

INDUSTRIAL CITY 3.0

Exploring The Potentials of Urban Re-Industrialization as
Planning Concept to Counteract The Shrinkage Phenomenon

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Master's Thesis

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Thank You,
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ABSTRACT

Since the early 18th century, industry has been the key concept influencing the human settlements, and their demographics. Later that role was taken over by the service sector which has been the dominant factor in the formation of contemporary cities, and their planning policies. Such a shift has been reflected in the creation of the 'post-industrial' city model through the process of de-industrialization, which has been applied to the majority of cities in the Western World. The recession of 2008 clearly showed how fragile these cities have become, which raised many concerns for their future, but also encouraged the birth of new concepts. One such concept, initially developed for capital cities, is 'Urban re-industrialization'.

As the three biggest cities in Sweden (Stockholm, Gothenburg and Malmö) are constantly growing and attracting new inhabitants, many other municipalities are suffering from an aging or shrinking population. The thesis is an investigation of the 'Urban re-industrialization' concept, and the potential of applying it on a monocentric town-scale as a planning policy to counteract the shrinkage phenomenon. Hence, an analysis of the modern industries, and their economic theories will be carried out, to determine which lines of businesses can benefit by allocating in small towns. Moreover, the thesis is relying on the current market measurements to evaluate the efficiency of the concept.

The research will be applied on the context of Eskilstuna, with the development of an urban design proposal for the former slaughterhouse area. Starting with a heritage valuation for the existing structures, as well as a market valuation 'DCF', the proposal will additionally delve into how intangible values of the industrial heritage can be reflected in tangible characteristics, and explore the capability of architectural design as a tool to ensure heritage conservation.

KEYWORDS: re-industrialization, shrinking cities, Scandinavia, urban design, architecture, urban economics, real estate, urban planning, industrial heritage, technology, resilience, adaptive reuse.

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READING INSTRUCTIONS

The thesis opens with an introduction chapter that presents the subject background, defines the problems and research questions, and describes the method used to carry out the work. The research of the theory is presented in three chapters (Chapter 2- The Urban Economic Model; Chapter 3- Urban Re-industrialization; and Chapter 4- Re-use of Industrial Buildings). Chapter 5 (Conclusions of the Research) summarizes the relevant findings that will be used to create the design proposal. Chapter 6 (The Case Study) offers analysis of Eskilstuna on an urban level, and of the slaughterhouse on an area level. Furthermore, examples of the heritage evaluation is shown to illustrate how the model is used. The design proposal is revealed in Chapter 7, and the conclusions and reflections wrap up Chapter 8.

DIVISION OF WORK

The thesis was born out of a shared interest in exploring the concept of Urban Re-industrialization and using it to address industrial heritage and phenomena of shrinking and aging municipalities in Sweden. Ossama was responsible for researching the field of Urban Economics and finding possible solutions for the application of urban re-industrialization from an economic perspective. In turn, Selma took care of the theories and methods of the conservation and evaluation of industrial heritage. After summarizing the conclusions of the research, we joined forces to develop the design proposal.

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1

INTRODUCTION

1.1 Background

1.2 Aim & Purpose

1.3 Research Questions

1.4 Method & Process

1.5 Theory

1.6 Scope

1.1. BACKGROUND

1.1.1 Growth of Cities

The expansion of cities has been observed since the early industrial revolution, when massive waves of domestic and international migration, driven by a variety of incentives, moved from the countryside to bigger industrial towns. This put an enormous pressure on the cities to rapidly grow and develop more centres, to accommodate services, infrastructure, and amenities for the newly arrived inhabitants. This is illustrated by Cedric Price in the diagram "The City as an Egg".

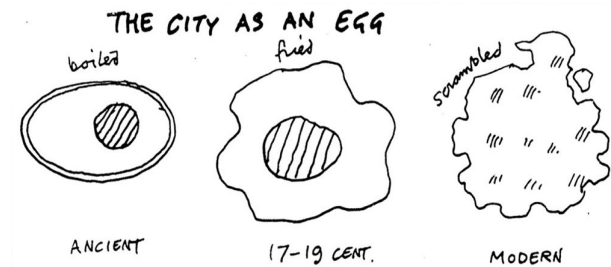


Figure-1. The City as an Egg (Price, 1982). Reprinted with permission

While major cities and metropolitan areas are constantly growing, other forms of human settlements are shrinking. For the first time in history, urban areas have more inhabitants than the rural ones. History studies show that waves of social mobility often occur with each global shift: the industrial revolution in the 18th century, followed by the second revolution, and recently the technological advancement, as well as changes in the economic trends.

Consequently, urban planning trends and policies had to adapt and cope with the shift by:

- * Increasing the footprint of the city centres where most of the services and amenities are located.
- * Creating other smaller centres
- * Pushing the city boundaries further away for additional housing areas.
- * Relocating the industrial areas from the centre to wherever land and labour are cheaper.

1.1.2 De-industrialization

Due to advancements in technology, changing economic trends, and an increased awareness of environmental hazards, numerous industrial areas built during the 19th and early 20th century, have been left abandoned (Rogic, 2009). With the birth of the concept of "heritage" in the 1960s, these former industrial sites later became desirable areas for urban regeneration. In this process a great number of the former industrial buildings and other objects related to the production were reused (Rogic, 2009, p.2). The late 1970s and 1980s saw a great increase in the number of industrial buildings included in the national heritage inventories in Europe, as there was a shift in viewing vernacular buildings as a part of heritage and therefore worthy of conservation. Conservation charters propagated constant use as the best method of maintenance of an old building (Rogic, 2009).

This gave birth to a design movement called architecture of conversion. This design trend was merely a reflection of a bigger turnover that happened in the social and economic structure in Central and Northern Europe over the last few decades. The vast majority of cities have been reallocating their industries overseas, where land and labour are cheaper, resulting in a planning and economic strategy that is called “de-industrialization”. This led to the current urban fabric in most cities that are nowadays known as post-industrial.



Figure-2. A mixed-use building in Sheffield, Shoreham Street (Project Orange, 2012). Reprinted with permission.

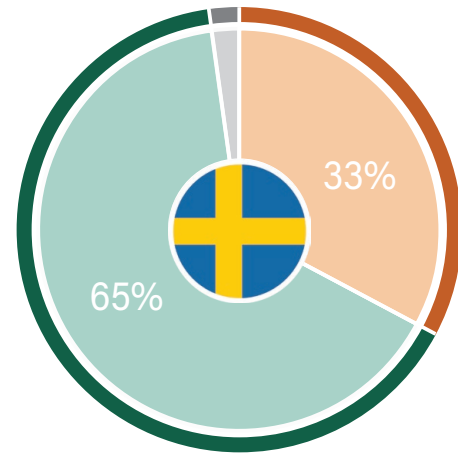


Figure-3. The Swedish economy by sector (OECD, 2016).

The Swedish economy has always been dependant on mining and forestry, besides other forms of machinery-dependent industries. Nowadays, the main sector of the economy is services, which represents over 65% of the economy according to the annual budget report of 2016, while the traditional industry is constantly shrinking and reached about 33% of the same year, and agriculture is only represented by 2% (OECD, 2017) Technology has arrived and taken its place as a new dominant aspect in the structure of economy within the service sector. IT services and consultancy, software development, telecommunications, and other types of services have been taking over the Swedish export from the traditional industries. Therefore, it can be concluded that technology is the “industry” of the 21st century.

