows the construction of new materials to harmonize the existing setup, hence *"falsifying"* that authenticity, as criticized by Sir George Gilbert Scott and many other practitioners. However, the work of building restoration is still highly appreciated, as it aesthetically improves and repairs the impact and destruction of time and wars on affected constructions.

The definition of architectural conservation is specified with more details in The Heritage Canada Foundation – Preservation Strategy No.3, 1983 (as listed in ICOSMOS Heritage Conservation Terminology (LeBlanc, 2009)): "The physical intervention in a building to counteract deterioration or to ensure its structural stability." According to this definition, conservation not only encourages the maintenance of an architectural structure as it has been built but also allows "physical intervention" – for example, *"cleaning of wallpaper, reattachment of loose plaster, masonry repointing and consolidation of an existing foundation"* – in order to take a step further in enhancing the existing assets of that structure. This is related to the definition of preventive conservation: *"All measures and actions aimed at avoiding and minimizing future deterioration or loss"*, defined by the International Council of Museums (ICOM-CC 2008). Additionally, LeBlanc describes *"conservation"* in his Terminology as *"they do*

not interfere with the materials and structures of the items. They do not modify their appearance". (LeBlanc, 2009)

These actions, though different, exist to achieve an ultimate goal: preserving a structure's cultural significance. The Burra Charter 2013 describes cultural significance as the *"aesthetic, historic, scientific, social or spiritual value for past, present or future generation"* of a place. All historic buildings have invaluable assets that need retaining, regardless of the purposes they serve.

The International Council on Monuments and Sites (ICOMOS) started The Venice Charter 1964 with the following lines:

> *Imbued with a message from the past, the historic monuments of generations of people remain to the present day as living witnesses of their age-old traditions. People are becoming more and more conscious of the unity of human values and regard ancient monuments as a common heritage. The common responsibility to safeguard them for future generations is recognized. It is our duty to hand them on in the full riches of their authenticity. (The Venice Charter 1964, 1)*

They believe that historic monuments carry a story, a message to future generations. Those are architectural works that acquired a cultural significance throughout the years, and act as an "*evidence of a particular civilization", "significant development*" or *"historic event"* (ICOMOS 1964, Article 1). Nevertheless, buildings cannot fight the negative influence of their surrounding environments; they deteriorate and collapse without appropriate conservation methods. In the famous prelude to Lord of the Rings series, The Hobbit (J.R.R.Tolkien, 1937), there is a riddle that, in a nutshell, described the power of time upon undeniably everything:

This thing all things devours:

Birds, beasts, trees, flowers;

Gnaws iron, bites steel;

Grinds hard stones to meal;

Slays king, ruins town

And beats high mountain down.

Regardless of how significant a monument is, it is susceptible to the power of time. Historic buildings, throughout the years, would not be able to battle its own deterioration rate without the interference of architectural conservation – and future generations would not have the opportunities to admire the extraordinary achievements in history and architecture their ancestors accomplished.

The decaying rate of a building is determined by various factors, separated into two main categories: either by *"the actions of man"* or *"climatic and environmental effects"* (Feilden, 2007). Natural disasters (earthquakes, floods, hurricanes, etc.) are accounted for an extent of the deterioration of historic monuments, as well as lesser influential factors like weather, air pollution and natural world. (Wrightson, 2002). Weather conditions, described as hot and dry, cold or wet condition, along with thunderstorm and wind (Crissinger, 2005), can negatively affect appearance of a building, thus degrade its aesthetic and historical values. Uncontrolled moisture is believed one of the main causes of damages in historic buildings, especially those made of bricks or stones. Water can penetrate through the surface into the pores of stone materials in different states (described in the table below by Lisø, Kvande, Hygen, Thue and Harstveit, 2007), destroying their structure in continuous exposure to rainfall or frost. (Lisø et al, 2007)

Table 2: Moisture transfer mechanism and their driving forces (Lisø et al., 2007)

State (or phase)	Transport mechanism	Driving force
Water vapour	(Water vapour) diffusion	Differences in vapour pressure in air on each side of a material, structure or component
Water vapour	Convection	Differences in air pressure on each side of a material, structure or component
Liquid	Gravitation	E.g. leaks from roofs into underlying materials, structures or components
Liquid	Wind pressure	Wind pressure can force liquid water in to cracks or other openings in the building enclosure
Liquid	Capillary suction	Adhesion forces between water and the pore surface, allowing water being sucked into the pores. The surface stress of the water, the diameter of the pore and the angle of contact between the water and the pore surface determine the strength of this capillary force. At equilibrium the capillary force equals the pressure of the pore water multiplied with the cross-sectional area of the pore

Living organisms also cause building deterioration. The most regularly found culprits for damages in wood are insects, such as termites, furniture beetles/woodworm as

well as bees/wasps and ants – which build their nest in old wood and soil the building (Komine, 2008). Insect pests are more significantly found in dirty, damp and dark areas than clean and well-lit; their damage can be accounted for human neglect of building conservation. Birds and rodents are also common residents found in old buildings; they damage wood finishes, electrical wires and spread potential deadly diseases with their droppings (Park, 1993). Different types of insects and other creatures dwell on different living conditions (temperature, humidity, lighting, etc.), hence the difficulty to completely eliminate their existence (Lauder and Pinniger, 2006).

On another hand, as the author of Conservation of Historic Buildings, Sir Bernard Feilden, cited: *"Human causes nowadays probably produce the greatest damage"*, the source of the majority of damages happen to premises are directly or indirectly caused by human activities, but they mostly result from the ignorance of building conservation principles and inappropriate repair methods, as well as the neglect of maintenance needs (Feilden, 2007). Some examples of poor conservation practices that could worsen the assets of a historic building are noted by Jonathan Taylor in The Building Conservation Directory:

- Employing inexperienced contractors for historic building projects.
- Neglecting regular maintenance tasks and damage inspection.
- Poor, mismatching choices of materials for replacement, coverage and extension.
- Failing to apply correct cleaning methods and substances to fragile surfaces.
- Intrusively placing modern equipment and fixture in inappropriate locations. (Taylor, 1998)

All of the points Taylor (1998) mentioned do cohere with the damages caused to historic buildings; however, one of them invoked a concern in the thesis author. Since life advances and technology develops, there is always a demand of modern equipment in the premises either to support fundamental human needs or assist education and office work. The need for space in central areas somewhat becomes an itch for urban planners as cities expand and population grows. Purchasable lands are not always available; and in addition to this, the complexity of time, costs and paperwork needed to erect a new construction combine and result in the struggle

between the decision to build or not to build a new structure. These problems inspire the solution of “recycling” existing buildings, despite having been built for decades, are still standing steady with an admirable touch of history.

Since the target of this thesis is located in a university – and a wide range of activities happening within universities – the buildings need to adapt to serve their purposes while maintaining its cultural significance. Bustling with people in ordinary lectures, group work, individual studies to workshops, events and club meeting, etc., historic university campuses need to withstand a significant amount of human impact every day; just as implied in the Conservation of Historic Buildings (Feilden, 2007). Nevertheless, this impact is inevitable; and in order to maintain their cultural significance – most transparently, their aesthetic aspects – the managers of these buildings need to take in account the necessary actions to maintain them in good shape, while flexibly utilize their limited spaces for the constant demands of university life – hence the concept of “adaptation”, one of the objectives of historic building conservation.

2.3 Historic building adaptation

As written above, it is important to preserve outstanding historical buildings for their numerous values (architecture, historical context, usability properties, etc.). The problem is how to incorporate them into changing socio-economic conditions. Forasmuch as cities, societies and countries are in fact living organisms, their needs and functions evolve through generations. Various factors, for instance geopolitics, regime, technology, social order and religion, have revolutionized much different now than in the period when historical buildings were originally constructed. Consequently, the structures once vital and essential may become obsolete and unnecessary as time goes by.

Kohler (2002, 229) stated that: *“the criteria of historic significance are used to justify the need to protect individual objects or groups of buildings”*. To determine whether a building is worth saving and adapting, it depends on various factors, different aspects and measurements to decide the values of a historic building.

Scholars in architectural conservation throughout the years have been debating how the values of a heritage should be specified. In fact, different publications of conservation principles categorized these values differently. An essay written by Randall Mason for the Getty Conservation Institute (Los Angeles) research report summarizes these categories in the table below (Mason, 2002):

Table 3: Summary of heritage value typologies devised by various scholars and organizations. (Reigl 1982; Lipe 1984; for the Burra Charter, Australia ICOMOS 1998; Frey 1997; English Heritage 1997)

Reigl (1902)	Lipe (1984)	Burra Charter (1998)	Frey (1997)	English Heritage (1997)
Age	Economic	Aesthetic	Monetary	Cultural
Historical	Aesthetic	Historic	Option	Educational and academic
Commemorative	Associative-symbolic	Scientific	Existence	Economic
Use	Informational	Social (including spiritual,	Bequest	Resource
Newness		political, national, other	Prestige	Recreational
		cultural)	Educational	Aesthetic

As indicated by Mason, the variety of defined value typologies made it complicated to generate a framework to effectively evaluate heritage sites. They tend to contradict each other, and if an artefact value is considered more dominantly than the others (e.g. economic versus historical), the dominated value would downgrade them, resulting in a misdirected approach to the conservation of that artefact. The value typologies are traditionally decided upon by experts in historic, social and artistic fields, e.g. historians, artists, archaeologists, *"as a work of art or a record of the past"* (Mason, 2002). Eventually, the economists stepped in, and heritages are estimated also with market values and profit potential for the stakeholders. Experts from other fields also suggested additional value assessments (e.g. educational, scientific, recreational, etc.), but in general, these assessments overlap with the aforementioned, hence creating complications in deciding a legitimate typology for value assessments.

In his research report, Mason (2002) proposed a provisional typology to help categorizing these values easier. In his opinion regarding the published categories in Table 3, *"they describe the same pie, but slice it in subtly different ways."* This could be

interpreted as: even though the assessments are different in definition, they circulate similar aspects of a heritage, and hence could possibly be simplified. By grouping these values into two main categories, Mason proposed a simpler typology to assess them:

Table 4: Provisional typology of heritage values, by Randall Mason (2002)

Sociocultural Values	**Economic Values**
Historical	Use (market) value
Cultural/symbolic	Nonuse (nonmarket) values
Social	Existence
Spiritual/religious	Option
Aesthetic	Bequest

2.3.1 Socio-cultural values

When above-mentioned situations regards building that does not present much historical values, it is less problematic to apply conservation standards into its maintenance. However, when its value is in great consideration, concrete architectural principle must by applied in the conservation and adaptation process, in order to turn the building into one of the assets that enriches national and cultural heritage of a region.

The cultural heritage of a building turns it into, as defined by economist, public good (Navrud and Ready, 2002). Its first definition was establish by an economist named Paul A. Samuelson in 1954:

> *…[good] which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good... (Samuelson, 1954)*

According to them, public goods have two specific characteristics – they must be "nonexcludible" and "nonrival". A building's nonexcludability is presented in the sense that everyone could gain access to the view of its exterior and interior without being

"excluded" – as in being charged a fee or being kept out due to authorization. (Navrud and Ready, 2002). In the case of universities, it is difficult to consider them as public goods since the accessibility to their interior and equipment is often limited to staffs and students only – which consequently, exclude the entry of other parties. However, as for the exterior, Navrud and Ready cited in their book that it is impractical to exclude the public from enjoying it, as most buildings can be observed from a distance - unless being in a well-walled area. In addition, El-Belazie (2004, 41) mentioned that tourism does benefit urban conservation, as it encourages "the reuse of buildings for the tourist function". Many tourists arrive to attraction sites for the sole purpose of "consuming" this external value of historic buildings, especially when they are on tight budget or concerned of the amount of queue and waiting time to enter the attraction. An example of this can be seen at the Cathedral of Milan, Italy (see Figure 1):

Figure 1: Duomo di Milano, one of the most famous attraction in Italy. (Image by MarkusMark, provided for Wikipedia).

The Cathedral itself attracts approximately five millions visitors per year, 75% percent of which are foreigners (numbers provided by the official website of Duomo di Milano – duomomilano.it). According to a study by students in Tourism Management from International University of Language and Media (IULM, Italy), 98% of tourists in Milan are aware of the Cathedral – and 95% have visited it (see Table 5).

Table 5: Tourist Characteristics and the Perceived Image of Milan, a study by MTM sty by IULM students in Milan. (MTM IULM, 2009)

AWARENESS		SEEN	
Duomo	98%	Duomo	95%
La Scala Theatre	86%	The Castle	73%
The Castle	80%	Fashion District	66%
Fashion District	75%	La Scala Theatre	60%
The Last Supper	67%	Navigli	59%
Navigli	61%	The Last Supper	48%
Sant'Ambrogio Abbey	57%	Sant'Ambrogio Abbey	46%
Brera District	54%	Brera District	46%
Monumental Cemetery	39%	Monumental Cemetery	25%

With an average basic ticket price of EUR 10 and a significant amount of people queuing to visit the Cathedral interior every day, many tourists shy out at the idea of having to wait until their entrance – especially when only a group of fifteen is allowed to enter each time. This regulation excludes people who are not willing to pay the entry fee, and there is a rivalry in the order of visiting groups – which oppose the definition of public good.

However, with such a magnificent appearance, many tourists have come to Milan for the pleasure of observing and capturing the image of Duomo di Milano. They take pride from the pure presence of themselves at the attraction spot without the need to enter its interior. The unique structure of the Cathedral represents a history identity for Milan as a highly identifiable landmark. It is remarkably visible from many location and free to approach, which makes it a very valuable public good since it attracts tourism and generates profit for the entire city of Milan.

Such move is justified by following Winston Churchill's words "*We shape our buildings; thereafter they shape us.*" Young people, being the core of society must be given a coherent pattern to develop into valuable adult members of society. If such pattern is enhanced by fine art and architecture it is even better.

2.3.2 Economic values

A building construction requires great amount of time, material and human resource before it could become functional and possibly returns profit.

Architect Carl Elefante (AIA, LEED AP) quoted in his journal published by The National Trust of Historic Preservation (USA):

The greenest building is one that is already built – (Elefante, 2007)

This phrase, eventually, became the mantra of many authors with an enthusiasm in the movement of green preservation. It has been rephrased many times in various articles published by, for example, the Time (Sifferlin, 2012), Treehugger (Alter, 2012), Switchboard (Benfield, 2011) or The Craftsman Blog (Sidler, 2014) – each with a different interpretation and approach from the original saying. Both Sifferlin (2012) and Alter (2012) quoted a report by Preservation Green Lab from the National Trust for Historic Preservation (Frey, Dunn and Cochran, 2011) as the reference for their contents. They mentioned that a newly built building, despite being sustainably constructed and efficiently operated, will take from 10 to 80 years – depending on the building type – to overcome the negative impact it created throughout its construction. Frey et al. (2011) has confirmed this via their report in the following table:

Table 6: Number of Years Required for New Buildings to Overcome Climate Change Impacts from Construction Process (ibid)

Building Type	Chicago	Portland
Urban Village Mixed Use	42 years	80 years
Single-Family Residential	38 years	50 years
Commercial Office	25 years	42 years
Warehouse-to-Office Conversion	12 years	19 years
Multifamily Residential	16 years	20 years
Elementary School	10 years	16 years
Warehouse-to-Residential Conversion*	Never	Never

*The warehouse-to-multifamily conversion (which operates at an average level of efficiency) does not offer a climate change impact savings compared to new construction that is 30 percent more efficient. These results are driven by the amount and type of materials used in this particular building conversion. The warehouse-to-residential conversion does offer a climate change advantage when the energy performance levels of new and existing building are assumed to be equal (see Figure 14). Thus, it may be particularly important to retrofit warehouse buildings for improved energy performance while renovating them. Furthermore, care should be taken to select materials that maximize environmental savings.

Sifferlin (2012) wrote*: "Green construction is only as green as the materials used"* to rephrase what Frey and her colleagues (2011) found from their research:

> *Materials matter: the quantity and type of materials used in a building renovation can reduce, or even negate, the benefits of reuse. – (Frey et al.,2011)*

The Historic England Annual Report (2016, 14-16) has recorded that the rehabilitation of historic buildings have a significant positive influence on sustainability. From 2013-14 to 2015-16, total gross emissions of CO^2 reduced 4 times lower (from over 10 tonnes of CO^2 to roughly 2.5 tonnes), electricity consumption dropped from 17 million kWh to 4.5 million, and gas consumption from 8 million to roughly 2 million kWh. Expenditure on energy in 2015/16 is about 5 times lower than in 2013/14. Total waste also drops from 700 to 430 tonnes between 2014 and 2016. (See figure 2,3 and appendix 2)

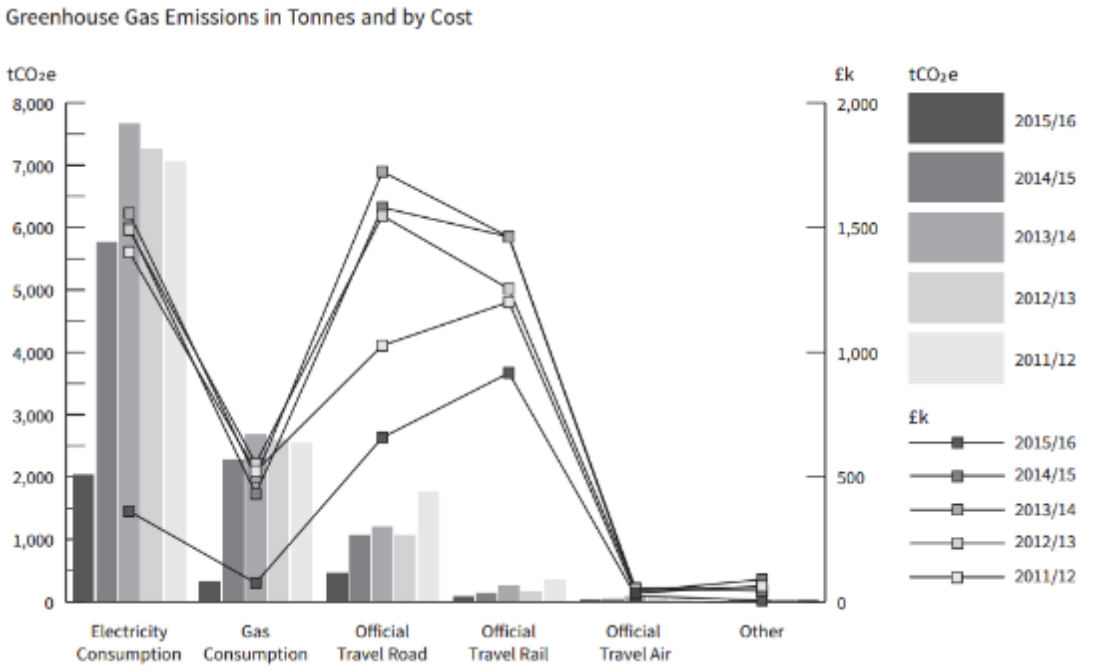

Figure 2: Greenhouse Gas Emissions in Tonnes and by Cost (Historic England 2016, 14)

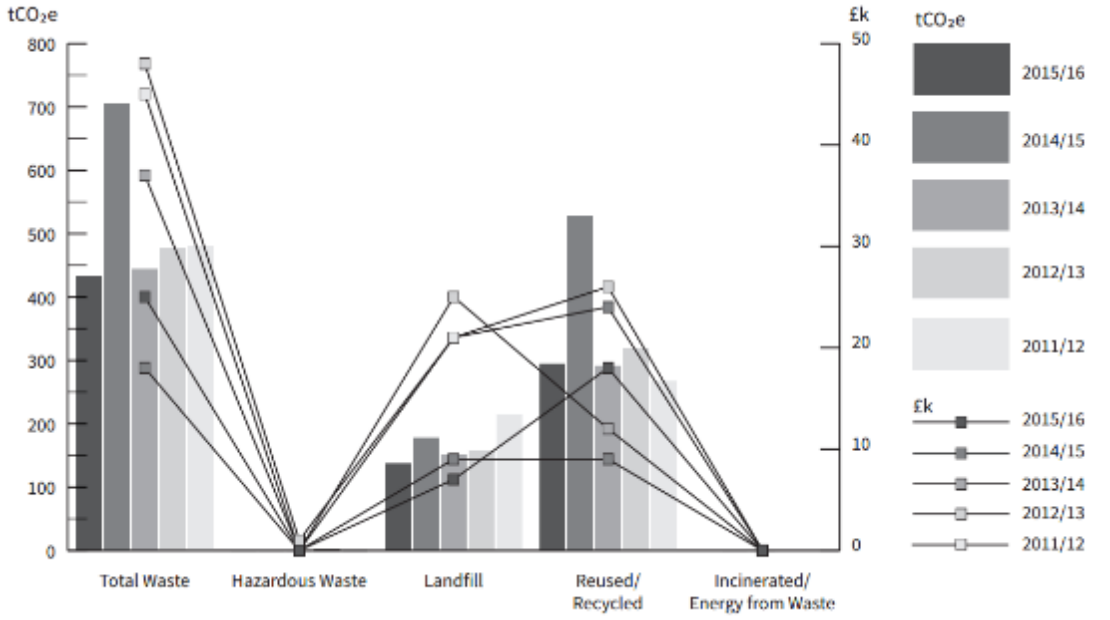

Figure 3: Waste Volumes and Disposal Routes in Tonnes and by Cost (Historic England 2016, 15)

There are numerous economic values affiliated with discussed subject as well. Apart from microeconomic aspects such as increase of property value or extension of whole life of a building there are numerous macroeconomic factors valuable for the topic of this thesis. (Douglas J. 2006, 295) First of all, it provides and ensures a lot of workload

in uncountable fields as vast number of specialists and worker is needed to perform the task. Adaptation of historical buildings is the source of creating small, yet highly-specialized businesses and an opportunity to develop them effectively. It may even present a significant value for tourist market, as properly maintained historic buildings improve cultural impact and value of surrounding area, as quoted in a publication of British Standard Institution: "[its] character, quality, interest or beauty enhances the value of the immediate area in which it is set or of the wider area or country as a whole" (BS7913 1998, 6). Moreover, it is a chance for universities to develop themselves, as constantly growing business requires new specialists educated in properly adopted buildings. Finally, such a growing industry is a great boost for local economies, especially when numerous successful adaptations will result in new tasks to improve both public and individual good.

3 Methodology

3.1 Philosophical position

A research process starts from ontology (what there is to know), to epistemology (how to know about it) and methodology (how to achieve the knowledge). According to the nature of this thesis which attempts to conceptualize the principles of historic university conservation and practices of Spacesharing through objective observation, it has the possibility to be apprehended probabilistically; yet there are some aspects that cannot be numerically calculated. Conservation can happen systematically on schedule – but it cannot be ignored that some people would perform maintenance if they *feel* that their object is gradually becoming old, dirty or broken. This mental process can happen alongside with systematic schedules and still result in the same outcomes (a cleaned, fixed object), which encourages post-positivism as the philological position for this thesis. Post-positivists do not consider everything conclusive or verifiable; it can be "tentative and socially and individually constructed", and that "Knowledge is the basis of meaning. Meaning is a human invention." (Reimer 1996, 123). This is quoted more universally by Trochim (2008, 25):

> *Post-positivist might begin by recognizing that the way scientists think and work and the way we think in our everyday life are not distinctly different. Scientific reasoning and common sense reasoning are essentially the same process.*

Historic university campuses can be renovated by professionals based on their experience and observance, but there are precautions that should be considered based on previous practices. New methods can develop over time depending on new technology and outdating old ones. Hence, critical realism in ontology is more appropriate. Critical realism is more flexible to a variety of research methods (Sayer 2000, 19) – *"Compared to positivism and interpretivism, critical realism endorses or is compatible with a relatively wide range of research methods, but it implies that the particular choices should depend on the nature of the object of study and what one wants to learn about it"*

Historic campus reconstructions are observation and experience based. They are a combination of many details that need taking care of (e.g. heating, ventilation, fire safety, interior design). The knowledge of restoration is triggered by the desire to repair and maintain the historic aspects of a university campus, hence the epistemology of this thesis is a posteriori/empiricism. According to the Routledge Syllabus on *Knowledge empiricism,* "Propositions that can only be established through experience are a posteriori".

There were three main research methodologies, but qualitative was followed as the in-depth details and characteristics of architectural conservation and Spacesharing conceptualization were to be explored. A quantitative approach was hardly applicable here since research following this approach leans more towards a calculable impact of a phenomenon or statistical analysis. This method would have been useful if there had been relatable variables that could be "operationally defined" (Silverman 2005, 9), which was not in the nature of this thesis. It could have been possible if measuring how working/studying in a historic building affects the participants by using a large-scale survey or group experiment to find a causal relationship between certain defined factors had been easier (Anderson 2006, 2 and Creswell 2003, 14). The lack of numerical data also eliminated mixed methods as an approach, since this would have

required the integration of both quantitative and qualitative data, regardless of how dominant they were comparing to the other one (Creswell 2003, 19, see Appendix 3).

Qualitative method, on the other hand, granted the author the possibility to use personal experience and observation in order to approach the research problem. Collier and Elman (2008, 781) describe qualitative researchers as ones who "routinely rely on rich, dense information concerning specific cases". Since a very limited amount of solid literature for the topic could have been found, the qualitative approach – which approves open-ended, emerging data – allowed the author to "derive a general, abstract theory of a process, action, or interaction" (ibid, 14) as she attempted to depict the concept of Spacesharing. Since very little has been researched on this concept and no solid theory has been created, a qualitative method should be applied according to Kananen (2013, 31).

3.2 Theoretical framework and research questions

Since there has not been many published works on Spacesharing – specifically Spacesharing in Historic Universities, a theory framework is needed to create a solid base for its definition. This concept is related to architectural conservation, building adaptation and Spacesharing.

An initial framework on this topic could be generated as follows: (see Figure 4)

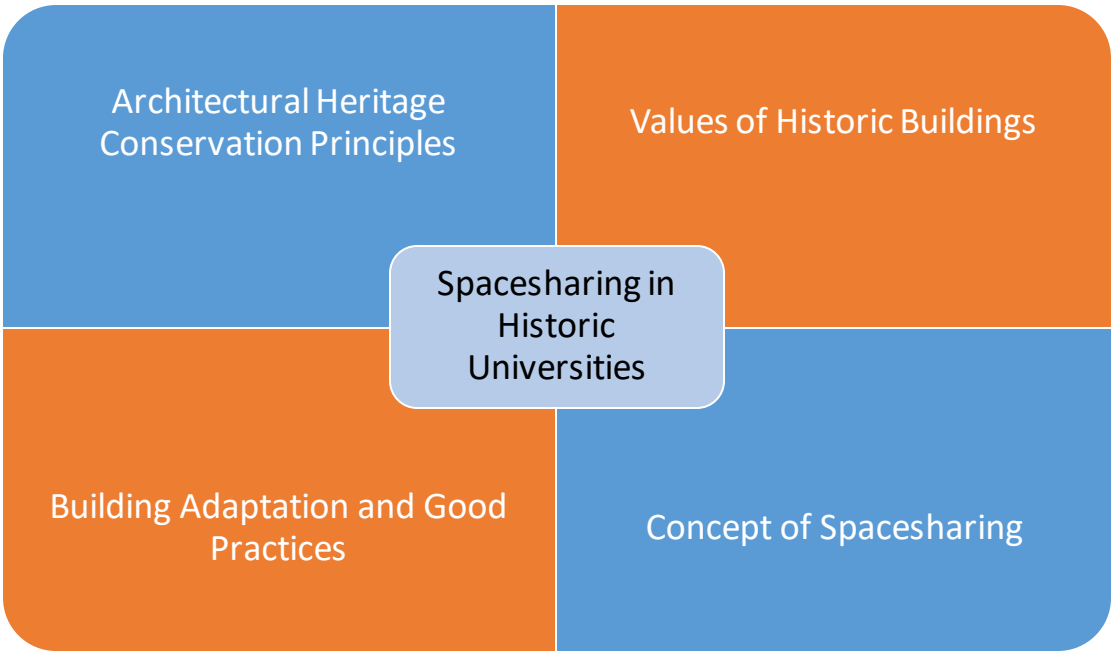

Figure 4: Theoretical framework for the concept of Spacesharing in historic universities

From this theory framework, it was assumed that the theory of Spacesharing in Historic University would generally be:

> *Spacesharing would benefit greatly to historical buildings; however, in order to successfully adapt this concept, one must closely follow architectural heritage conservation principles and regulations, in order to preserve the buildings cultural significance and historical values.*

From the basic descriptions of architectural conservation, the value of ancient monuments and why it is necessary to adapt a historic building for modern activities, it was better understood why universities insist on maintaining the premises they were originally built in, despite some having the fund to start new construction. There is a known pride to study in prestige universities of which names have been mentioned for years and the local authorities strive to maintain the face of their community. This is questioned whether there is a generalized guideline for specifically universities conservation, as each university is different from the materials they are made of, their location, the local weather conditions, the original architectural style, etc. Each and every of them requires a customized maintenance routine and refined techniques of

architectural conservation. On the other hand, the development of modern teaching methods urge them to welcome new machinery into hundreds-year-old premises. The demand for education also requires universities to obtain enough space for study activities, which vary greatly depending on their types. According to the Higher Education Space Standard Study (Paulien and Thibodeau, 2011), a classroom needs to provide approximately 12 ASF/FTE (assignable square feet per full-time equivalent student) – 1.1 m2, while research laboratories need to acquire from 35-425 ASF/FTE (3.25-40 m2), depends on the complexity of research subjects. (See Appendix 11)

Universities are gradually getting more crowded due to large numbers of incoming students since the pursuit of education has gotten easier thanks to good policies and globalization. With such growth, it is questionable that their hundreds-year-old walls would be able to provide a safe roof to the people inside and their ongoing activities while displaying the characteristics from their bygone days. Architects in 18th century might have envisioned their work to last for century, but it is doubtful that they expected these universities will install a massive computing system, a conference room with heavy media equipment, nor simply a couple of chemistry and biology labs The importance of electricity cables might not be appreciated, as their role was not as fundamental as they are today. If these buildings are to be used efficiently, their residents need to not only adapt them to their current demands, but also to prepare them for what the future generations will be asking.