1.1.3 Ever-expanding Cities and Shrinking Towns

Due to the changes in the economical forces driving the process of de-industrialization, and the creation of the “post-industrial city”, the modern cities are now offering only offices, research facilities, cultural activities, shopping malls, and entertainment facilities. While these cities are constantly expanding in size and attracting more people, other towns are suffering from shrinkage. Consequently, major business chains, cultural institutions, educational and research facilities, and other schemes of urban-sound facilities have been located exclusively in capital cities, where a bigger portion of inhabitants are located. Their growth continues with the arrival of new inhabitants who find such cities attractive to live in.

Economies of agglomeration have contributed to the attractiveness of cities by offering wider and more diverse opportunities for the inhabitants, which guaranteed steadily increasing population rates. That came with a price that is being paid by smaller towns as they steadily decrease in size and/or are facing the challenge of aging population in the near future.

Figure-4 is a map showing an extract from EU statistics covering the change in population in Sweden between 2005 and 2015. The phenomenon of shrinking cities is obvious in the northern parts. While the majority of municipalities are decreasing in population, only three cities in Sweden (Stockholm, Göteborg, Malmö) are growing with a rate of more than 2%.

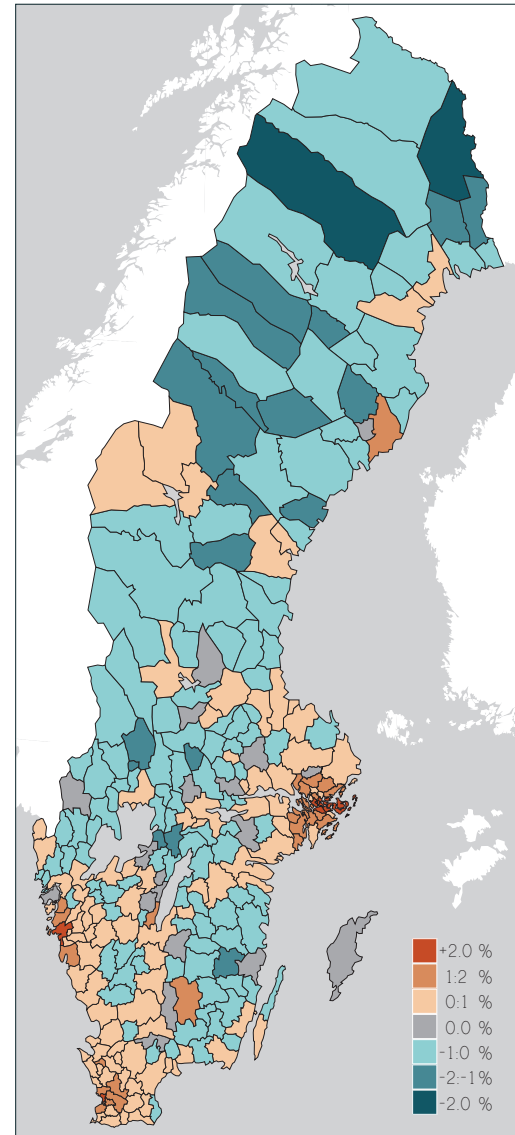


Figure-4. The change in population in Sweden, 2005-2015. (European Commission, 2016). Adapted with permission.

These three cities today host more than 40% of the total Swedish population. Their surrounding municipalities are mostly growing with a rate between 1% to 2%, and most commonly functioning as sleeping towns "Commuter Towns" or "Sleeping Towns". These are small towns whose residents mostly work or study in the near-by, bigger city.

The current social mobility has been significantly increasing due to changes at the macro-level in the economic structure, globalization, and de-industrialization. It is a clear result of the interdependent processes of peripheralization and centralization by attracting population, economic productivity, and infrastructural functions. This has benefited some localities, whereas others have been experiencing an outflow of capital and human resources, and have been suffering from a lack of entrepreneurship and low levels of innovation and intellectual engagement.

The consequences of urban shrinkage are vital on both short and long run. Due to the common propensity among certain groups such as highly educated and qualified singles and young couples, to move to bigger cities, the population becomes more homogeneous in age and more influenced by low-educated people, which poses several threats to the development of shrinking cities. That type of migration process is called "selective outmigration" and it leads to demographic decline (Weck and Beisswenger, 2014) since it changes the social

capital structure. Hutter and Neumann (2008, p.2) argue that these changes lead to "a low social capital and a loss of cultural diversity at local level." According to Martínez-Fernández et al. (2012, p.213), the communities influenced by selective outmigration are characterized by "a lack of entrepreneurship and low levels of innovation and intellectual engagement". Even though outmigration might be one of the main causes of the population shrinkage, the low fertility rates in the shrinking communities can also explain a part of the decline. This effect is enhanced with every new generation since "in a society with fewer children, the number of potential mothers also recedes – children who are not born cannot produce their own children" Hospers and Reverda (2015, p.9).

Additionally, since the population of the shrinking communities is aging, the numbers of tax payers are correspondingly decreasing which means their ability to provide healthcare to their aging population will soon run out even with the policies of increasing tax rates and fees.

The consequences are not exclusively social and demographic, but also economic, as the pricing mechanism in the real estate market is substantially correlated with the demand and supply in any free market as the Swedish one. Therefore, it has been observed that the housing prices that are steadily decreasing due to the surplus of spaces in the shrinking communities.

1.2 AIM & PURPOSE

The purpose of the thesis is to address two issues: the newly developed concept of 'Urban Re-industrialization', and the development of manufacturing processes in the modern industries. Secondly, the current practices in the conservation methods of the built industrial heritage.

The aim of the thesis is a holistic urban regeneration model that combines the fields of urban economics and architecture; to propose a new perspective on heritage conservation; and to develop an urban planning policy that potentially could counteract the shrinking phenomenon in small towns.

1.3 RESEARCH QUESTIONS

1. How can "urban re-industrialization" be implemented as a planning concept to counteract the shrinking / aging population?

In a society where the service sector is the main driver in the formation of urban fabric, implementing the concept of 'Urban Re-industrialization' in a town such as Eskilstuna needs to be economically investigated. Creating opportunities for modern industrial investments could result in forming incentives for the younger generations to live and work in small towns. Hence, the characteristics of industries of the 21st century need to be identified and analysed, in order to determine which lines of businesses can benefit by allocating in small towns.