With the mentioned thoughts in mind, there are two questions of which answers would solve the resolve research problem (Booth et al., 2008)

- *How can modern technologies be combined with historical characteristics of a university building?*
- *What are the requirements to apply Spacesharing concept to historic universities, considering the conservation principles?*

For these questions, the main goal is to define two things:

- What are the standards of architectural conservation and building rehabilitation that can be applied to historic universities? (Findings from literature review).

- What are the limitations in an old building when it comes to renovation and installation? (Findings from literature reviews)
- In which way can one add modern details to an old building (e.g. historic universities) without disturbing the existing interior aesthetically? (Findings from observation).
- What is the ultimate concept of Spacesharing and how to apply it? (Findings from workshop brainstorming)

3.3 Research methods

In order to answer the mentioned questions, there are two suitable methods to be applied. Grounded theory would be used to build the concept of Spacesharing, and then use that along with conservation principles to propose a case study for AMU newly adapted room. Both methods are qualitative, and this combination is called "multimethodology", according to Creswell and Plano (2007): "Writers in mixed methods are also careful to distinguish 'multi-method studies' in which multiple types of qualitative or quantitative data are collected from 'mixed methods studies' that incorporate collecting both qualitative and quantitative data." (273). It is, however, more preferable to focus on using grounded theory as the base for this thesis, and propose a case study for interested parties in the future.

Creswell (2013) cited the definition of grounded theory from his study of Charmaz (2006) and Corbin & Strauss (2007) as follows:

> *Grounded theory is a design of inquiry from sociology in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants. This process involves using multiple stages of data collection and the refinement and interrelationship of categories of information. (42)*

Studies by Halaweh, Fidler, McRoob (2008, 4-5), and Glaser and Strauss (1967) are considered the first to present this theory. Later, Strauss partnered with Corbin (1990, 1998) to develop and extend the original methods, which Glaser (1994) was strongly against. Grounded theory then was divided into two approaches, the Glaserian and Straussian. The different between these two is that Strauss and Corbin (1990) believes

there should be some literature and phenomenon reviews prior to the study, while Glaser (1992) criticizes that this action biases the writer's hypothesis and observation.

This particular thesis would be more suitable with the Straussian approach, which combines grounded theory with involving data collection in different stages and data triangulation, constantly comparing data with emerging categories to capture similar patterns and differences (Creswell 2014, 14). It involves three steps of coding as a process: open, axial and selective coding (Strauss and Corbin, 1990). Böhm (2004) describes these processes in *A Companion to Qualitative Research* as follows:

- Open coding: Breaking down data to develop concepts, and use it as "building blocks" to create a model for the research
- Axial coding: Is used in later stages of an analysis, to "refine and differentiate concepts", then categorize them and develop around those categories.
- Selective coding: Deciding on the "core category" from repeating patterns, forming relationships with other categories, and finally conceptualize the theory. (271-274)

3.4 Data collection and analysis

3.4.1 Exploratory observation and visual survey

Based on the previously mentioned process, during the first phase – open coding, exploratory observation method is used in targeted universities in order to find a pattern of how modern technologies are blended into a historic environment.

Observation, whether only observing or observing and participating, allows the researcher to approach the target in their own environment. It is subjective to the author's beliefs, giving them an understanding of the environment they are surrounded in (Mack, Woodson, Macqueen, Quest and Namey 2005, 13-14). This method is commonly used in ethnographic research – one that requires the researcher to study a phenomenon or social and cultural context by spending time to emerge themselves in that environment (Myer, 1999, interpreted by Iacono et al. 2009, 40). Exploratory observation and visual survey require minimal participation and allow note taking at the same time, which let the author record what was observed immediately without relying on memory as in participant observation. This method is

usually questioned because of ethical reasons because unobtrusive observation often takes place without notifying the participants or introducing the researcher's role. In order to document the process, photographs are taken as observed. This is a very helpful tool for exploratory observation since it describes the subject as it was seen, without the objectivity of the photo capturer. It is stated in *Photography as Social Science Data* by Harper (2010, 231):

> *Photographs are the most common form of visual sociology, and they are the most peculiar because they have the dual qualities of recording the world seemingly without interpretation, and at the same time with profound subjectivity.*

As the intention is only to observe the objects that are relevant architectural conservation (carvings, paintings, lighting system, safety and security equipment, other furniture, etc.) that are publicly located, it comes to the author's belief that it does not violate any individual's privacy. During this phase, she took careful measures to ask for permission from responsible parties about her presence, and avoided sights of human activities when taking photos. In order to keep an objectivist approach (Angrosino 2006), the objective was maintained and no influences or interference by any other activities were allowed to bias the observation. Data collected from this phase of open, mostly photographs, is called "visual ethnography" (Pink, 2001). These photos were to be rearranged and categorized following the definition of axial coding.

3.4.2 Complete participant

Later in the thesis, the author discussed her participation during Spacesharing workshop, which took place in Stuttgart, February 2016. During this phase, she took a participant observant role and became a part of the brainstorming process in order to contribute her opinions along with other participants. Together, their objective was using what they learned from the workshop to develop Spacesharing concept. Kawulich (2005) quoted what she studied from Marshall and Rossman (1995) in her article on *Participant Observation as a Data Collection Method:*

> *Participant observation allows researchers to check definitions of terms that participants use in interviews, observe events that informants may be unable or unwilling to share when doing so would*

> *be impolitic, impolite, or insensitive, and observe situations informants have described in interviews, thereby making them aware of distortions or inaccuracies in description provided by those informants.*

Axial coding of grounded theory happened during this stage, in which the findings during open coding and observation are compared with the learnings from this concept to find a relationship between historic conservation and Spacesharing. Materials and notes taken during this time were compared and analysed to support the search of connection between previously mentioned subjects.

3.4.3 Data analysis techniques

Since there were a lot of data accumulated from literature reviews, observations, and field notes, it was not possible to start analysing without grouping similar data, categorise and contrast them with each other. Recordings from observation and field notes were compared with reviewed theories, then systematically placed into proposed theoretical framework to result in generalized concept for Spacesharing in historic universities.

4 Practices of historic building rehabilitation

4.1 Standards for Interior Rehabilitation

According to The Secretary of Interior's Standards for Rehabilitation of U.S. Department of Interior, rehabilitation of building's interior may be divided into three main groups:

- Structural systems,
- Spaces, features and finishes
- Mechanical systems

Detailed guidelines including description and explanation for both recommended and not recommended practices were introduced in this document. It contains sufficient data to determine whether solutions utilized in case studies are desired or not (Morton 1996, 47-60).

First of all, as for the rehabilitation of structural systems, the crucial first steps are to identify, retain, and preserve as much from the interior as possible. Physical interventions like demolishing, removing or covering original features are not recommended. However, in order to protect and maintain the structure, further actions need to be considered. Heavily damaged pieces of a structure (e.g., roof flashing) require cleaning and replacements to ensure the entity possess no traces of infestation or decomposition. When possible, the state of addressed structure is to be examined with noninvasive measures such as x-ray photography.

Further maintenance steps will vary depending on the estimated condition, being either reparation or replacement. In this phase, reinforcement and refurbishment of weakened and exploited structures with new additions (such as floor panels) are allowed to the level that such action should not diminish the historical value of a building. Replacement should only occur when an important specimen is missing or its condition is so strongly deteriorated, restoration is impossible. Substituting placements should be of the same material, shape, details and blend in flawlessly with the remaining. When the structure is to be adopted for a new function or adjusted for legal regulations, all physical interventions taken place must be limited to the minimum. Each intrusion during such adjustment must be preceded with detailed archaeological studies. (ibid, 47-52)

The rehabilitation of spaces is closely related to structural systems and guided by similar principles established above and in the Burra Charter. Discussed studies for spaces tend to be more lenient, as a building interior can be divided in various ways depending on the users' needs; but mainly separated into primary space and secondary space.

The former one, primary space, is vital for keeping historic value and character of premises. This includes entrance halls, lobbies and other spaces determining functions of a building – these are considered the "core" area and special care must be taken for ensure as little amount of physical interventions are executed as possible. The latter ones, secondary space, includes service rooms such as bathrooms, kitchens, utility spaces, staircases, and other areas not strictly determining the historic character of a building. During rehabilitation, modern materials and technologies can be used;

especially when considering necessary measures to secure interior against vandalism, danger, or threat not formerly calculated (doors, windows, locks, fences or barriers). Any changes or additions of materials, colors, forms and patterns must be consulted with responsible authorities in order to maintain historic value. (ibid, 53-60)

Last but not least, the rehabilitation of mechanical systems. It is generally considered the easiest to conduct, as long as they are not exposed and tamper with the historic look. Hidden mechanical systems that are easily exploited (pipes, cables, wires) or where safety is involved should be regularly exchanged. (ibid, 61-66)

4.2 Observation protocols

In order to carry out this research, the observation targets were universities built from 1920s the latest. The observation was conducted based on several universities in Poland and Germany where exist a long history of higher education. It would have been better related if the thesis was based on old and famous campuses, e.g., the University of Cambridge, the University of Oxford (England), University of Bologna (Italy), etc. – but unfortunately this could not take place due to the inconvenience of location and timing.

Nevertheless, the author believed that her choices of observation targets consisted of sufficient evidence to create solid findings. Furthermore, most of these buildings are functional full time as a university, unlike the aforementioned which have also tourism functions, for example: tours, museums and exhibitions (University of Oxford, 2016; University of Cambridge, 2016; University of Bologna, 2016). The popularity of these campuses and their practices may somewhat bias the conservation methods, as more funding is provided to improve the premises for the financial advantage of those functions.

The list of visited universities for this dissertation is as following: (See Appendix 4 for images).

Table 7: The list of universities visited and their information

	Name	Establish-ment	Location	Museum	Visited buildings
1	Adam Mickiewicz University	1919	Poznan, Poland	No	Collegium Minus and Collegium Maius
2	Poznan University of Economics	1926	Poznan, Poland	No	Main building and B building
3	University of Wroclaw	1702	Wroclaw, Poland	Same building	Main building
4	University of Heidelberg	1306	Heidelberg, Germany	Separate buildings	Library and "New" building
5	University of Mannheim	1763	Mannheim, Germany	No	Main building
6	University of Tuebingen	1417	Tuebingen, Germany	Separate buildings	Main building

Accordingly, structured observation was chosen to be conducted, as it was not always possible to find the preferred objects to take note of. However, prior to the interview, more attention were paid to certain items which could answer the questions of interest below:

- *Where are the electricity cables and how are they concealed?*
- *How is the harmony between modern addition and original details? (color, material, placement)*
- *How flexible is the furniture? Can they be moved/modified to create more space?*

- *How are lighting and ventilation affecting the atmosphere of the observing area?*

The amount of electronic devices and stationary available were also taken in attention, but this could be biased as different rooms hold different functions, and hence the difference in number and installation of equipment. The exterior of these buildings were also considered as they contribute greatly to the architectural structures; but since it did not seem significant to the topic, the details were not precisely studied.

From the observation, it was noted that while the methods of installing new additions in these buildings vary, there were three main approaches to accommodate new modern details:

- Concealing them under panels or behind walls, and painting the maintenance hatches with matching colors.
- Blending them in with decorative covers (wooden or metal) or with vintage design.
- Keeping them visible but minimal, without disturbing the overall surrounding.

4.3 Observed practices

4.3.1 Practices on concealing modern details

4.3.1.1 Electricity and internet cables

In general, most of the electricity system in these universities were hidden inside or between the walls, with very subtly colored hatches that are barely noticeable. In some other cases, there were built-in boxes on the wall painted the same color and with a warning sticker (see Figure 5 and 6)

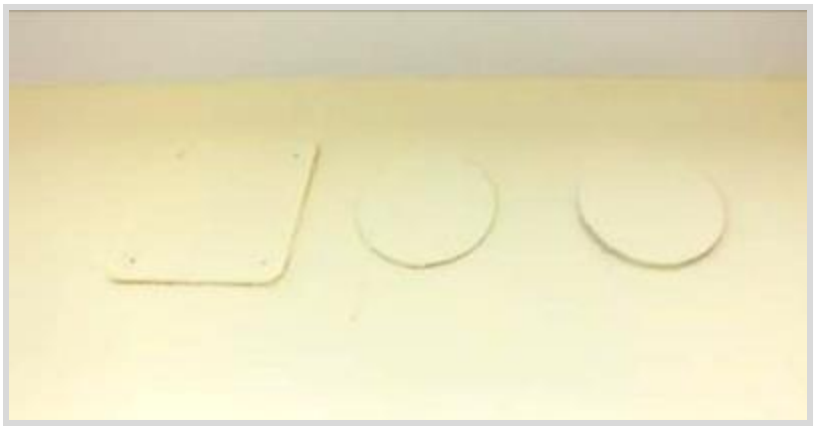

Figure 5: Hatches are subtly colored not to be intrusive to the overall design (Poznan University of Economics)

Figure 6: Doors to electricity system control with small, yet visible warning stickers (University of Mannheim)

In representative areas, all the cables were very discreetly hidden to preserve the antique look. However, in more functional areas (classrooms, libraries, conference rooms), it was easy to notice the electric plugs and cables. Sometimes these cables are covered by a plastic panel that matches the colour of the wall, sometimes they are just left visible (see Figure 7 and 8). This suggested that, in these areas, the functionality was more important than the aestheticism. In addition, these areas were mostly reserved to the students and staffs to perform their tasks; therefore, it is essential to ensure they are provided with good accessibility to electricity and modern devices.

Figure 7: Cables at the foot of a wall coated in color-matching paint (University of Mannheim)

Figure 8: Cables are covered by matching-colored panels (taken in University of Tubingen)

In spaces with a representative characteristic, yet required sufficient audio and media functions (e.g. conference rooms), panelled walls with cables hidden behind them were commonly seen (see Figure 9 and 10). These panels added an elegant touch to the room while camouflaging the needed connections. They could also be easily removed for new instalments, maintenance or reparation.

Figure 9: Removable panels to access the electricity system. (Taken in Adam Mickiewicz University)

Figure 10: Conference room in with panelled ceiling and part of the wall (taken in University of Heidelberg)

4.3.1.2 Water pipes, ventilators and smoke alarms

One of the common methods noted was painting the water pies, ventilators and smoke alarms the same colour as the wall they were attached too. They were usually placed discreetly out of sight, for example on the ceiling, in a corner or under staircase (see Figure 11-13).

Figure 11: Barely noticeable smoke alarms on the ceilings of University of Tuebingen (left) and Poznan University of Economics (right).

Figure 12: Part of the water system in Poznan University of Economics, well hidden in the basement in a corner.

Figure 13: Radiator painted the same colour as the window pane above, as seen in University of Heidelberg.

Ventilating system in these universities were commonly placed as under window panes in the hollow part between intruding walls or discreetly as part of the ceiling (see Figure 14-17). These are not remarkable to the eye without having to look for them; yet they play a very important part in keeping the air ventilated – especially in oxygen-deficient areas such as basements. Without ventilators, the building's occupants may suffer from Sick Building Syndrome. Biological contaminants (bacteria, fungus, molds, etc.) and chemical contaminants (exhaust, dust, paint, etc.) are the main responsible factor, but inadequate ventilation would reduce indoor air quality, increase the growth of the contaminants; and thus severing this syndrome. (Joshi, 2008).

Figure 14: Small ventilator placed along the window pane, as seen in University of Heidelberg.

Figure 15: Ventilator hidden next to an intruding wall, as seen in University of Wroclaw.

Figure 16: Ventilator hidden inside wooden window pane in Adam Mickiewicz University.