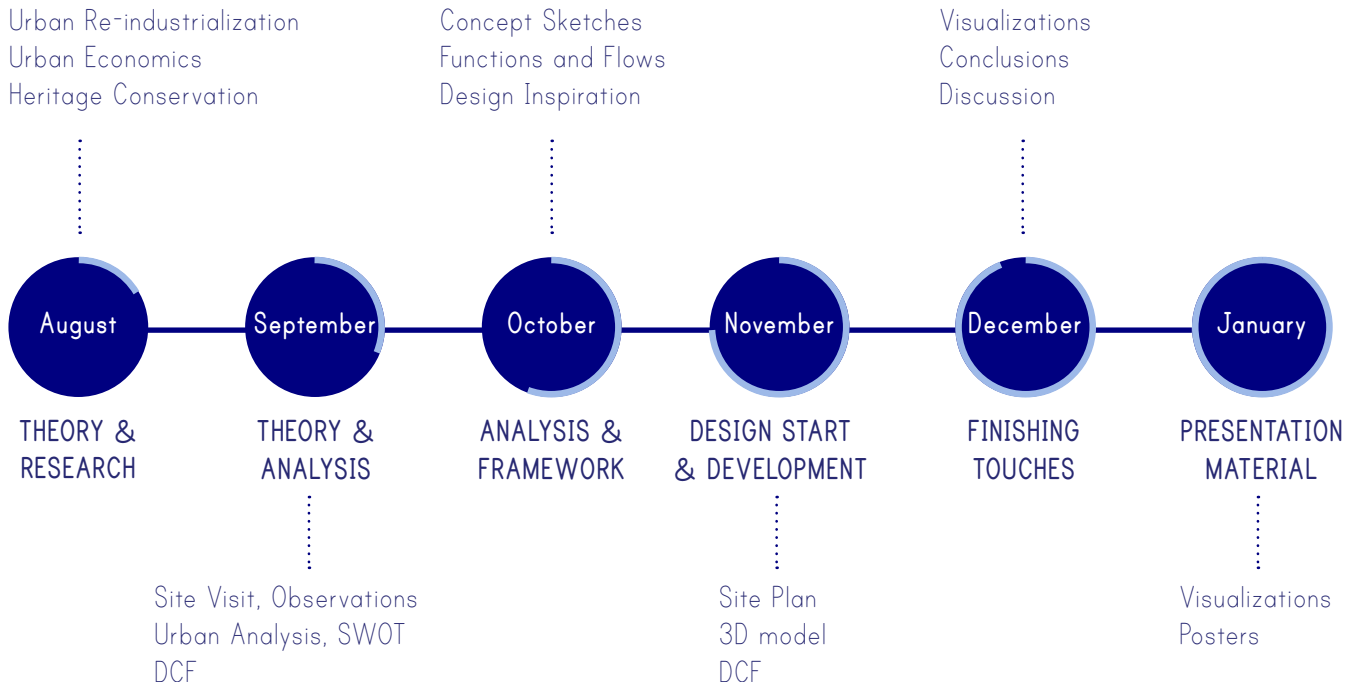
2. How can the intangible values of industrial heritage be captured and preserved in the development of former industrial sites?

According to the current market practices in real estate property valuation, industrial buildings are often undervalued, despite their architectural and heritage value. Moreover, conservation charters focus solely on the physical characteristics and advise minimal changes during the development processes, resulting in the decrease of interest in such sites. Therefore, capturing the intangible values, and preserving the building's stories can be an alternative which can also give more freedom for the design solutions in providing profitable programs, which increases their market value.

1.4 METHOD & PROCESS

The method employed in this thesis is *Research for Design*. This means that the first phase of the thesis consisted of reading up on the theory of urban re-industrialization, heritage conservation and urban economics, as well as researching which Swedish town would be the most suitable context for the thesis. Based on the conclusions of the research, a framework could be formed that would inform the program and the design of the transformation of the slaughterhouse area.

The analysis of Eskilstuna and the former slaughterhouse area was based on geographical maps, statistics, municipal documents and historical photos. Moreover, a site visit gave an opportunity to meet with the city architect, make observations of the area and take photos. The economical assessment of the current building stock, and the proposed new functions was based on information obtained through *Datscha* (information provider for the property market), and complemented with other market research reports (Catella, CBRE, and Newsec).



1.5 THEORY

The thesis was born out of an interest to explore the concept of Urban Re-industrialization and the potential of applying it on small towns, in order to counteract the aging population and the shrinkage phenomena. Hence, the research is based on the book *Urban Re-industrialization* edited by Krzysztof Nawratek (2017). The book is a collection of essays that discuss the concept from architectural, urban planning, political, and economic perspectives.

The second major spine of the research is investigating the economic efficiency of Urban Re-industrialization as a planning concept, and the reliability of the proposed design. The thesis relies on *Lectures on Urban Economics* by Jan Brueckner (2014) as one of the most read theoretical materials in the field of Urban Economics. Furthermore, in order to understand the evolution of industrial enterprises and their economic behaviours, the thesis turns to the classic material of modern economics *Principles of Economics* by Alfred Marshall (1920).

The third backbone of the thesis is architectural heritage. Since the aim of the heritage evaluation is to form a quick overview of how much of the built environment is worth preserving, the thesis followed the SAVE-method in grading the heritage value of the chosen site. Apart from a written description and images, the result of the evaluation is also a quantifiable score that allows the buildings to be ranked and compared to each other.

1.6 SCOPE

ARCHITECTURE & URBAN PLANNING

URBAN ECONOMICS

Economic Valuation Methods

Profitable Conversion

Monocentric and Polycentric
Settlements

Real Estate Investments

HERITAGE

Industrial Heritage

Heritage Evaluation

Tangibility & Intangibility

Conservation & Conversion

Slaughterhouse

URBAN RE-INDUSTRIALIZATION

Industry in the 21st Century

Creative Industries

Urban Planning for Shrinking/Aging
Municipalities

Allocation of Industrial Assets



2

THE URBAN ECONOMIC MODEL

- 2.1 Why Do Cities Exist?
- 2.2 Brueckner's Urban Model
- 2.3 Real Estate Economics

2.1 WHY DO CITIES EXIST?

2.1.1 The Field of Urban Economics

Broadly speaking, urban economics is the economic study of urban areas. It is a sub-field of economics that refers to the analysis of cities, and touches on a broad range of topics, such as urban planning, land use, housing, transportation, urbanization, the cost of living index, and the provision of local public goods (University of Pennsylvania, 2013). According to other definitions, urban economics is a branch of microeconomics that studies the spatial structure of the urban areas (Quigley, 2008).

Scholars and researchers of urban economics provide insights and interpretations regarding the behaviour patterns of the urban areas, mostly cities and metropolitan areas, their markets, crime rates, education levels, and distribution of income. On the practice side, urban economists use analysis models to evaluate ongoing projects, as well as to spot the direction of urban growth.

Urban economics emphasizes the spatial arrangements of households, firms, and capital in metropolitan areas, the externalities which arise from the proximity of households and land uses, and the public policy issues which arise from the interplay of these economic forces (Quigley, 2008). By applying basic models and economic tools on the aggregate data, to build a sophisticated interpretation of the spatial structure, the study extends to cover real estate markets as well.

2.1.2 Economic Definition of Cities

The debate of defining a city, or an urban area has existed for centuries. Whether the definition is from a scientific or literature text book, the general discourse is dependant on the focus and background of the author. While in the humanitarian science and literature the focus of the definition is on the social level, the definition is mainly focused on the concentration of economic bodies, enterprises, jobs, and forms of employment in the field of economics.

Throughout centuries the human race has been highly concentrated in a spatial sense, while the rest of the land was vacant or inhabited at very low population densities. "Whether the origin of human settlements was due to social reasons, defence, or availability of resources, the current most dominating motivation for such concentration is economic purpose in the form of employment, jobs, and business opportunities." (Brueckner, 2011, p.1)

McDonald & McMillen used the population density to define the city as, "a place with a very high population density, compared to the surrounding areas, and a total population greater than some minimum number" (McDonald & McMillen, 2007, p.4). National Geographic (2011) uses an economic approach in their definition: "An urban area where most inhabitants have non-agricultural jobs. Urban areas are very developed, meaning there is a density of human structures such as houses, commercial buildings, roads, bridges, and railways".

The continuous growth of major cities and metropolitan areas has been observed since the early industrial revolution, when massive waves of domestic and international migration, driven by a variety of incentives, moved from the countryside to bigger industrial towns. In our modern world, economists argue that pursuing a better living conditions is one of the biggest incentive for social mobility nowadays.

This eventually leads to a higher concentration of people in a limited area, which can be defined as a city or a town. A clear example is the fact that the three biggest cities in Sweden, Stockholm, Gothenburg and Malmö are growing with a rate of 2% per year (EU, 2016) due to the concentration of jobs, education opportunities and entertainment diversity. At the same time most other smaller municipalities are shrinking. This socio-economic concentration is argued to be generated by two main forces: agglomeration economies, and scale economies. In turn, the city influences these forces. Since both economic behaviours, agglomeration economies and scale economies, are the cause and consequence of each other, the result is a closed loop system when conditions are met. (DiPasquale & Wheaton, 1995).

2.1.3 Factors of City Grow

Social and economic theorists have been developing concepts and theories to understand and explain the development of modern economics. The thesis focused on the three most discussed theories:

i) Economies of Scale:

The relationship between (Q) quantity of production, and (L) labour involved in the process can be illustrated with a simple graph. The curve reflects that the output per worker is higher when a factory or a business enterprise has many workers (Slope B) than when it has only a few (Slope A), which means that “business enterprises become more efficient at large scales of operation. The reason is the common one underlying scale economies: division of labour.” (Brueckner, 2011, p.1).

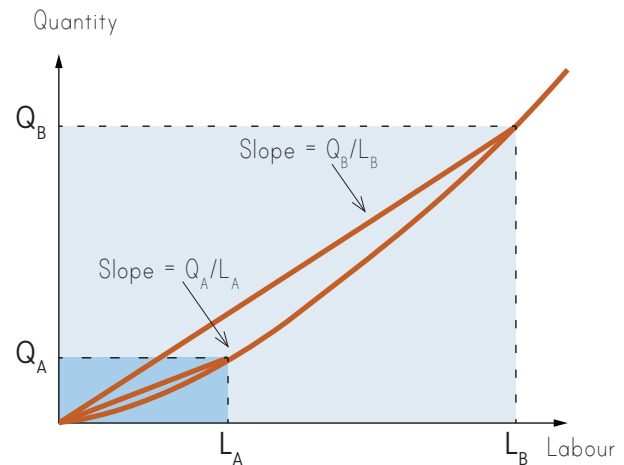


Figure-5. Graph showing the relationship between quantity and labour (Brueckner, 2011). Adapted with permission.

Most of the modern production processes exhibit such a relationship between the input (labour) and output (quantity), which is commonly known as economies of scale.

The word 'economies' in some terms means 'savings', or 'benefits', specifically when used with 'scale', or 'agglomeration'. (Brueckner, 2011). The benefits of the scale have been summarized in the graph, and they are mostly associated with the level of efficiency, and the productivity of the workers in relation to the input.

Hence, the principle of creating large enterprises is favoured by the vast majority of business owners and entrepreneurs, which results in creating a spatial concentration of employment that attracts job-seekers. The principle of Economies of scale has been structured in the early modern textbook of economics by Alfred Marshall in 1920. Here he interpreted the idea in theoretical and mathematical terms, which then paved the way for other leading economists to adjust and improve the approach, such as George Stigler in the 1950's.

Marshall argued that division of labour is the first condition of an efficient industrial organization. He described this as leaving "[...] on one side for the present the distribution of work between those who carry out the details of production, and those who manage its general arrangement and undertake its risk on the other." (Marshall, 1920, p.107) He explained the reciprocal effects of division of labour and localization of industries, and highlighted the benefits of large scale manufacturing. Out of dozens of industrial enterprises, Marshall (1920) emphasized the impact of the scale on three types of activities:

- * Economy of skill,
such as: Process Management, IT Services

- * Economy of machinery,
such as: Manufacturing, Agriculture.

- * Economy of materials,
such as: Mining, Quarrying.

Moreover, he argued that waste is better managed and handled on a bigger scale. As illustrated in the example of manufacturing furniture, when hundreds of sheets have to be cut out similarly, a greater attention is then paid to the process of planning the cutting of the cloth in order to decrease the wasted pieces, which is defined as 'economy of skill', "as the planning is made to suffice for many tasks, and therefore can be done well and carefully" (Marshall, 1920, p.131).

The third argument is having the ability to afford upgrading of processes, which is a competitive advantage only large manufacturers can afford. Therefore, entrepreneurship is described as the characteristic task of the modern manufacturing, "that of creating new wants by showing people something which they had never thought of having before; but which they want to have as soon as the notion is suggested to them". (Marshall, 1920, p.133). These incentives have led to the merge of many industrial enterprises into fewer, yet larger and highly organized economic bodies.

Keeping in mind the industrial revolution of the nineteenth century, and the technical advances in machinery at the time when most of the modern economic concepts were structured, it comes without surprise that most economic lecturers advocated the replacement of hand-made by machine-made. Such a replacement comes in handy when executed on a bigger scale. Hence stand many arguments supporting the economies of scale, but the most relevant to mention is the argument of maintaining the quality of the products, no matter the required quantity.

ii) Agglomeration Economies:

Whereas scale economies take place internally within a firm, agglomeration economies are external to the enterprises. Industries are usually geographically concentrated, since the principle of clustering or agglomeration increases the benefits gained by a firm when it locates among other enterprises (DiPasquale & Wheaton, 1995). The firm can benefit from the reduction in input costs, particularly labour, which increases its potential savings, along with gains in productivity and efficiency (Marshall, 1920).

Generally speaking, there are three types of transport costs that Marshall (1920) emphasized: the costs of moving goods, people, and ideas. All three of these can be reduced if industries are spatially agglomerated, and all three costs are advocated by three main arguments. First, firms prefer to save shipping costs

which leads them to locate near their suppliers or customers. Second, the idea of intellectual spillovers as a consequence of the concentration, since in agglomerations “the mysteries of the trade become no mystery, but are, as it were, in the air.” (Marshall, 1920, p125). Third, the theory of the labour market as previously explained in the economies of scale that leads to the division of labour which only happens at certain scale of business.

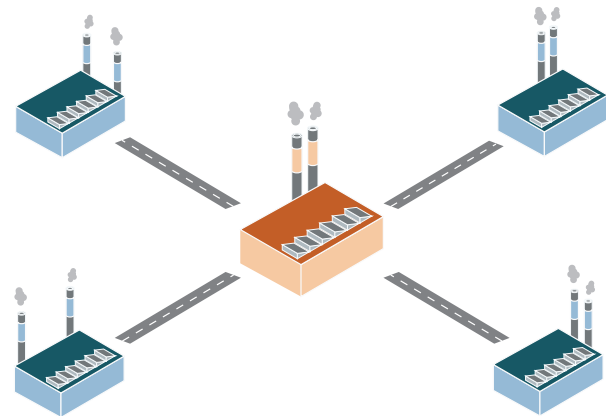


Figure-6. Centralization of industrial enterprises (Brueckner, 2011). Adapted with permission.