Figure 17: Well-hidden ventilator hatch on the ceiling of conference room (seen in Adam Mickiewicz University)

4.3.2 Practices on blending in the modern additions

4.3.2.1 Elevator

Originally, elevators were not part of historic buildings; at least not until 1857, when the first elevator was installed by Elisha Otis (1811-1861) and remodelled with automatic doors in 1859 by Otis Turfs (1804 – 1869) in New York. (The New York Times, 1860 – as interpreted by Allwine, 2011). It was difficult to tell whether the space that take place by the elevators in visited universities were previously reserved for an older model of elevators, or that space was originally used to perform other tasks and modified to accommodate these machines. Nevertheless, these elevators are relatively new, and some were installed in a way that does not disturb the inner walls of the buildings. A few are also created to resemble old elevators, with transparent glass wall that allow passengers to see the elevation. This design lightens the bulky look of typical all-metal “boxed” elevators, while allowing natural lights from window to bright up the area and creating an open space (see Figure 18).

Figure 18: Elevator installed in the available space of an original spiralling staircase, partially removed to create entrance (left: Adam Mickiewicz University, right: University of Mannheim.)

At the University of Heidelberg, the elevator in their main library is framed with wooden bars to unify it with other historical details (see Figure 19). These bars are painted in the same color as the door frames; they also have transparent walls to create an illusion of extra spaces, since the size of this elevator occupies a big area on this corridor. This effect is very subtle, but it did create a perception that the elevator has been part of the antique surroundings since the beginning.

Figure 19: The stylized elevator in University of Heidelberg Library

As for the Poznan University of Economics, their elevator was not originally planned to be installed in the building. However, since there is a demand for automatic elevation (disabled minority, narrow staircases, high floor), they installed their elevator on the outside of the building. The machine blends in quite well with the exterior thanks to the climbing vines and glass walls (see Figure 20).

Figure 20: The elevator of Poznan University of Economics from the outside

4.3.2.2 Radiators

Radiators were one of the most interesting objects found onsite. All of these universities use aged steam radiators, which receive most of their heat from district heating plants fuelled by biomass, natural gas or coal. (Nussbaumer and Thalmann, 2014). Radiators play a vital part in the winter since the average temperature then is -5 degree Celsius, and occasionally can drop down to -20 degree C.

In representative spaces, radiators are usually guarded by decorative covers – which are commonly made of wood or metal. The patterns on these covers more than often fit to the general design of the room in which they are installed (see Figure 21 and 22). They also act as a barrier between people and hot heating, as in direct contact this might result in physical burns.

Figure 21: Radiator with a wooden covers and benches at the sides (as seen in Adam Mickiewicz University)

Figure 22: Brass radiators with matching marble frames in University of Tuebingen (left) and with decorative metal frames in Adam Mickiewicz University (right).

4.3.2.3 Lighting

Lighting plays an essential part as the spine of every building. Without sufficient lighting, the buildings would become adversely dark and affect daily activities of their occupants. *"Lighting plays such an integral part in collaborative spaces …"* – says Woofter, the president of Strategic Sustainability Consulting – *"… It plays a huge factor in how a person perceives the workplace"*. (Morton, 2014). The lack of light would place a strain on physical and mental health, following with bad eye sight, headache, absenteeism, depression and in general, low work productivity and collaboration. (Veicht and Gifford, 1996). In addition to the natural light source coming through the

windows installed since these buildings were first erected, the demand for extra lighting is inevitable in universities where academic research and collaboration take place. However, since these are historic buildings, lighting needs to be installed without affecting the overall look of the whole building.

A common practice for light installation is placing them along the ceiling, either with a panel to cover the cables or distributing electricity cables between the walls. LED light in reflecting ceiling fixtures are regularly seen used for this purpose, especially where a lot of light is needed for a variety of activities. These lightbulbs do not intrude notably from the wall; yet they provide strong brightness for all sort of activities. Some universities opt for the vintage ceiling light pendants or those that can be hidden on the pillars – this is usually seen in halls or corridors (see Figure 23-27).

Figure 23: Ceiling light fixtures installed in accordance with the decorative carvings (seen in University of Tuebingen)

Figure 24: Decorative vintage light pendants, as seen in University of Heidelberg (left) and Poznan University of Economics (right)

Figure 25: Light hidden on top of the decorative pillars, as seen in Adam Mickiewicz University (left) and University of Wroclaw (right)

Figure 26: The combination of ceiling fluorescent lights and hidden bulbs in the decorative panel, as seen in University of Mannheim.

Figure 27: Ceiling light fixtures in conference room, as seen in University of Heidelberg.

4.3.2.4 Others

Back in the older years, electronic devices like projectors or projecting screen are rarely seen, thus no one had planned how it should be installed in an historical setup. More billboards are needed to attach announcements and events on campus, and new furniture is also needed as the number of student increases. In the University of

Mannheim, wash basins and lockers are latterly equipped in lecture room, and they needed to match it with the existing furniture (see Figure 28).

The most common practice seen when adding new objects in these universities is to make sure they are made of wood, covered by wood or at least, have wood characteristics (color, pattern). Wood was one of the most popular and primary material for constructions; usage of the most basic wood products, plywood and veneer, can be traced back to the year 3000 BC (Youngs, 2009). According to Youngs, the consumption of wood products in construction became the trendiest in the beginning of 20th century, and it is going back into favor in these recent years – as observed by Egons Garklavs, creator of Dores Factory – a Latvian construction company. He believes that "Wood is the most suitable material for creating a pleasant living environment." (Dores Fabrika, 2016), and indeed, wood is proven to create a warm, calming and relaxing effect on the human minds; it is the most preferred materials among others. (Rice, Kozac, Meitner and Cohen, 2006)

Back to the topic of historic building adaptation, as wood is a forgiving material, it is easy to blend new additions to an old building by adding a "woody" touch to the object, as presented in University of Mannheim and Adam Mickiewicz University (see Figure 28 and 29). This practice adds a modern touch to the room, yet still perfectly blend it in with the antiqueness of the building.

Figure 28: Wooden furniture in a lecture room (University of Mannheim)

Figure 29: Billboard with wooden frame and wooden name tags, as seen in Adam Mickiewicz University

It is also common to use mobile devices, meaning moving necessary equipment into the rooms only when required. This practice is popular in spaces where the interior details must be preserved as any installation would damage the valuable carvings and paintings (as seen in Aula Leopoldina – the most significant auditorium in University of Wroclaw in Figure 30). This room, during special events – e.g. graduation ceremonies, admission days, important conferences, etc. – is provided with necessary media appliances (microphones, speakers, projector, etc.) (See Figure 31). Other than that, during normal days when the university is open for visit, it serves as a significant exhibition of medieval arts – which is the main attraction for all the visitors of University of Wroclaw. Most of the appliances are then taken away, recovering the authentic and original details that have been preserved since the day it established (1702)

Figure 30: Aula Leopoldina in normal days. (Photo by Grzegorz Sanik.)

Figure 31: Aula Leopoldina during an event, with projectors, microphones, etc. (Source: Wikipedia, author unknown)

4.3.3 Practices on minimizing nonmodifiable objects

Safety and security is an important issue in every building, regardless of their age. Fire alarms, extinguisher, emergency exits and building maps when placed appropriately will save the occupants' lives in case of crisis. Therefore, these signs and objects are required to present their universal colors, even when they mismatch with the surroundings and there is not much can be done about this.

In most of the observed universities, a common practice is to place them near the entrance, where they can be easily seen when passing by. Some are placed under certain objects to reduce their vibrancy (see Figure 32-34). These signs and items are often placed together in order not to clutter the overall look.

Figure 32: Fire safety information and appliances are put together in the same place, as seen in University of Mannheim (right) and University of Tuebingen (left)

Figure 33: Fire extinguisher put in the corner of the corridor, exclusively from the main part. (Left: University of Heidelberg, right: Adam Mickiewicz University)

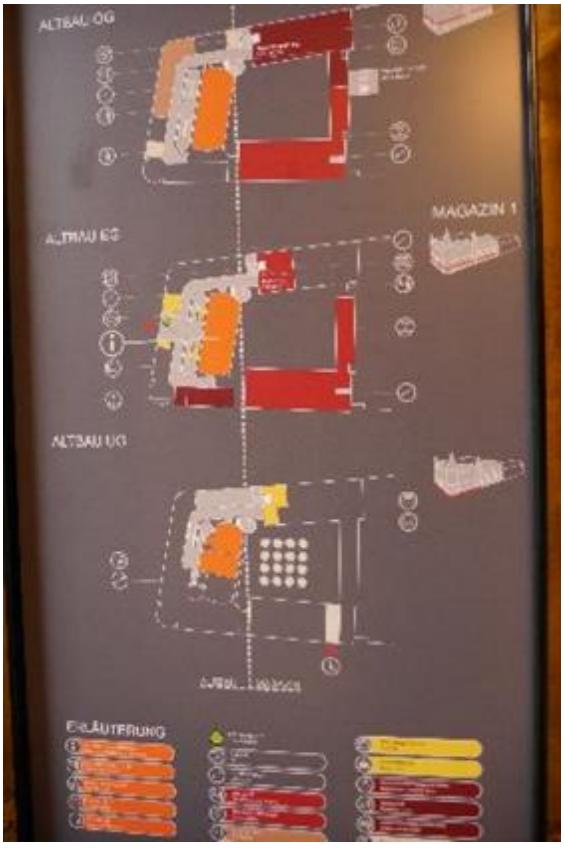

Figure 34: Building maps in a matching, yet appealing set of colors. (Seen in University of Heidelberg).

In conclusion, this chapter covered the good practices of historic building interior were observed and discussed with visual proofs to provide a better view on how universities buildings are adapted for modern usage. It was expected to link this practical information to the Spacesharing concept in order to support the adaptation of this concept to historic university easier.

From the author's observation, the practices of harmonizing modern additions in historic universities could be narrowed down to a few common methods (see Table 8)

Table 8: Observed common methods of harmonizing modern additions with existing historic features

Type of addition	Method
Connections of necessary building systems (electricity, water, internet, etc.)	If installed in between walls, accessible hatches are painted with similar color as the wall, with or without warning sign If unable to be installed within the wall, the connections can either be painted over with the wall color, or plastic cases can be placed over to conceal them.
Mechanical additions (e.g., elevators, radiators, conference equipment)	Transparent glass is commonly used to make the addition invisible or create an illusion of extra space. Decorating the object with consistent elements as its surrounding (wooden or metal carvings), or covering its appearance with similar material from other furniture For spaces with very strong representative value, moveable equipment is arranged only when necessary, otherwise stored out of sight to maintain the untouched view.
Safety and security equipment	Placed partially hidden and condensed in a particular area, not scattered around. Signs are placed subtly as needed, visible enough not to intrude the overall atmosphere

5 Spacesharing Concept

5.1 Concept of Spacesharing and its origin.

"Spacesharing" is a rather new concept that is still being researched and applied in the recent years. It is close to impossible to find an exact definition for this term in any academic documents. So far, only the most precise description found for "Spacesharing" was concluded from a project called "Reallabor Spacesharing" from the EuroFM Winterschool Workshop. This project contained brainstorming sessions and was led by Professor Matthias Rudolph at State Academy of Fine Art Stuttgart, in cooperation with DHBW Stuttgart.

The definition for "Spacesharing", as established by the project founders, is *"maximizing and facilitating space use intensity"*. The foundation of this project was inspired from the concern that the amount of usable space being built increases, but the "intensity" of space usage (how regularly and the variety of purposes that space can be used for) is on decline.

However, a numerous articles online (Haase, 2014; Neate, 2014, Bendavid, 2014) have shown a fact that there are a significant amount (11 million) of unused houses all across Europe (Neate, 2014). In the United Kingdom alone, this number was quoted 700,000 (CTB, 2015 – see Appendix 5), Spain 3.4 million, 84% of which in good condition (INE, 2013), Portugal 735 000, Germany 1.8 million – as demonstrated in an infographic created by Neate (2014) for The Guardian (see Figure 35):

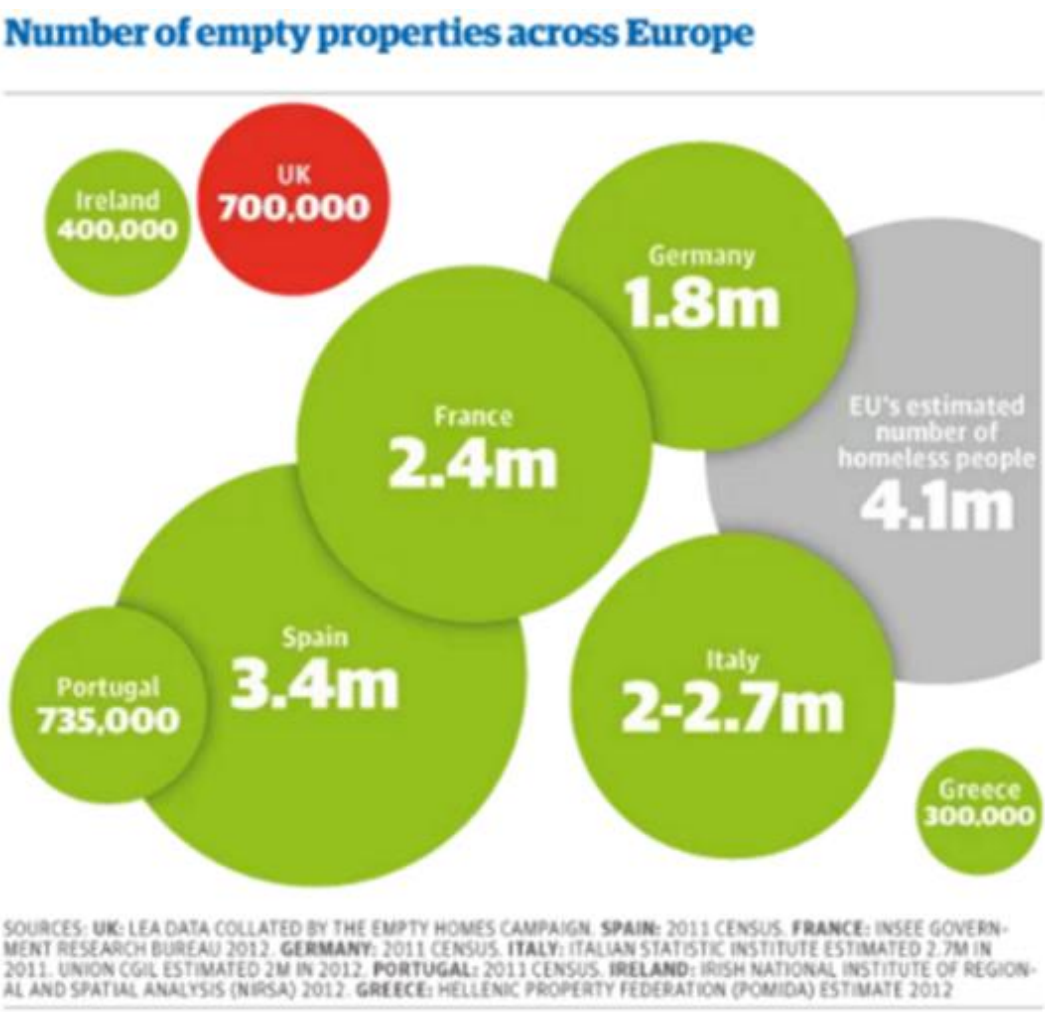

Figure 35: Number of empty properties across Europe, retrieved from The Guardian (Neate, 2014)

Buildings with once significant religious and cultural value also could not avoid the fate of being abandoned and neglected. According to The Wall Street Journal (Bendavid, 2014), churches of decades old are becoming empty due to the decline in worshippers, and are forced to be closed down or sold due to the lack of conservation and renovation funding. Every year, 20 churches of The Church of England are closed down. In Denmark, 200 of them are confirmed "unviable or underused"; 515 of Roman Catholic churches in Germany are closed in the last decade, and this number in the Netherlands is predicted to be more than 1000 in ten years. Many of these churches, unable to be transformed into other public properties (libraries or concert halls), seek commercial solutions – dance clubs, pubs, skating stage, despite being criticized by the morality of the religious leaders – in order to retain their existence in the area.

All of these issues bring together a problem that, despite having vacant space, a great number of these are abandoned and neglected. Even when they once held important position in the community, they are forced to disregard their traditional values (e.g. religion, in the case of aforementioned churches) for the search for adaptation and survival in the new ages as their financial situation changes. It is questionable whether the lack of flexibility in their usage has driven them to invisibility in the community, and whether they could have found better funding and maintained their premises in good condition if they have overlooked past their strict standards and requirements for usage.

In the previously mentioned article by Bendavid (2014), some of the churches reaching the edge of existence were obliged to seek a buyer and turn themselves into a commercial building. Some turned into bars, some into shops, schools, etc. In the end, they are no longer regarded as a church since all religious activities ceased to exist. However, the architecture and their aesthetical / historical value remained, and they gained more profits and admirers as a commercial structure.

The point here is that, if a certain space is built – or in the case of historic buildings – renovated into a space that fit a demand – or better, demands – then it can easily find users and help them achieve what they need. Under the circumstances, what are the prerequisites of a multi-purposes space? What can one do to turn a space into something many people can share, at different times, for different activities? What can one do to increase the intensity of usage in that space? Those are the questions an interested facility manager should look into regarding the concept of Spacesharing.

5.2 Project Introduction

Reallabor Spacesharing (see Figure 36) is a project led by Professor Matthias Rudolf from Stuttgart Academy of Fine Arts and his colleagues. It was inspired by the idea of a space that could be shared by many people, for different activities, throughout 24 hours a day.

Figure 36: Reallabor Spacesharing project logo (Source: Stuttgart Academy of Fine Arts)

The project was in collaboration with six other universities in the areas. It was funded by a state program themed "Strengthening the contribution of science for sustainable development". This program aimed to promote scientific knowledge on politics and economy as well as sustainability. Through this project, the collaborators wished to contribute to the development of Baden Württemberg state in order to increase improve resource efficiency, space utilization efficiency and solve the conflict between available spaces and the intensity of space usage.

The implementation of Spacesharing concept through services and booking platform was also planned as part of the research. They promised to offer extensive networking, expertise cluster opportunities, handbooks and manuals on the implementation of Spacesharing. (Reallabor Spacesharing, 2016)

The project coordinators created a video to promote and recruit interested parties. This video presented the concept of a 4-by-4 "room" which could hold different activities, from dusk to dawn, 24 hours a day. The idea behind this presentation was that, with organization and the right type of furniture, the space can be utilized for many purposes. (See Appendix 6)

5.3 Process of Concept Hypothesizing

During the EuroFM Winter School 2016 in Stuttgart, Spacesharing from a vague concept became more transparent through brainstorming sessions and customer researches. The participants discussed the advantages and disadvantages of the

chosen locations, designed different activities that would fit to the given space and envisaged the profiles of customers who would be interested in renting the space.

The project was based on a building called Calwer Kopfbau which located in the heart of Stuttgart. The location of this building is its primary advantage; it has a convenient proximity to the Old town, accessible by all transportation methods – by train, by subway, by car, on foot, by bike. However, the building itself lack the proper modification to become more attractive to customers.

Built in the end of 1970s, it has a typical "blocky" look adapted from architecture trend this era. With dark paint and glass windows – while being surrounded with brighter colored buildings – it does not exude welcoming aura towards visitors. The interior is dark and incomplete, with hanging cables that seemed dangerous to its occupants. Next to this building, there is a passage with built-in kiosk for temporary shops or exhibition. However, many of them are left empty for the majority of time. The amount of pedestrians walking through this passage is not significant either, it always looked vacant and abandoned.

The usable area for this project includes five rooms, each consecutively has an area of $50m^2$, $26m^2$, two of $15m^2$ and the smallest of $8m^2$ – spacious enough for various types of activity (see Appendix 7). But here comes the issue – they have space, they have the facilities (internet, kitchen, tables & chair, stationary, toilets, etc.), but they cannot utilize their property and cannot attract more customers either. The rental of spaces in this building has not been properly planned and announced among potential clients either. At that point, it was crucial to identify what their problem was and find a solution to it – which was the main goal of this project.

"Reallabor Spacesharing" participating students took part in a brainstorming session where they considered all the possible advantages and drawbacks of this building and create an analysis (see Figure 37):

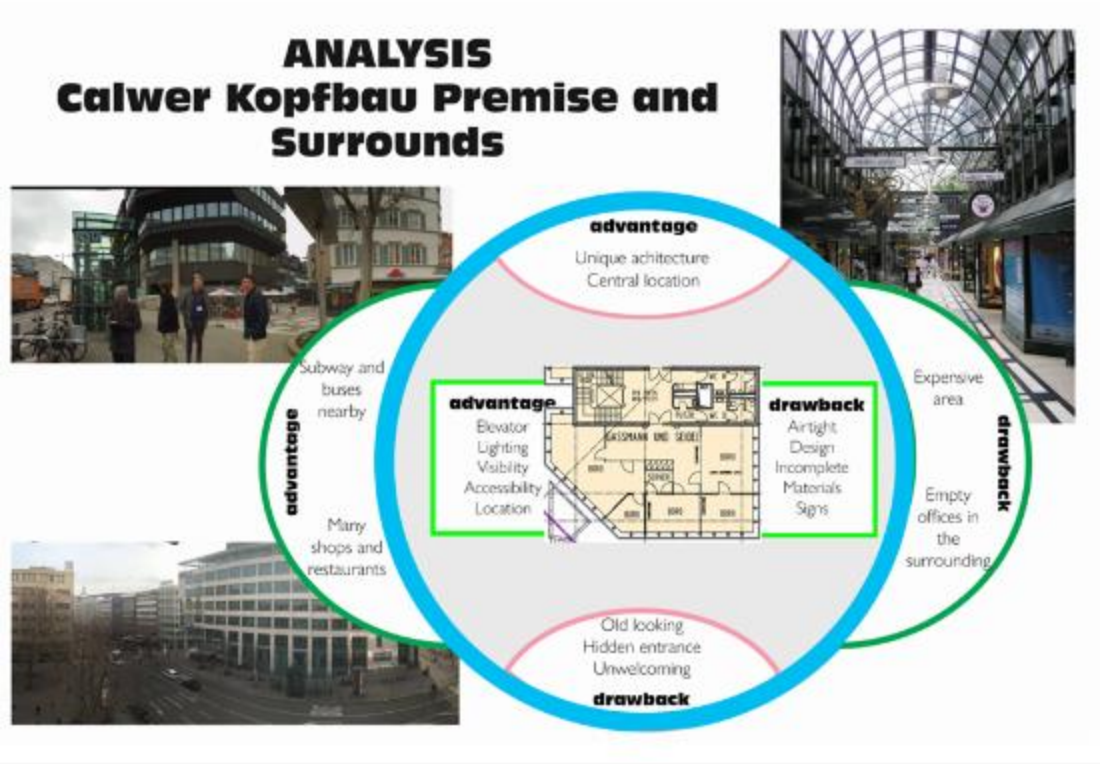

Figure 37: Analysis of internal and external factors that would affect the well-being and profitability of Calwer Kopfbau

From the information collected and analyzed, the student abstracted a conclusion on what the desirability of a space depended on:

- Location (transportation, proximity to popular areas)
- Exterior (overall architecture, entrance)
- Interior (lighting, air circulation, atmosphere, lighting, aestheticism)
- Facilities (convenience, availability, flexibility)

When a client or a stakeholder searches for a space, in most cases they already have a vision of what they would like to have equipped and what to accomplish from the given space. Depending on the person's background, expertise and demands, it is difficult to satisfy every client as there is a big variety in what they demand. In the search for a solution, the project participants created different one persona for each of these stakeholder types (see Appendix 8):

- Reality Lab stakeholders
- Education stakeholders
- City Council stakeholders

- Creative stakeholders

From prototyping, the students made a list of what activities and equipment would be needed, in which timeline the activities would happen, to provide the best environment for these client types. The space would need to be equipped with different furniture/device/services for each particular activity (see Figure 38). It was concluded that the possibilities could be endless. One room could provide enough space for different activities, but it is necessary to identify the obstacle that prevent people from using this space. The students also concerned about whether it was possible to provide clients with all the equipment they required, and whether it is possible to fill all 24 hours a day with activities without them overlapping one another.

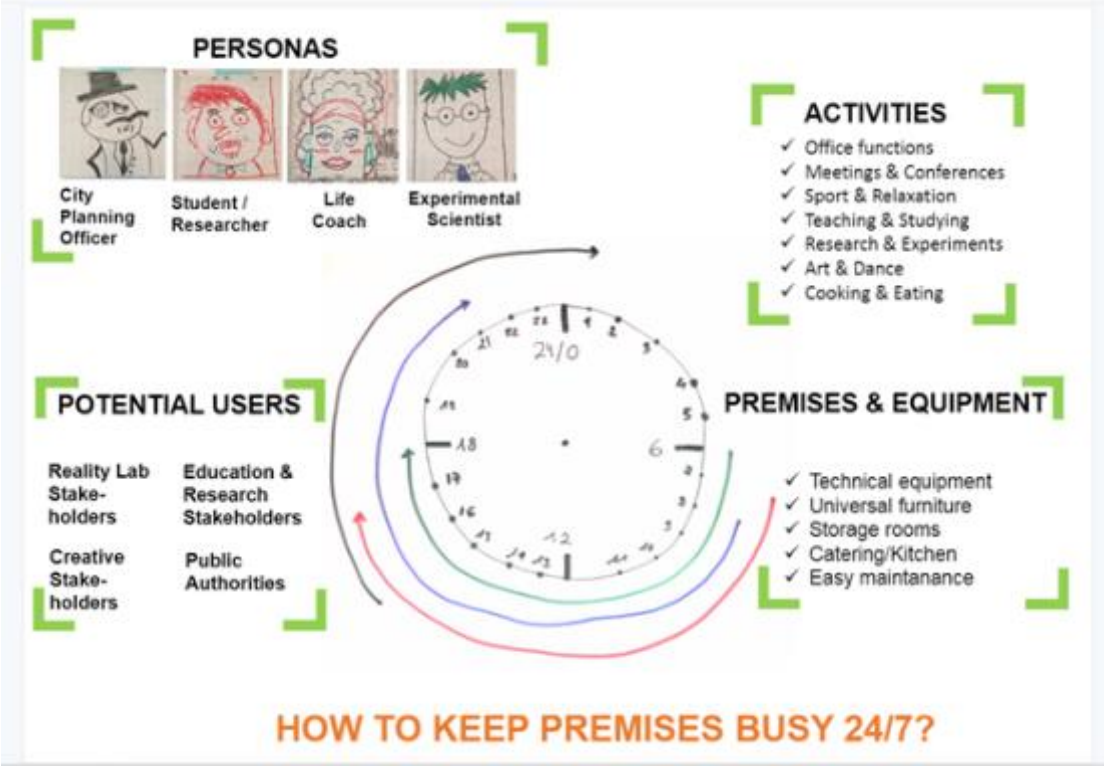

Figure 38: The generated activities and necessary equipment for this particular space.

For this issue, we considered a few solutions that could overcome these matters:

- Using a booking platform (in order to control the booking and distribute the renting hours)

- Obtaining a set of universal equipment and facilities (tables and chairs, storage room, presentation equipment, stationary, etc.).
- Having an area of common use facilities (kitchen, toilet, etc.)
- Providing other specific services (catering, maintenance, cleaning, equipment rental, etc.)

As a conclusion, the concept of Spacesharing is closely related to the definition of *"flexible spaces"* – a space that can be optimized for usage without wasting the resources (Gibson, 2003); *"hot-desking"* – a system that involve the usage of a single surface for different activities in different periods (Millward et al., 2007) and *"sustainable building design"* – creating an effective energy and resource usage plan for sustainable living (WBDG Sustainable Committee, 2015). Spacesharing involves Sustainability and Efficiency, as it aims to provide a sharable space, community, network that supports the growth and development of urban areas. This project is still undergoing implementation, and at the moment the collaborators have started a trial test run with first group of user in early May, and are open for rental request until 30.09.2017. The collaborators hope to create an innovative and energetic environment for sustainable development and expandable networking platform, which at the same time tackles the issue of underused spaces and turn them into organized, structured and economical platforms.

6 Findings

When combining these theories and concept together, a supporting pattern between Historic buildings and Spacesharing can be seen. The characteristics of a historic building – university in specific – fulfils some of the requirement for successful space distributing, and Spacesharing helps solving the problem within the limited walls of a historic building.

6.1 Adapting the concept

6.1.1 Advantages and Disadvantages

The concept of Spacesharing needs a good location to attract clients, which historic universities with their convenient location in big cities within good public transportation, significant values, famous history and architecture have to offer. The first requirement for successful space sharing, location, is fulfilled thanks to this. It would be more tempting for clients if universities offer the space in their antique interior for rent. In addition, since the space in historic universities is hardly expandable without damaging the existing interior, adapting the concept of Spacesharing would allow more flexible and efficient use of the existing areas. By creating a booking platform and allowing the space to be used more often than it is ordinarily scheduled for, more activities can take place within the premise, and hence promoting more productivity among the staff and students.

However, in order to adapt this concept to old university buildings, there are regulations that need following. As mentioned in the previous chapter, it is allowed to make modifications to these buildings; yet the modifications should not interfere with the existing historical values. Any replacement or addition should inherit the same details and general outlook as the original, in color, shape or material. The Burra Charter (2013) has strongly stated that the cultural significance of a building must be preserved; and under no unnecessary conditions should it be interrupted with inappropriate additions or demolished. The removal of original object from its place also need to be placed under great consideration. (Australia ICOMOS, 2013 pp. 3-5).

As the main description of Spacesharing concept is “maximizing the space use intensity”, this also means that more human traffic would be allowed in offered space. However, given the possibility that not many people may understand the limitations for activities under a historical roof, without strict supervisor and regulations, this may lead to unrepairable damages to the building.