One of the clearest evidence of that economic behaviour in the modern times is described in the case of the Silicon Valley in California, where many IT companies and start-ups have allocated themselves in the area, which resulted in creating a global centre for high technology. These firms chose to locate near one another to learn and to speed their rate of innovation (Saxenian, 1996).

* Pecuniary Agglomeration

This is the type of agglomeration that leads to a reduction in the cost of a firm's inputs without affecting the productivity of the inputs (Brueckner, 2011). The labour market of a big city represents a perfect example for this case. Due to the large concentration of jobs, many workers offer their services to their potential employers, resulting in the rise of the competition level, which increases the quality of the workers. Thus, the existing employment concentration in the big city is the reason and the consequence of the expanding labour market.

On the contrary, the labour market of a small town would offer much lower quality of workers in most cases (Marshall, 1920), or perhaps not offering the desired type of the employees at all. And because of that, a firm might be forced to conduct more expensive methods to fill its needs. A firm might start searching for the desired employees in other cities, and consequently having to pay for their commuting expenses (DiPasquale & Wheaton, 1995).

* Technological Agglomeration

This is the type of agglomeration that increases the productivity of the inputs without lowering their cost (Brueckner, 2011). The concentration of IT firms in the Silicon Valley, USA, and the automotive industries in Bavaria, Germany, are two cases that represent the result of knowledge spillovers.

As Marshall argued, intellectual spillovers are a type of externality that has a positive influence on the productivity of the workers in an agglomerated zone of a specific field or technology. The example of work-related chats that occur in the evenings or weekends among engineers who work for different firms, can clearly represent the effect of intellectual spillovers as Brueckner (2011) highlighted.

iii) Transportation & Commuting:

As organised by Marshall (1920), there are three types of transport costs: the costs of moving goods, people, and ideas. All three types together form an enormous incentive for firms to locate themselves in the most reasonable location that reduces such costs. The savings of the transportation-cost can be viewed as a type of pecuniary agglomeration effect (Brueckner, 2011), since it may draw firms to a large city where both its market and suppliers are located.

The economies of distance exhibited by the shipping costs in the sense that the cost per km of shipping a ton of material declines with the distance shipped. Figure-7 illustrates the relationship as having two components. The first is terminal cost which must be incurred regardless of shipping distance, in the form of: the loading of goods, wages, logistics, and taxations. The second component is the variable cost, which equals the fixed incremental cost per km and the distance shipped (Brueckner, 2011).

The logic used to estimate the best location for any manufacturing process has two components; input and output. And based on the principle of economies of distance, most firms prefer to avoid the pay for both the input and the output (DiPasquale & Wheaton, 1995). Thus, either of the two components should be shipped the entire factory-to-market distance. Therefore, the most economic decision is the one that is cheaper (Marshall, 1920). Moreover, transport costs can play a role in the overall organization of any production. In particular, economies of distance can help determining whether the production is centralised in one large factory or divided among a number of smaller establishments.

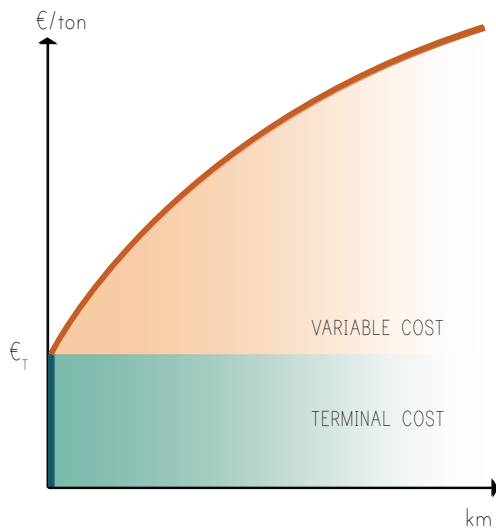


Figure-7. Graph showing the relationship between cost and distance (Brueckner, 2011). Adapted with permission.

2.2 BRUECKNER'S URBAN MODEL

Urban economists and real estate theorists have developed an economic model of cities that is mathematically and diagrammatically systematised. The sole purpose of the model is to capture most of the regularities of the urban spatial structures (Brueckner, 2011). Although the model is interpreted through mathematical equations, it mostly uses an accessible diagrammatic approach to demonstrate these regularities.

The model was initially introduced in the works of William Alonso (1964), Richard Muth (1969), and Edwin Mills (1967). In the following decade, William Wheaton (1974), and Jan Brueckner (1987) have derived some respectful predictions and conclusions from the model (Brueckner, 2011). The contribution then was continued by other theorists and practitioners of urban economics.

Since the urban model has shown an accurate image of predictions and analysis of the regularities of cities (DiPasquale & Wheaton, 1995), it is reliably used for predictive purposes in investment analysis of urban development projects, as well as in policy-making context such as:

- * Changes in the population size
- * Increases or decreases in real estate taxations
- * Changes in construction costs
- * Changes in the gasoline price
- * Improvement in public transportation systems

The thesis will use the model to understand the difference between poly-centric cities such as: Stockholm, and mono-centric towns such as: Eskilstuna, in economic perspective, in order to propose a justified program for the chosen site.

2.2.1 Analysing The Urban Spatial Structure

In most cases, the city centre is characterised by a striking concentration of tall buildings, mostly offices and commercial facilities, as well as small residential dwellings. The second characteristic is the gradual decrease in building heights the further away from the city centre (Brueckner, 2011).

The third and equally important spatial feature involves the changes in sizes of individual dwellings. The size parameter of individual dwellings has dual characteristics that are associated with the distance to the city centre. The dwellings of the high-rise buildings in the centre tend to be relatively small in terms of their floor areas, while suburban houses are much more spacious and recognised by their low-rise.

Considering the previously mentioned features, the fourth characteristic is logically reflected in the price of the square meter of each dwelling. While the prices of square meters are striking in the centre (land or built), they gradually decrease the further away from the centre (DiPasquale & Wheaton, 1995).



Figure-8. Aerial view of Chicago, USA (Chicago Architecture Biennial 2016). Reprinted with permission.

2.2.2 Basic Assumptions of The Model

As previously mentioned, the growth of the city is not exclusively depending on one simple factor, however, there are many aspects that influence the expansion of the urban structure. The essence of urban economics as a field of study is to develop simple analysis models to understand and conclude sophisticated phenomena in the urban context. Therefore, while economists have been developing the Urban Model, a list of assumptions has been created and simplifications that have been strategically chosen to facilitate the analysis (Brueckner, 2011). The assumptions were chosen to capture the essential features of cities, leaving out details that may be less important.

i) All the city's jobs are located in the CBD.

The first simplification of the model is a general assumption that all job opportunities are exclusively located in the city centre, which is commonly referred to as Central Business District (CBD). While in reality, many firms, institutions, and consequently job opportunities are scattered in various locations or else concentrated in remote employment subcentres. "Although decentralization is a hallmark of modern cities, this process is initially ignored. The model is inspired by cities of the early twentieth century, in which jobs were more centralised than they are nowadays" (Brueckner, 2011, p25).

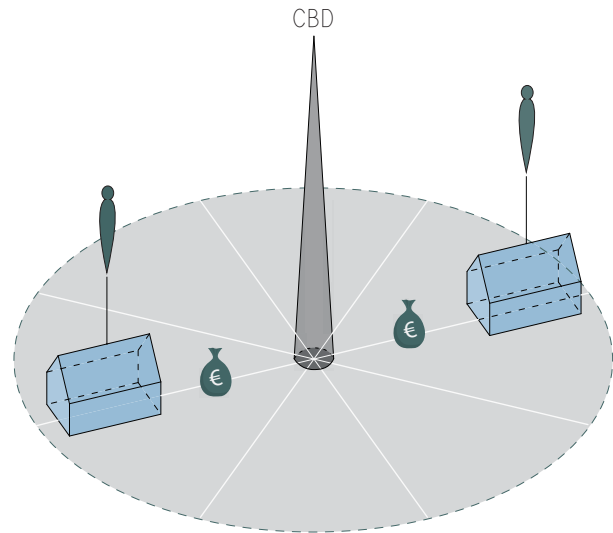


Figure-9. Urban model assumptions (Brueckner, 2011). Adapted with permission.

ii) The city is built as a circle.

Despite the complexity of the urban spatial structure in reality, it is assumed that the city is shaped as a circle (Brueckner, 2011), with a radial network of roads that solely connect the residential areas to the CBD, as illustrated in figure 9. Moreover, the model simplified the diversity of street network, and assumed an identical street typology.

Due to the significance effect of the commuting costs in the analysis, it is simplified that all residents are using the same mean of transport in commuting, whether private or public, as the essence of this part is to help evaluating the attractiveness of living in one place rather than another.

iii) The city contains one identical typology of houses.

Although, the housing markets nowadays are offering a wide range of typologies, the model simplified that diversity by assuming that the city contains one identical typology (DiPasquale & Wheaton, 1995). The main reason here is to avoid the complications of consumer choice involved in the process of purchasing or renting a dwelling, and narrow the preferences of the decision making process.

The other assumption regards the households, that is all residents of the city stand at the same income level (Brueckner, 2011), which means, there are no rich or poor groups. A detraction that is vital in the analysis process, since the dominant parameter is to be analysed in the thesis is the distance.

iv) The residents consume only housing & bread.

However, the level of income, consumption behaviours, and the taxation systems, are assuredly the most essential parameters of analysing any urban context (Brueckner, 2011), the analysis model ignored all types of goods, and assumed that the residents consume only two goods: housing and a composite good that consists of everything other than housing, which is called (bread).

2.2.3 Monocentric Towns & Polycentric Cities

The generally accepted principles in urban planning concluded two main categories of contemporary human settlements: monocentric and polycentric. While the monocentric urbanism contains one clear centre with a higher density of population and amenities, which gradually decrease the further away from the city centre, the polycentric urbanism contains several centres and sub-centres, and the population density moderately decreases to reach the lowest level that is commonly known as suburbs.

Apart from the spatial differentiations between the two models, there are some other economic and social phenomena that characterise each of them (Brueckner, 2011):

- i) Commuting Costs
- ii) Consumption Behaviours
- iii) Population Density

i) Commuting Costs

Commuting distance, and therefore commuting cost, is the single most important component of defining any urban agglomeration. In urban economics, the cost is based on two components: money and time. The money can be the price of the car, gas, insurance, or the cost of using the public transport. The second component is time, which is the amount of time spent to commute from door to door, which is mostly referred to as opportunity cost, (DiPasquale & Wheaton, 1995).

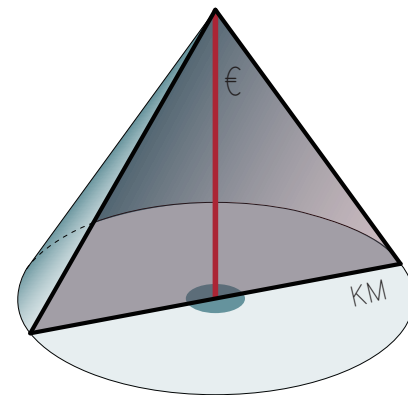


Figure-10. Diagram of monocentric towns (Brueckner, 2011). Adapted with permission.

Since the general equation for the commuting cost is estimated by $T * X$, when the travelled distance is represented by (X) , and (T) represents the per-km cost of commuting, the commuting cost within the monocentric agglomerations hence are most likely to be lower than in the polycentric ones, due to the shorter distances.

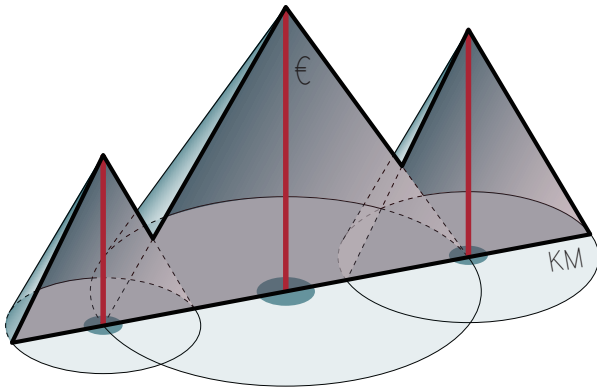


Figure-11. Diagram of polycentric cities (Brueckner, 2011). Adapted with permission.

A more accurate way to measure it is by comparing the commuting cost to the individual's income (Y) (Brueckner, 2011). The disposable income, net of commuting cost, for a resident living at distance (X) is equal to: $Y - (T * X)$. This expression shows that disposable income (Y) decreases as travelled distance (X) increases, a consequence of longer distances and more expensive commute, which is a crucial characteristic for the polycentric agglomerations.

ii) Consumption Behaviours

While the consumption of the composite goods is denoted by (C) which reflects the amount of money spent, the housing consumption is denoted by (Q). The (Q) will be used to reflect the amount of square meter per dwelling, and (P) is the price per square meter. (Brueckner, 2011). Assuming all residents in

the city are renters, the rent then will equal the price per square meter times the number of rented meters: ($P * Q$). A summary of all the parameters discussed so far can be concluded in the budget constraint: $C + (P * Q) = Y - (T * X)$.

Since it is assumed that all residents of the city stand at the same income level, and all residents are equally well off regardless of where they live in the city. Meaning that if a resident decided to live closer to the CBD in order to decrease the commuting costs ($T * X$), that resident will have to pay more rent ($P * Q$) and consequently consume less of bread (C). As one of the most common regularities is the decline of price per square meter of housing floor as the distance to the CBD increases (DiPasquale & Wheaton, 1995). Symbolically, $P \downarrow$ as $X \uparrow$

Since the average personal income in polycentric agglomerations, such as Stockholm, is often higher than monocentric agglomerations, such as Eskilstuna. By applying the first layer of the analysis to both cases, the model can then predict that more residents will be prepared to move to Stockholm only if the disposal income (Y) is higher enough to cover the shift in prices of housing (P), goods (C), and commuting cost ($T * X$), which it is in reality. Therefore, the incentive indeed exists. This explanation makes it clear that the lower housing price (P) at distant locations serves as a compensating differential that reconciles suburban residents to their long and costly commutes (Brueckner, 2011).

iii) Population Density

A third and final regularity is the decline of population density the further away from the city centre (Brueckner, 2011). Population density, denoted by D , is generally defined by the amount of people per land they live upon. But since it is assumed that dwellings contain a single person, D then reflects the number of dwellings per square kilometre. Figure-11 shows the difference in population density across the city. While the central area of the city contains tall buildings that are divided into small dwellings, the suburban areas have short buildings divided into large dwellings. Thus, D falls moving away from the CBD. Symbolically, $D \downarrow$ as $X \uparrow$

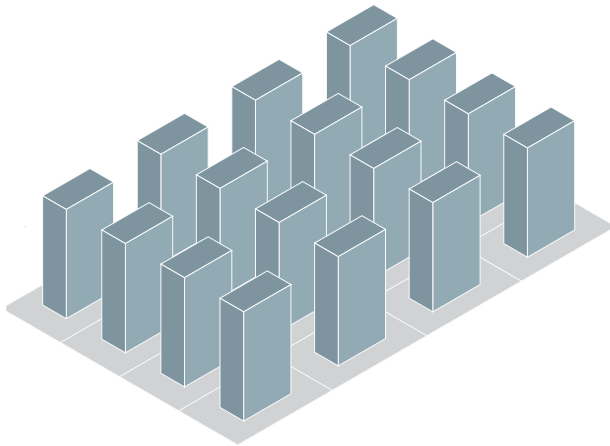


Figure-12. Population density across the CBD (Brueckner, 2011). Adapted with permission.