For successful Spacesharing adaptation, it is essential to have mobile furniture that can be easily rearranged for different activities. As observed in most of the visited universities, the furniture in lecture rooms are usually bolted to the floor (see Figure 39). They are often secured in a way that is not easy to rearrange, plus the common

use of foldable row seats permanently occupy the space they are placed on. This greatly limit the possibility to transform the room on demand, and thus it limits the variety of activities that could take place

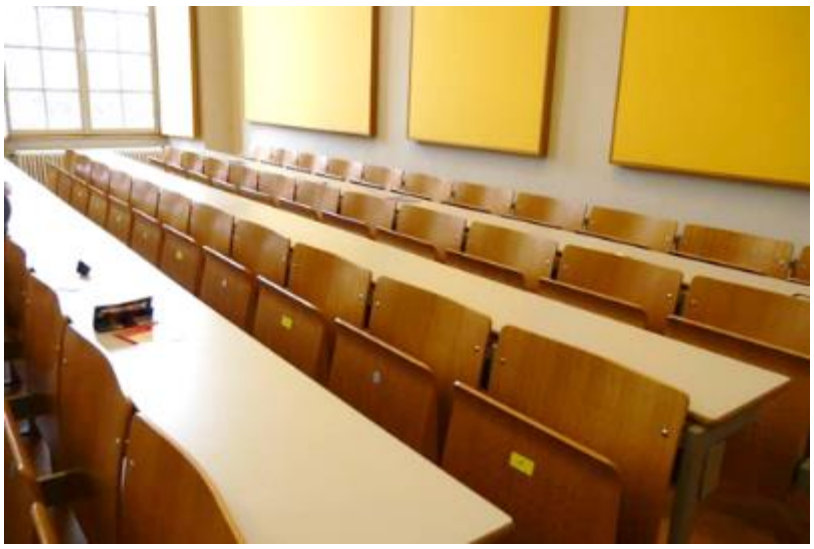

Figure 3939: Secured rows of foldable chairs in a lecture room (as seen in University of Mannheim)

6.1.2 Adaptation

As mentioned above, spaces with permanent furniture are not fully adaptable to this concept. It is essential to find an empty room, with movable furniture when needed. This will assure that the space can be utilized in any necessary direction. It will also provide more working area when needed, and still serve the purpose of entertainment in other times.

As seen in the promotional video of Reallabor Spacesharing, an area as small as 4x4 m^2 can be extensively utilized. However, in order to allow more functions within these walls, the bigger the space the better. A fifteen meter square room would be suitable for lectures and workshops; bigger ones could accommodate events and even parties.

Movable furniture, especially with wheels and can be folded or disassembled, would benefit the space greatly. The furniture material should also be taken into consideration – wood products would be perfect candidate for a historic room as they

are elegant enough to serve in a formal event, and stable enough for creative projects. Other than this, bean bags or soft pillows would provide a cosy and casual atmosphere for movie nights or student gatherings.

Lighting is also an essential part of a room. It adds energy to happening activities, especially at nightfall. Having a good lighting system would allow the space to be used longer, hence compromising with the Spacesharing concept. Suitable lighting system for this type of space should be adjustable based on the need of the occupants, so that it can be bright enough for brainstorming sessions or warm and cosy for social events. Ceiling light fixtures would be a good addition, as they don't interfere much with the overall look of the historic space.

Adequate ventilating system should also be taken care off, since spaces that tend to lack oxygen (e.g. basement, underground) can make their occupants uncomfortable; and thus, reducing their productivity. The placement of ventilators should be discreet – having them on the ceiling or in the wall corners should provide the room with sufficient air circulation.

The basic of equipment that should be in a "Spacesharing" room should include at least a computer (laptop), projector and projectile screen. On certain occasions, speakers and microphones can be provided for better quality. Some flipcharts and stationary will also be useful. Apart from all the mentioned equipment, the room can be kept empty when there is no event going on. An empty room will provide the opportunity to arrange it for desired use. It is not necessary to have these equipment install in the room, as it may damage the historical details.

Nevertheless, the internet connection and electricity must be assured. For the internet, it should be sufficient to provide high-speed wireless connections. Numerous electricity plugs or extension cords should be available onsite, for the usage for personal electronic devices is relatively high in this modern age.

Regardless of the decorations and objects, they should be designed or chosen to share similar characteristics as their surroundings. It is usually safe to utilize wooden materials and warm colors since these fit well in a historic building.

When completely new kitchen or bathroom cannot be added into an existing room, the offered space should be located within close proximity to essential facilities, such as toilets, smoking area, canteen or restaurants. This allows occupants to perform comfortably and effectively as their needs are fulfilled. Managers of Spacesharing facilities could offer useful services, such as cleaning, equipment rental, etc. This could be a good opportunity for students to assist in managing the facilities and earn experience for it.

6.2 Discussion

The main problem encountered during performing this thesis was language barrier preventing the author from obtaining the full information, what made further studies necessary. Frequently numerous permission, either formal or verbal, were needed for the preparation of photo documentation in places described in case studies. It was almost as problematic as the lack of knowledge regarding laws, conditions and state of a facility, especially where necessary documents were either missing, still not prepared or need to be kept secret.

This thesis is recognizably worth further research and the amendments to responsible authorities should be proposed, as both cultural and scientific aspects of historic buildings are invaluable and need to be preserved. In author's opinion, the best way to connect practical and scientific value of the study is to visit various universities across Europe collect data for documentation, train facility managers or other responsible authorities about good practices regarding their domain and regularly update research report.

As such study is an overwhelming amount of work to be performed by one person, it is suggested to gather an international expert group that can undertake such noble task in order to protect and preserve European cultural heritage of historic buildings that serve educational purposes. Such initiatives should be incorporated by university, facility management, ministry and conservation authorities, since specialized knowledge could help a lot of goals to be achieved faster, better and with a smaller amount of resources.

6.2.1 Case study proposal

Adam Mickiewicz University recently renovated their underground space to accommodate more activities, and there was one particular room that caught the author's attention. It was surrounded with original walls from 19th centuries, which gave a great historical charm to the space. This room, however, was still under construction with incomplete ceiling panels and cabling (see Figure 40 and 41). The facility manager mentioned that it was often used for theatre rehearsals, which explained why there was a small changing room at the corner of the room.

Figure 40: Overall look of the underground room of Adam Mickiewicz University

Figure 41: The wall has been standing since 1900s and still perfectly intact.

This room could certainly serve as an experiment project for Spacesharing in a historic university building. At the moment, there were a lot of improvements to be done; however, it could perfectly serve as a multipurpose space for different activities. There was enough space to arrange meeting facilities outside of this room; and within walkithe premise, there was a cafeteria that served coffee and lunch. Formal and budget restaurants could also be found in the neighbourhood, within 500m proximity. The room is placed in Collegium Maius campus, which is right next to the busiest tram and bus stop in the city, Fredry. Unfortunately, there was a language barrier between the author and the facility manager that prevented the request for permission to use this room. However, with the right amount of effort, this room could beautifully turn into a Spacesharing facility that promotes sustainability and efficiency.

Even though the author mentioned that this was an "underground" room, it has a direct connection to the outside. The university itself is levelled higher than the street, which placed this floor at the same height as the street it is connected to. This floor is an extension of the university; it was renovated a few years back, which currently covers an area of around $80m^2$ – including a small cafeteria and security booth (see Figure 42). The targeted room has roughly $20m^2$, which is not big enough to hold a conference, but it should be enough for small workshops, group/club meeting, student events, etc. Not limited to the space inside this room, with the advantage of location

(direct entrance to the street, next to tram and bus stop), facility (near a cafeteria and big hall), it is perfect for mentioned purposes.

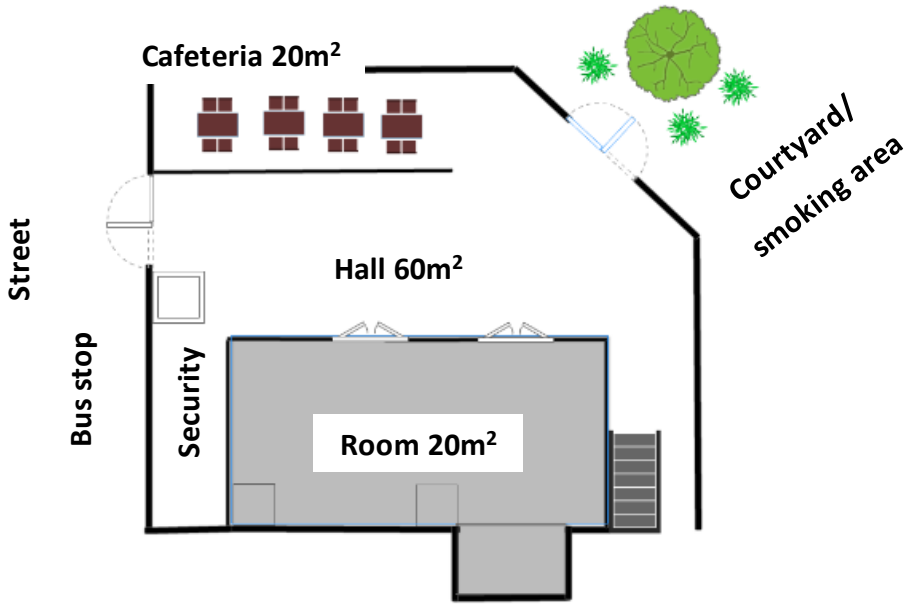

Figure 42: "Underground" floor plan, recreated by the author

By applying the space model developed by Paulien and Thibodeau (2011) for Utah System of Higher Education, this space can be classified as a "General Use Space" from the following description:

> *General use spaces are those facilities that are available to a broad group of people in the institutional and community populations for assembly, exhibition, dining, merchandising, relaxation, and general meetings. These facilities include auditoria (610 and 615), museums (620 and 625); food venues (630 and 635); day care centers (640 and 645); lounges (650 and 655); merchandising such as bookstores, (660 and 665); and recreation, such as billiards and game rooms (670 and 675); and meeting rooms (680 and 685). (Paulien et al, 2011, 61)*

From Paulien and Thibodeau' studies, the consulted amount of space per person ranges from 10 – 15 ASF/FTE (assignable square feet per full-time equivalent student), which is approximately 0.9 – 1.4 m^2 (see Appendix 11). Depending on the type of activities and equipment required, the studied room could serve a maximum of 20 people.

This room still needed better heating, as it was cold and lack of ventilation. The visible cables and water system should be concealed by ceiling panels, and the wall could be repainted. Current lighting system is sufficient, but for more intensive and sophisticated events, it would be useful to install LED lights instead of existing yellow light bulbs which do not provide enough brightness and consume more energy. As this room is rather small, tables and chairs could be stored in a different place and brought over when needed, or some foldable seating options could be available in the room for quick distribution.

Through a booking system or direct contact to the manager, this room could be booked on demand, either by students, staffs, or interested event holders. Usually, the security guard was only available from morning until 8pm; but with some arrangements if the university allows activities at night, the building could be secured as needed. Since this particular floor has a direct entrance to the outside and can be isolated from the main part of the building, accessibility can be monitored and kept under control.

7 Conclusion

The topic of historic universities building in modern age had always been intriguing to the author – how to maintain it, how to adapt it to new technologies and additions. The opportunity of joining a Spacesharing concept workshop helped a lot in suggesting good practices to utilize the space use in a historic university; and at the same time, promoting new learning and teaching techniques. Although this concept is still under development, the vision its collaborators showed that it provided a great opportunity and solution to underused spaces.

By combining the two concepts, historic university conservation and Spacesharing, spaces will be better utilized and still possessing the original look given from the beginning. Universities will be able to maintain their prestige architecture, and at the same time, provide their occupants with possibilities to develop themselves and connect with each other.

It was regretted that there had not been good opportunities to research this thesis with a quantitative approach. With opinions from actual users (students, staffs, visitors, etc.) of these universities based on their experience and calculable tests, it would result in more scientifically accurate information on how the concept of Spacesharing can be actualized in historic campus and what they could benefit from it. Discussions with facility managers from these university also could have been helpful in recognizing what the exact needs, activities and maintenance schedule for each university could be.

Nevertheless, although this dissertation was still not as detailed as it could be, hopefully it had provided some insights on how to maintain and develop an existing space to follow the new trends in technology consumption, while still being able to conserve the aesthetic and historical values.

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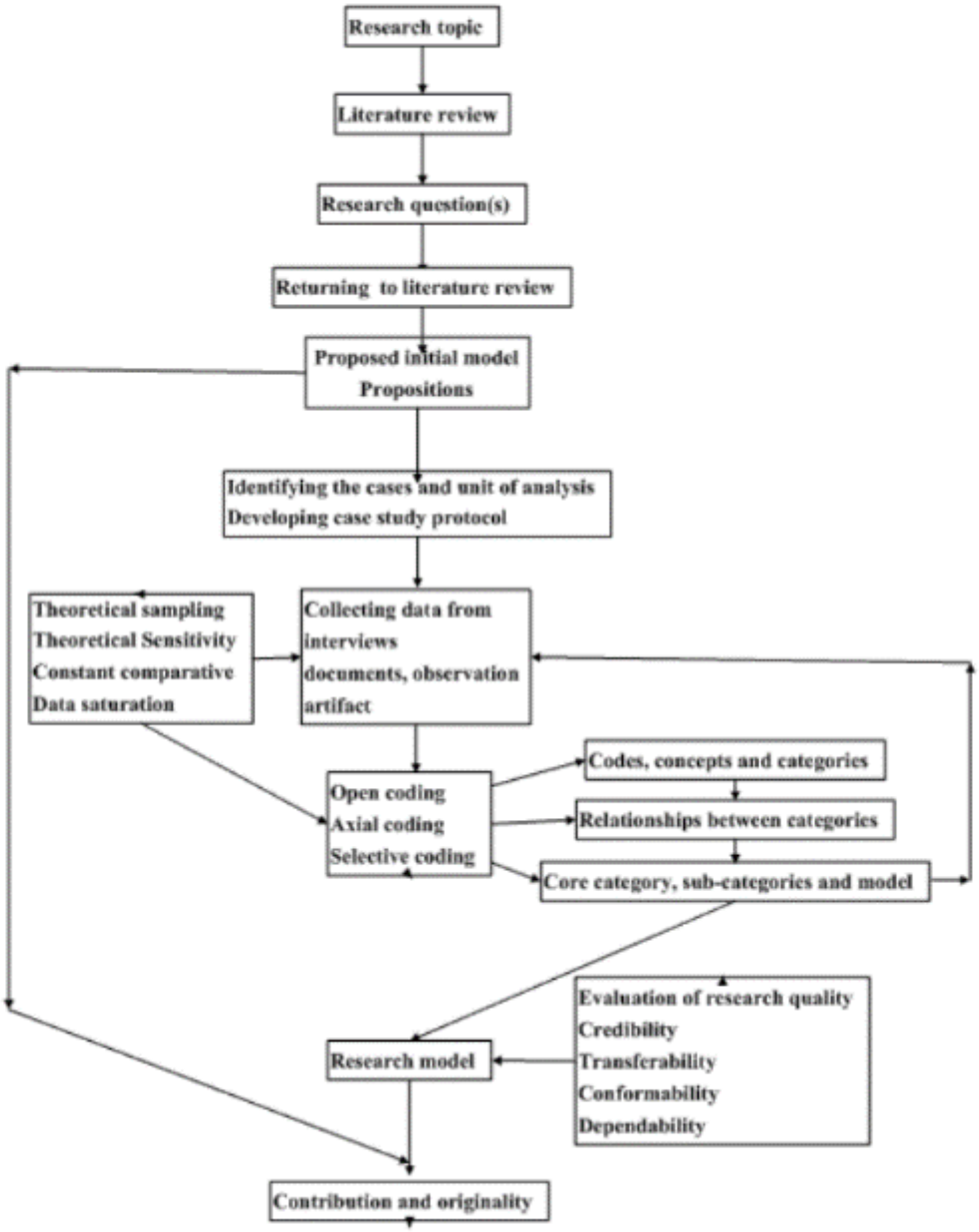
Appendices

Appendix 1: Case study – Grounded theory Methodology (Halaweh et al., 2008)



Appendix 2: Sustainability report of Historic England, 2015/16

Greenhouse Gas Emissions

	2015/16	2014/15	2013/14	2012/13	2011/12
Non-Financial Indicators (tCO_2e: tonnes of CO_2 equivalent)[1]					
Total Gross Emissions for Scopes 1 & 2	**2,380**	8,045	10,339	9,885	9,325
Total Net Emissions for Scopes 1 & 2 (i.e. less reductions – e.g. green tariffs)	**2,380**	8,045	10,339	9,885	9,325
Gross Emissions Scope 3 Business Travel	**576**	1,283	1,551	1,335	2,220
Other Scope 3 Emissions Measured	**0**	0	0	0	284
Related Energy Consumption (kWh: kilowatthour)					
Electricity: Non-Renewable	**4,414,481**	11,668,174	17,193,565	15,807,451	15,602,043
Electricity: Renewable	**–**	–	–	–	–
Gas	**1,843,784**	8,139,913	9,655,304	8,908,677	7,966,231
Liquefied Petroleum Gas	**0**	127,220	366,389	262,184	173,320
Other	**0**	2,944,953	3,258,587	3,482,639	2,927,507
Financial Indicators					
Expenditure on Energy	**£438k**	£1,932k	£2,055k	£2,045k	£1,925k
CRC[2] License Expenditure (2010 onwards)	**£40k**	£131k	£0k	£0k	£0k
CRC[2] Income from Recycling Payments	**£0k**	£0k	£0k	£0k	£0k
Expenditure on Accredited Offsets (e.g. GCOF)	**£0k**	£0k	£0k	£0k	£0k
Expenditure on Official Business Travel	**£1,604k**	£3,169k	£3,297k	£2,896k	£2,326k

1 The scopes and conversion rates are set out in the UK Government conversion factors for Company Reporting guidelines issued by Defra and are available at http://www.ukconversionfactorscarbonsmart.co.uk/.