Dozens of empirical studies have investigated the spatial behaviour of population density, in particular the relationship between population density and distance to the CBD for individual cities all over the world. Relying on the fact that cities are divided into smaller spatial zones, each zone's population density can be computed by dividing the population by its area. The vast majority of these studies landed on the same conclusion which Brueckner's model has identified (Brueckner, 2011). When using a point scatter to draw the result, it always generates a curve with downward sloping for the world's most cities, confirming the prediction of the model of which population density (D) falls when moving away (X) from the CBD.

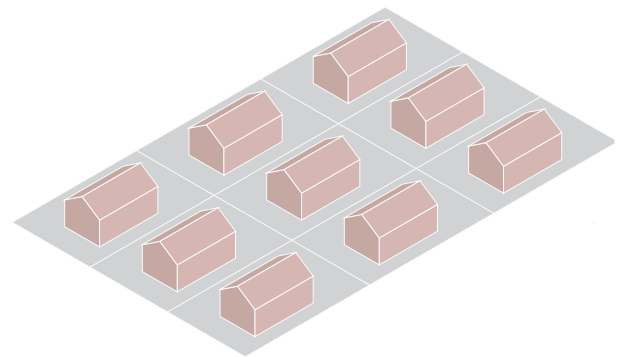


Figure-13. Population density in the suburbs (Brueckner, 2011). Adapted with permission.

2.3 REAL ESTATE ECONOMICS

Real Estate Economics is defined as a subfield of economics which focuses on the analysis of pricing patterns, supply, and demand in the real estate markets (IVSC, 2017). It is the direct application of the economic theories described in the broader field of Urban Economics. The definition of (Real Estate) itself refers to all sort of properties, vacant or built on, within an agricultural or urban context (DiPasquale & Wheaton, 1995).

Since each property is unique in the real estate market, valuation comes in handy to compensate the heterogeneity of products (DiPasquale & Wheaton, 1995). While in other markets with homogeneous goods that are traded frequently, like the automotive market, it is relatively simple to compare between two products in relation to their prices, conditions, and characteristics, the comparison becomes more complicated when valuing two properties in the real estate market since there are no two properties that are alike. Therefore, an international framework of properties valuation standards have been laid out by some academic and organisational groups, such as The International Valuation Standards Council (IVSC), and The Royal Institution of Chartered Surveyors (RICS).

Valuation is defined as “the process of determining the price of a real estate property, as a direct result of an interaction between supply and demand, in the form of an exchange price in an arm-length transaction” (Wyatt, 2013, p49).

The purpose of the valuation affects the technique used in the process. Therefore, a property may have many values, such as: market value, true value, investment value. Moreover, the value of any property is a matter of opinion more than a straightforward fact. Hence a property may have many values even within the same type of valuation, depending on the buyer’s level of interest, and the technique used by the valuer (IVSC, 2017). Furthermore, the process of valuation requires a multidisciplinary approach, since multiple factors are involved in the value of any real estate product (DiPasquale & Wheaton, 1995).

2.3.1 Real Estate Valuation Methods

Amongst the various types of values, the thesis will adopt the market value, as it is considered the most relevant and comparative to describe the current situation of the chosen property.

As previously mentioned, there are several approaches and methods for real estate valuation, and the choice of a specific methodology shall be justified. Generally speaking, all approaches of valuation are based on the economic principles of price equilibrium, and anticipation of benefits or substitution (RICS, 2018). The approaches are:

- i) Market Approach.
- ii) Cost Approach.
- iii) Income Approach.

i) Market Approach:

Also known as Sales Comparison Approach in which the valuer “examines the sales of comparable properties and uses this market intelligence to help estimate a value” (Wyatt, 2013, p.101). The market approach provides an indication of value by comparing the asset with other comparable assets for which price information is available. The approach is considered to be relatively easier in giving an overall estimate regarding a property’s value, however the subject asset has to be recently sold in a transaction appropriate for consideration, and enjoy a level of similarity with the valued property (IVS, 2017).

ii) Cost Approach:

Also known as ‘Replacement Cost’ which “provides an indication of value using the economic principle that a buyer will pay no more for an asset than the cost to obtain an asset of equal utility, whether by purchase or by construction” (IVSC, 2017, p42).

Only if the obsolescence could be evaluated, the valuation then would become closer to the (True Value) of the subject. This approach is more commonly used in valuing an asset that is not directly income-generating, or has a unique nature (RICS, 2018).

$$\text{Value} = \text{Reproduction Costs} - \text{Accrued Depreciation} + \text{Site Value}$$

iii) Income Approach:

In this approach, the value is primarily based on “converting future cash flow, such as rent or any cost savings generated by the asset to a single current value” (IVSC, 2017, p36), plus the cash flow resulting from the ultimate disposition of the investment property, which is called Terminal value.

The income approach is commonly used in valuing assets that have the ability to produce income, or so-called ‘cash flow’, such as apartment buildings, or office premises. Hence, the asset’s efficiency is the critical element affecting the value, besides the holding period of the asset. Even though the income approach is the most used method in the real estate markets due to its accuracy, the valuation includes noticeably significant uncertainties since it is based on future forecasting (RICS, 2018). It follows:

$$FVN = PV (1+r)^N$$

FV: Future Value

r: Interest Rate

PV: Present Value

N: Number of Periods (time)

While carrying out a DCF valuation, there are few external aspects that may impact the valuation, such as: any drastic shifts in the macroeconomics that affects the inflation rates, the interest rates, and currency exchange rates. Moreover, the lack of information related to the subject asset. Furthermore, any natural disaster that may directly damage the asset, which increase the level of risks (IVSC, 2017).

3

URBAN RE-INDUSTRIALIZATION

3.1 The Concept of Urban Re-industrialization

3.2 Industry in the 21st century

3.1 THE CONCEPT OF URBAN RE-INDUSTRIALIZATION

Upon the economic recession of 2008 that hit most of the western economies, voices started to rise against the current 'Cappuccino City' model that most cities follow in their urban planning policies. The term 'Capuccino City' was introduced by Krzysztof Nawratek, Head of the Architecture Master's Program at Plymouth University, to describe the current fabric of most modern cities, and to argue that "the post-industrial city is a fiction, and it should be replaced by "Industrial City 2.0" (Nawratek, 2017, p16).