2 Carbon Reduction Commitment.

Waste

		2015/16	2014/15	2013/14	2012/13	2011/12
Non-Financial Indicators (tonnes)						
Total waste		**432**	705	444	477	480
Hazardous waste	Total	**0**	0	0	1	0
Non-hazardous waste	Landfill	**138**	177	152	157	213
	Reused/Recycled	**294**	528	292	319	267
	Incinerated/energy from waste	**0**	0	0	0	0
Financial Indicators						
Total disposal cost		**£25k**	£18k	£37k	£48k	£45k
Hazardous waste – Total disposal cost		**£0k**	£0k	£0k	£1k	£0k
Non-hazardous waste – Total disposal cost	Landfill	**£7k**	£9k	£25k	£21k	£21k
	Reused/Recycled	**£18k**	£9k	£12k	£26k	£24k
	Incinerated/energy from waste	**£0k**	£0k	£0k	£0k	£0k

Water – Finite Resource Consumption

		2015/16	2014/15	2013/14	2012/13	2011/12
Non-Financial Indicators (m^3)						
Water Consumption	Supplied	**8,729**	134,663	140,045	100,741	128,136
	Abstracted	**0**	0	0	0	0
Financial Indicators						
Water Supply Costs		**£25k**	£276k	£231k	£221k	£226k

Initiatives to install new systems which reduce the flow of water are being explored across Historic England's offices.

Paper – Finite Resource Consumption

	2015/16	2014/15	2013/14	2012/13	2011/12
Non-Financial Indicators (Reams)					
A3 Paper	**680**	546	500	500	–
A4 Paper	**6,380**	10,311	10,598	11,241	–
Financial Indicators					
A3 Paper	**£1k**	£3k	£3k	£3k	–
A4 Paper	**£11k**	£32k	£31k	£31k	–

Of the total paper purchased by Historic England, 22% is from recycled stock. The biggest users of paper are being targeted to first, switch to recycled paper and secondly, reduce the volume of paper procured. One improvement this year was the change to despatching Commission and committee papers electronically. While some members still require hard copies, this measure and the exploration of other IT solutions for sharing documents should have a considerable impact on paper usage.

Table 1.4 Qualitative, Quantitative, and Mixed Methods Approaches

Tend to or Typically	*Qualitative Approaches*	*Quantitative Approaches*	*Mixed Methods Approaches*
Use these philosophical assumptions Employ these strategies of inquiry	Constructivist/Advocacy/ Participatory knowledge claims Phenomenology, grounded theory, ethnography, case study, and narrative	Postpositivist knowledge claims Surveys and experiments	Pragmatic knowledge claims Sequential, concurrent, and transformative
Employ these methods	Open-ended questions, emerging approaches, text or image data	Closed-ended questions, predetermined approaches, numeric data	Both open- and closed-ended questions, both emerging and predetermined approaches, and both quantitative and qualitative data and analysis
Use these practices of research, as the researcher	Positions himself or herself Collects participant meanings Focuses on a single concept or phenomenon Brings personal values into the study Studies the context or setting of participants Validates the accuracy of findings Makes interpretations of the data Creates an agenda for change or reform Collaborates with the participants	Tests or verifies theories or explanations Identifies variables to study Relates variables in questions or hypotheses Uses standards of validity and reliability Observes and measures information numerically Uses unbiased approaches Employs statistical procedures	Collects both quantitative and qualitative data Develops a rationale for mixing Integrates the data at different stages of inquiry Presents visual pictures of the procedures in the study Employs the practices of both qualitative and quantitative research

Appendix 4: Visited University Campuses

Adam Mickiewicz University, Poznan (Poland)
Collegium Minus (©Thomas Quine 2012)

Collegium Maius (© Radomil Binek 2005, contributed for Wikipedia)

Poznan University of Economics, Poznan (Poland)
Main campus (© Maciej Woitkowiak)

University of Wroclaw, Wroclaw (Poland)
Main campus (© JacobJ 2010, contributed for Wikipedia)

University of Heidelberg, Heidelberg (Germany)
University Library (© Jan Beckendorf 2003)

Unviersity of Mannheim, Mannheim (Germany)
Main campus (© Alexander Kustov 2012)

Unviersity of Tuebingen, Tuebingen (Germany)
Neue Aula (© Szczebrzeszynski 2011)

Appendix 5: Extraction from Table 615: All vacant dwellings by local authority district, England, from 2004 (Gov.uk)

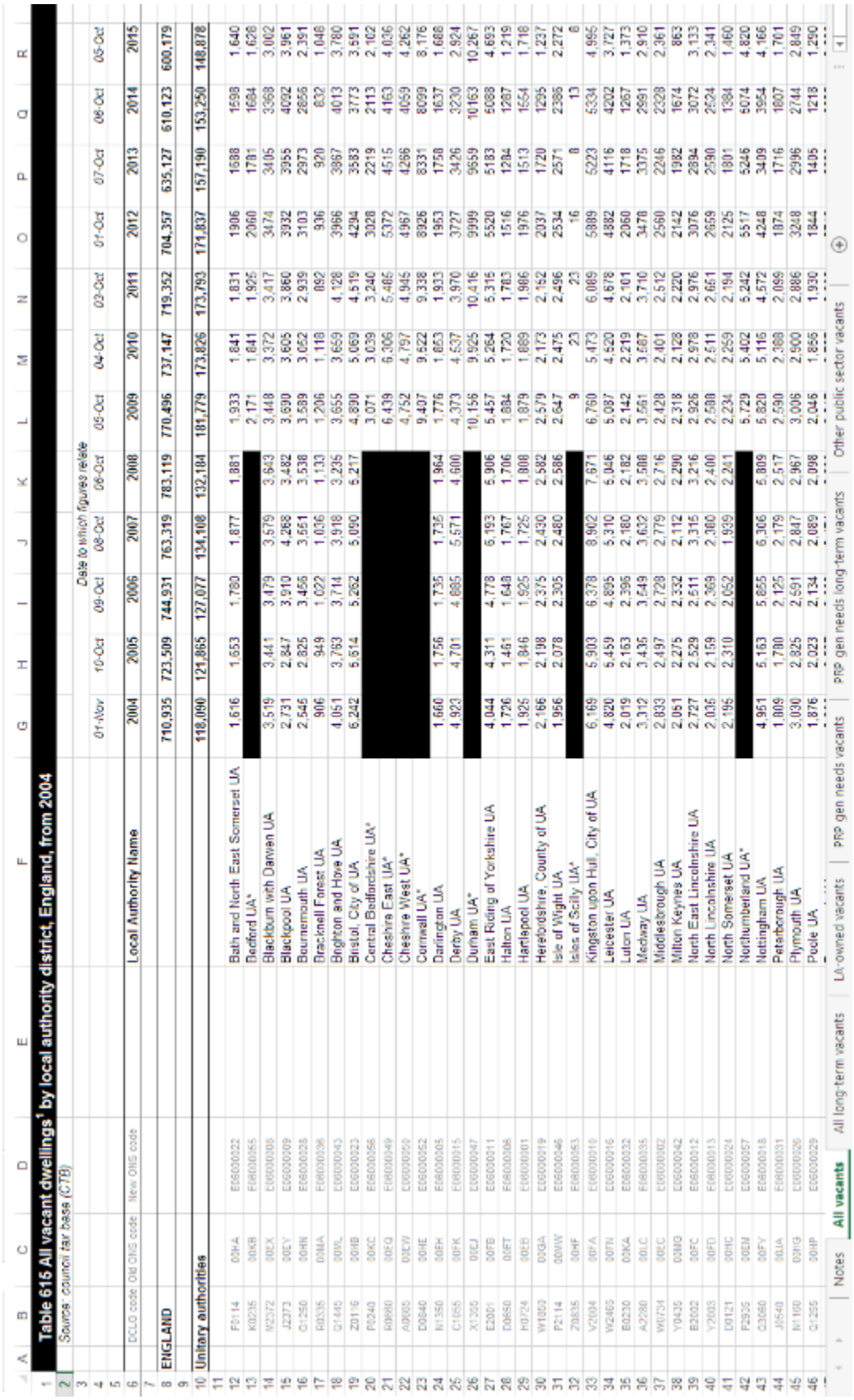


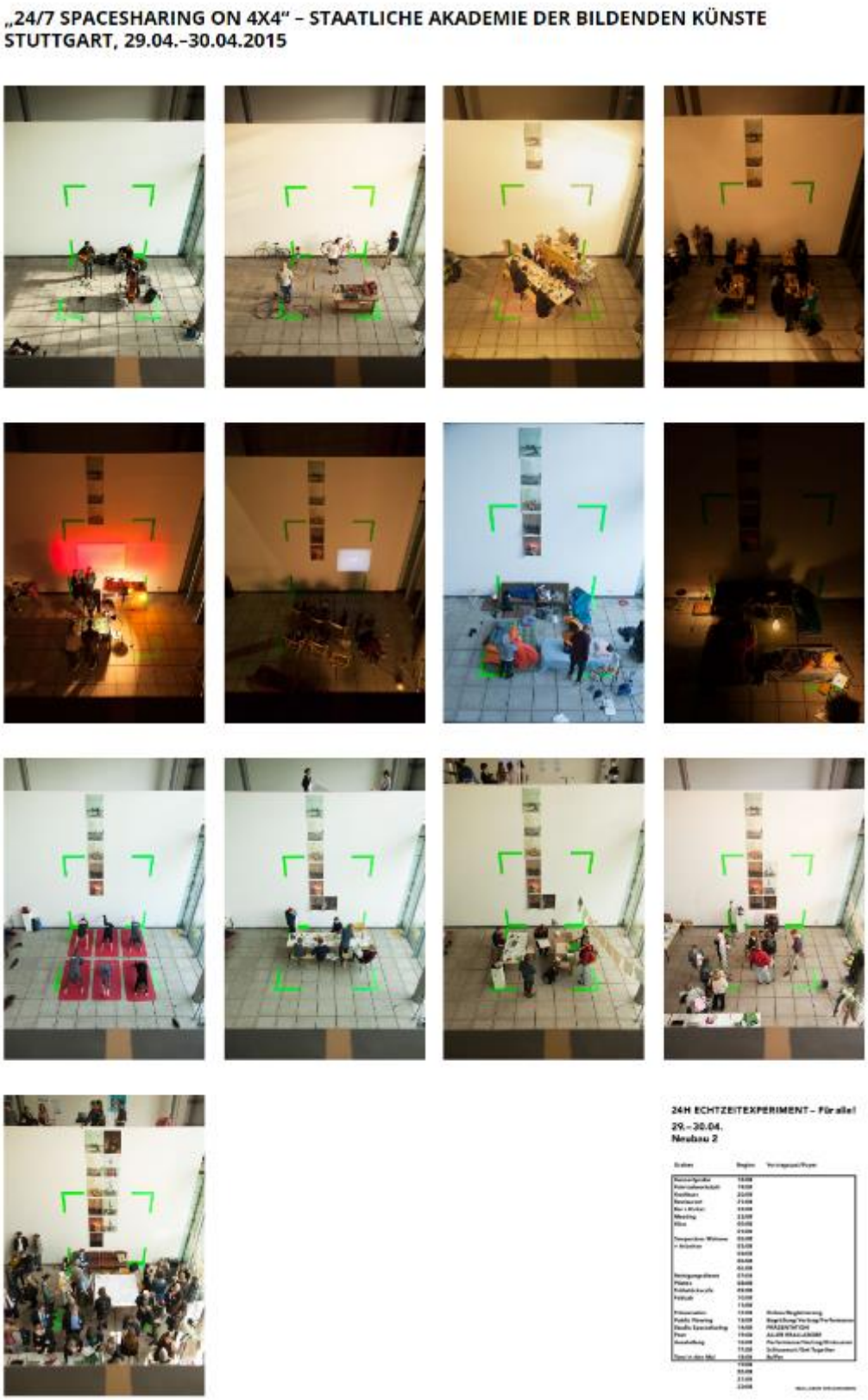
Table 615 All vacant dwellings[1] by local authority district, England, from 2004

Source: council tax base (CTB)

				Date to which figures relate												
				01-Nov	10-Oct	09-Oct	08-Oct	06-Oct	05-Oct	04-Oct	03-Oct	01-Oct	07-Oct	06-Oct	05-Oct
DCLG code	Old ONS code	New ONS code	Local Authority Name	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ENGLAND				710,935	723,509	744,931	763,319	783,119	770,496	737,147	719,352	704,357	635,127	610,123	600,179
Unitary authorities				118,090	121,865	127,077	134,108	132,184	181,779	173,826	173,793	171,837	157,190	153,250	148,878
F5114	00HA	E06000022	Bath and North East Somerset UA	1,516	1,653	1,780	1,877	1,881	1,933	1,841	1,831	1906	1688	1598	1,640
K0235	00KR	E06000055	Bedford UA*						2,171	1,641	1,925	2060	1701	1684	1,628
W2572	00CK	E06000008	Blackburn with Darwen UA	3,519	3,441	3,479	3,579	3,843	3,448	3,372	3,417	3474	3405	3368	3,002
J2373	00EY	E06000009	Blackpool UA	2,731	2,847	3,910	4,268	3,482	3,690	3,605	3,860	3932	3955	4092	3,961
G1250	00HN	E06000028	Bournemouth UA	2,546	2,825	3,456	3,661	3,536	3,589	3,052	2,939	3103	2973	2856	2,391
F0335	00MA	E06000036	Bracknell Forest UA	906	949	1,022	1,036	1,133	1,206	1,118	892	936	920	832	1,046
G1445	00ML	E06000043	Brighton and Hove UA	4,061	3,763	3,714	3,918	3,235	3,655	3,659	4,128	3966	3867	4013	3,780
Z0116	00HB	E06000023	Bristol, City of UA	6,242	5,614	5,262	5,090	5,217	4,890	5,069	4,519	4294	3583	3773	3,591
F0240	00KC	E06000056	Central Bedfordshire UA*						3,071	3,039	3,240	3028	2219	2113	2,102
K0880	00FQ	E06000049	Cheshire East UA*						6,439	6,306	5,485	5372	4515	4163	4,036
A0805	00EW	E06000050	Cheshire West UA*						4,752	4,797	4,945	4967	4266	4059	4,262
D0840	00HE	E06000052	Cornwall UA*						9,407	9,522	9,338	8926	8331	8099	8,176
N1350	00EH	E06000005	Darlington UA	1,660	1,756	1,735	1,735	1,964	1,776	1,853	1,933	1953	1758	1637	1,688
C1055	00FK	E06000015	Derby UA	4,923	4,701	4,885	5,571	4,600	4,373	4,537	3,970	3727	3426	3230	2,924
X1305	00EJ	E06000047	Durham UA*						10,156	9,925	10,416	9999	9659	10163	10,267
E2001	00FB	E06000011	East Riding of Yorkshire UA	4,044	4,311	4,778	6,193	5,906	5,457	5,264	5,315	5520	5183	5088	4,693
D0850	00ET	E06000006	Halton UA	1,726	1,461	1,648	1,767	1,706	1,884	1,720	1,763	1516	1284	1287	1,219
H0724	00EB	E06000001	Hartlepool UA	1,925	1,846	1,925	1,725	1,808	1,879	1,889	1,966	1976	1513	1554	1,716
W1959	00GA	E06000019	Herefordshire, County of UA	2,166	2,198	2,375	2,430	2,582	2,579	2,173	2,152	2037	1720	1295	1,237
P2114	00WW	E06000046	Isle of Wight UA	1,956	2,078	2,305	2,480	2,586	2,647	2,475	2,496	2534	2571	2386	2,272
Z0835	00HF	E06000053	Isles of Scilly UA*						9	23	23	16	8	13	8
V2004	00FA	E06000010	Kingston upon Hull, City of UA	6,169	5,903	6,378	6,902	7,871	6,760	5,473	6,089	5889	5223	5334	4,995
W2465	00FN	E06000016	Leicester UA	4,820	5,459	4,895	5,310	5,046	5,087	4,520	4,678	4882	4116	4202	3,727
B0230	00MA	E06000032	Luton UA	2,019	2,163	2,396	2,180	2,182	2,142	2,219	2,101	2060	1718	1267	1,373
A2280	00LC	E06000035	Medway UA	3,312	3,435	3,549	3,632	3,588	3,561	3,587	3,710	3478	3375	2991	2,910
W6734	00EC	E06000002	Middlesbrough UA	2,833	2,497	2,728	2,779	2,716	2,428	2,401	2,512	2560	2246	2328	2,361
Y0435	00MG	E06000042	Milton Keynes UA	2,051	2,275	2,332	2,112	2,290	2,318	2,128	2,220	2142	1982	1674	863
E2002	00FC	E06000012	North East Lincolnshire UA	2,727	2,529	2,511	3,315	3,216	2,926	2,978	2,976	3076	2894	3072	3,133
Y2003	00FD	E06000013	North Lincolnshire UA	2,035	2,159	2,369	2,360	2,400	2,588	2,511	2,651	2659	2590	2524	2,341
D0121	00HC	E06000024	North Somerset UA	2,195	2,310	2,052	1,939	2,241	2,234	2,259	2,194	2125	1801	1384	1,460
F2936	00EM	E06000057	Northumberland UA*						5,729	5,402	5,242	5517	5246	5074	4,820
G3060	00FV	E06000018	Nottingham UA	4,961	5,163	5,855	6,306	5,809	5,820	5,116	4,572	4248	3409	3954	4,166
J6540	00JA	E06000031	Peterborough UA	1,809	1,780	2,125	2,179	2,517	2,590	2,388	2,099	1874	1716	1607	1,761
W1160	00FG	E06000026	Plymouth UA	3,030	2,825	2,591	2,847	2,967	3,006	2,900	2,886	3248	2996	2744	2,849
G1255	00HP	E06000029	Poole UA	1,876	2,023	2,134	2,089	2,098	2,046	1,856	1,930	1844	1405	1218	1,290

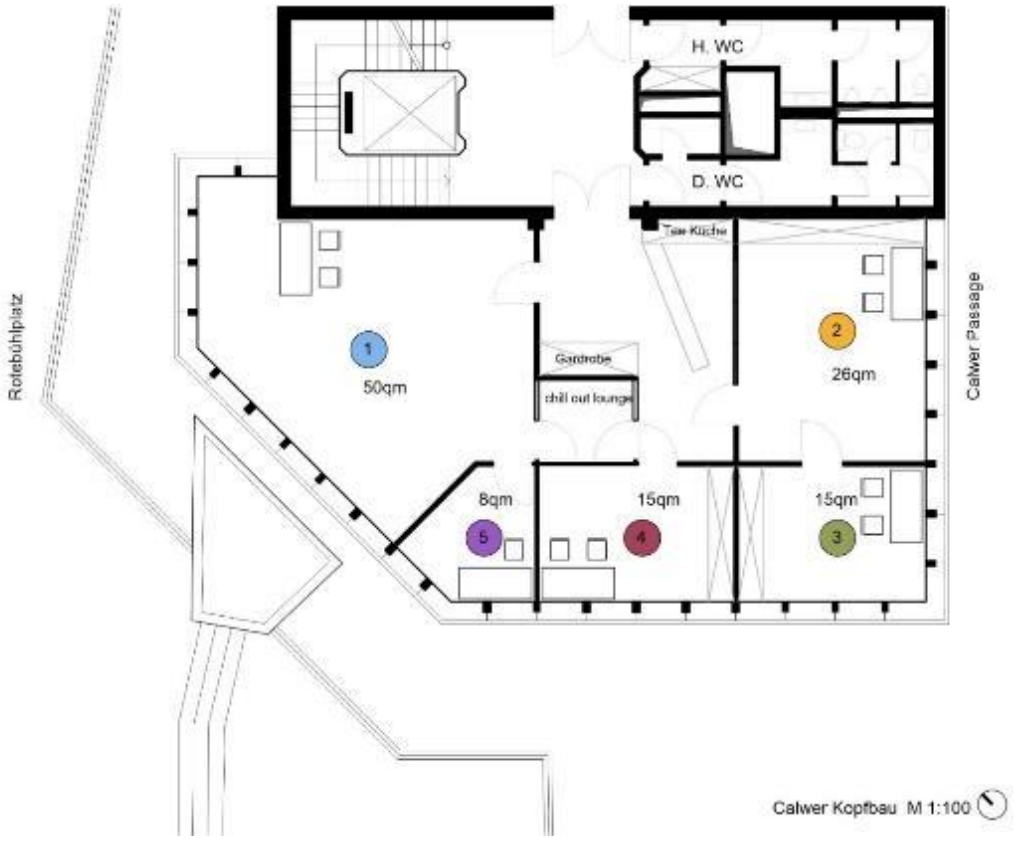
Notes | All vacants | All long-term vacants | LA-owned vacants | PRP gen needs vacants | PRP gen needs long-term vacants | Other public sector vacants

Appendix 6: Presumed activities that can be taken within a 4x4 square area in 24h



Bigger image: http://goo.gl/1zTSLw

Appendix 7: The floor plan of Spacesharing project, Calwer Kopfbau



Appendix 8: The blue print of Calwer Passage and Calwer Kopfbau in Stuttgart, where EuroFM Winter School 2016 took place.

Appendix 9: Creative stakeholder persona and what her proposed activities for this space could be.

Appendix 10: Notes taken during visit in Adam Mickiewicz University, with introduction by the Facility Manager – Katarzyna Kosewska

Collegium Maius was erected in 1908 for German Colonization Commission

Building was passed to University of Poznań by Polish authorities after regaining independence.

Currently building is shared between Adam Mickiewicz University and Karol Marcinkowski Medical University.

Part belonging to AMU has been restored as much as possible to historical shape. Even the slightest refurbishing needs Voivodeship Preservationist (Wojewódzki Konserwator Zabytków) opinion, allowance and supervision, as the building is unique pearl of architecture (real marbles, copper-craved heads of columns in the main hall, original wall-paintings).

The only exceptions from keeping the original shape are adjustments for utilities (running water, electricity, heating), new technologies (optical fibers), safety and security (CCTV, movement sensors, smoke sensors, fire hoses etc.) and facilities for disabled students and professors (elevators, floats). Generally person moving on the wheelchair can access any place in the building open for general public and classrooms.

Utilities are constantly modernized – currently the new transformer is being installed outside the premises on the parking lot behind the building.

Part belonging to Medical University on the contrary does not follow practices of AMU.

Old industrial, no longer necessary rooms were adjusted for educational purposes (boiler room converted into small theater, where traces of past function are preserved), what serves local community as well, as these locations are home of several cultural events opened for audience from outside the university.

The building was divided into zones, protected with fire-proof doors. Main evacuation routes are protected with fans, creating over-pressure, what keeps them free from smoke.

The only things what do not keep the original color palette are elements needed for safety (fire hoses boxes, fuse boxes, evacuation routes markings and other signs described in appropriate bills and acts of Polish law).

All the other elements are either hidden (wires, cables, pipes) or as least visible as possible (CCTV, sensors, elevators) with limited interference in the building structure.

Technological objects are easy to replace with more modern solutions. The whole idea was to preserve as much as possible from original atmosphere, shape and structure of the building with just a touch of new technologies and facilities vital for modern educational premises. All the installations are to be invisible or intangible.

In the least visible parts of the building (offices, maintenance routes) the advantage of modern furniture and floors (tiles) is chosen for practical reasons, yet all objects hard to remove (floors, doors) keep the same color pattern and style as the rest of the building.

Appendix 11: Utah System of Higher Education Space Planning Guidelines

Utah System of Higher Education
Space Planning Guidelines

Space Type / Institution Mission	FTE Enrollment			
	Fewer than 3,000 students	3,000 to 6,000 students	6,000 to 10,000 students	Greater than 10,000 students
Classrooms and Service	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE
Community College	13 ASF/FTE student	13 ASF/FTE student	12 ASF/FTE student	12 ASF/FTE student
Baccalaureate/Masters	12 ASF/FTE student	12 ASF/FTE student	11 ASF/FTE student	11 ASF/FTE student
Research University	11 ASF/FTE student	11 ASF/FTE student	10 ASF/FTE student	10 ASF/FTE student
Teaching Laboratories and Service General Academic Instruction	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE
Community College	16 ASF/FTE student	16 ASF/FTE student	15 ASF/FTE student	15 ASF/FTE student
Baccalaureate/Masters	15 ASF/FTE student	15 ASF/FTE student	13 ASF/FTE student	12 ASF/FTE student
Research University	14 ASF/FTE student	13 ASF/FTE student	12 ASF/FTE student	11 ASF/FTE student
Teaching Laboratories and Service Auto/Construct Trades Instruction	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE	applied to Non Dist Ed FTE
	*Existing ASF/FTE for campuses not increasing Auto/Construction Trades instruction			
Community College	6 ASF/FTE student	6 ASF/FTE student	5 ASF/FTE student	5 ASF/FTE student
Baccalaureate/Masters	5 ASF/FTE student	5 ASF/FTE student	4 ASF/FTE student	4 ASF/FTE student
Open Laboratories and Service				
Community College	8 ASF/FTE student	7 ASF/FTE student	6 ASF/FTE student	5 ASF/FTE student
Baccalaureate/Masters	8 ASF/FTE student	7 ASF/FTE student	6 ASF/FTE student	5 ASF/FTE student
Research University	8 ASF/FTE student	8 ASF/FTE student	8 ASF/FTE student	8 ASF/FTE student
Research Laboratories and Service				
Baccalaureate/Masters	35 ASF/FTE faculty	35 ASF/FTE faculty	35 ASF/FTE faculty	35 ASF/FTE faculty
Research University	475 ASF/FTE faculty	475 ASF/FTE faculty	475 ASF/FTE faculty	475 ASF/FTE faculty
Office and Office Service				
Community College	150 ASF/FTE employee	150 ASF/FTE employee	150 ASF/FTE employee	150 ASF/FTE employee
Baccalaureate/Masters	170 ASF/FTE employee	170 ASF/FTE employee	170 ASF/FTE employee	170 ASF/FTE employee
Research University	195 ASF/FTE employee	195 ASF/FTE employee	195 ASF/FTE employee	195 ASF/FTE employee
Libraries	15,000 ASF minimum			
Community College	7 ASF/FTE student	6 ASF/FTE student	5 ASF/FTE student	4 ASF/FTE student
Baccalaureate/Masters	9 ASF/FTE student	9 ASF/FTE student	7 ASF/FTE student	7 ASF/FTE student
Research University	14 ASF/FTE student	14 ASF/FTE student	14 ASF/FTE student	12 ASF/FTE student
Special Use Space				
Community College	3 ASF/FTE student	3 ASF/FTE student	3 ASF/FTE student	3 ASF/FTE student
Baccalaureate/Masters	3 ASF/FTE student	3 ASF/FTE student	3 ASF/FTE student	3 ASF/FTE student
Research University	3 ASF/FTE student	3 ASF/FTE student	3 ASF/FTE student	3 ASF/FTE student
Physical Education			35,000 ASF minimum	
Community College	35,000 ASF minimum	35,000 ASF minimum	4 ASF/FTE student	3 ASF/FTE student
Baccalaureate/Masters	35,000 ASF minimum	35,000 ASF minimum	4 ASF/FTE student	3 ASF/FTE student
Research University	35,000 ASF minimum	35,000 ASF minimum	4 ASF/FTE student	3 ASF/FTE student
General Use Space				
Community College	15 ASF/FTE student	13 ASF/FTE student	11 ASF/FTE student	10 ASF/FTE student
Baccalaureate/Masters	15 ASF/FTE student	13 ASF/FTE student	11 ASF/FTE student	10 ASF/FTE student
Research University	15 ASF/FTE student	13 ASF/FTE student	11 ASF/FTE student	10 ASF/FTE student
Support Space				
Community College	4 ASF/FTE student	4 ASF/FTE student	4 ASF/FTE student	4 ASF/FTE student
Baccalaureate/Masters	6 ASF/FTE student	6 ASF/FTE student	6 ASF/FTE student	6 ASF/FTE student
Research University	8 ASF/FTE student	8 ASF/FTE student	8 ASF/FTE student	8 ASF/FTE student
Land Grant Mission Addition	+6 ASF/FTE student	+6 ASF/FTE student	+6 ASF/FTE student	+6 ASF/FTE student

ASF- Assignable square feet
FTE- Full-time equivalent