The idea of urban re-industrialization was initially developed for capital cities. Simply put, the concept promotes bringing back the industry into the city and argues for the benefits of coexistence, proximity and synergy between industry and other urban functions. As such, it is considered as a negative of the modernist city where industrial activities have been moved out for health concerns, and logistical and economic reasons (Nawratek, 2017).

Nawratek (2017) explains how the present strategies of urban growth have a tendency of labelling only a narrow portion of urban activities as "productive and generative" (p.26). Consequently, the workers in these sub-sectors are identified as high-skilled and are rewarded high incomes. These kind of strategies help increase inequality, making it easy to disregard the contribution of the "poor" people in other sectors in making cities work. An example of that is the specialist elevator manufacture and repair companies

that respond quickly when elevators brake down in London's subway. Therefore, as a political, economic, and urban planning notion, urban re-industrialization encourages a reconsideration of the importance of these neglected industries for other urban activities. In that way it aims to rectify the current dominant narratives by "positioning a very different set of activities in the driving seat of future urban development." (Nawratek, 2017, p.26)

While the economic theories argue for gains in profit when allocating the manufacturing units overseas, other theories are, on the contrary, arguing for the idea of coexistence and proximity between production and consumption. The latter arguments have been supported by other forces (Nawratek, 2017):

- 1- A growth in the nationalism movement which crystallized in the promotion of the locally produced products accompanied with protectionist measures and taxations on importing.
- 2- A relative rise in wages and production costs in the production countries which will reduce their competitive advantage.
- 3- Increases in the cost of freight transport Due to rising oil prices, increased taxation, or even enforcements that aim to end marine pollution.
- 4- The demands to re-humanize work and reduce the consumers' alienation from the produced goods.

5- The critique of the conceptualization of 'the economy' as just the money-traded part of social life, valuing output on a market basis and devaluing much of society's most precious activities and skills.

6- The imperative to take full account of environmental impacts in measuring and valuing activity, and to reconfigure activity to stop or reverse environmental damage.

The concept advocates the economic approach of asset management in relation to redistributing the structure of the economy of our modern cities. Instead of the monofunctional structure which solely relies on the service sector, the idea is to enhance the service-industry balance, which may decrease the impacts of future economic recessions.

Reviving the industry in the post-industrial cities in the 21st century does not mean going back to the urban environment or the means of production of the 19th century. Modern manufacturing technologies, like 3D printing, and a revived interest in craft and artisanal local manufacture may help promote a "reorganization of the geography of production", thus integrating production in the inner-city urban areas and bringing it closer to the consumer. (Baker, 2017, p.122)

Advantages from a revived industrial sector can be further enhanced by the design of the built environment, that makes the facilities conspicuous, visible and easily-accessible for the public.

There are many ways in which publicly visible industry can benefit the city inhabitants (Baker, 2017):

- It can help the consumers understand the human labour, energy and mechanical processes that go into the manufacturing of products, thus making a certain respect emerge in the relationship between the consumer and the producer.

- The smells and noises of industry can enrich the sensory experience of urban life, and help create diverse mixed-use streets.

- "Making work more visible increases the legibility of the city and might introduce other ways of being in public – or loosely among others – in ways that are different to dominant modes of consumption-based public space." (Baker, 2017, p.122)

However, in order to achieve this, two points need to be addressed. First, the contemporary industrial activities, like digital manufacturing, are relatively clean and quiet, and should therefore not be planned according to the land-use zoning approaches created for 19th century industry. Secondly, the architectural quality of the industrial building should be recognized and the design should pay close attention to the connection between the interior and the exterior.

As mentioned before, this concept was developed for capital cities, and will need to be somewhat adapted for the purposes of this thesis.

3.2 INDUSTRY IN THE 21ST CENTURY

3.2.1 The Creative Industry

The UK Department for Culture, Media and Sports (DCMS) published in 1998 a report called Creative Industries - Mapping Document 1998 that defines creative industries as those that "have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property." (DCMS, 2001, p.5). The document also contains a list of 13 sectors of the creative industry (Figure 14).

Today the economic role of creative industries is recognized worldwide and it has created the idea of creative economy. The United Nations report of the global creative economy states that:

[...] the interface among creativity, culture, economics and technology, as expressed in the ability to create and circulate intellectual capital, has the potential to generate income, jobs and export earnings while at the same time promoting social inclusion, cultural diversity and human development. This is what the emerging creative economy has already begun to do as a leading component of economic growth, employment, trade, innovation and social cohesion in most advanced economies. (UNCTAD, 2008, p.iii)

Therefore, creativity, technology, knowledge and information are seen as some of the main drivers of development and economic growth in the 21st century.

Pitts (2015) argues that what is special about the creative industries of today is that they comprise an economically dominant factor. For a long time creativity has had the status of cultural activities spread throughout the society or was considered an essential component of a wider industry (Pitts, 2015). The specificity of creative industries lies in the standardisation, rationalisation and institutionalization of the creative process, resulting in a "network of businesses, employees, professional associations, representative bodies, government departments, and so on." (Pitts, 2015, p.82).

There are three driving forces behind the processes of creative industries (Chapain & De Propriis, 2009):

- * 'the creative class' and the importance of the environment,
- * clustering forces, and
- * local and regional business-support infrastructure.

The 'creative class' is a concept introduced by Richard Florida as one of the main drivers of post-industrial cities in the US. Florida (2005, p.34) defines the creative class as workers "whose function is to create 'meaningful new forms' ". He argues that the quality of life is one of the key factors that affect the location choices of the creative class. Cities that offer diverse environments and the technological infrastructure that supports the entrepreneurial culture, are able to attract a critical mass of creative talent and, as a consequence, perform well economically (Chapain &



Figure-14. Creative industry sectors. (UK DCMS, 2001).

De Propris, 2009). However, other factors such as emotional attachment to a place, an attraction to an atmosphere and the state of the housing market are important for an individual's choice of location, and can attract people to locate outside of big cities (Chapain & De Propris, 2009).

Studies suggest that creative industries tend to cluster geographically due to economical benefits generated by co-location (Chapain & De Propris, 2009). Creative clusters profit from agglomeration and urbanization economies. Geographical agglomeration that leads to the establishment of creative groups that specialize in a particular sector in close proximity to each other drives the processes of knowledge creation and knowledge transfer.

The most relevant benefits associated with agglomeration include the availability of a pooled specialized labour market; knowledge and innovation spillovers; reduction in transaction costs associated with the build up and management of the 'projects' that often underpin creative activities; and the emergence of a specialized institutional infrastructure. (Chapain & De Propris, 2009, p.13).

However, urbanization economies that offer diversity and a variety of sectors can be equally beneficial for the creative industries (Lorenzen & Frederiksen, 2008). This also shows how important the environment is for the creative industries, since the creative output is more often than not developed

within networks and communities, rather than being the product of individual talent.

The creative economy has become a significant and an important part of national economies. For example, in 2016 in the UK, the creative economy contributed 14,2 % to GVA (Gross Value Added) (DCMS, 2016), and the GVA of creative sectors grew at a slightly higher rate than the UK economy as a whole.

Further technological developments, especially in the field of artificial intelligence and robotics, are certainly going to impact employment on a global scale. Up to 47% of jobs in the US and 35% in the UK could be replaced by machines in the near future (Newbegin, 2010). However, it is argued that there is a significantly lower risk for 'highly creative' jobs to be displaced by automation (Nesta, 2015).

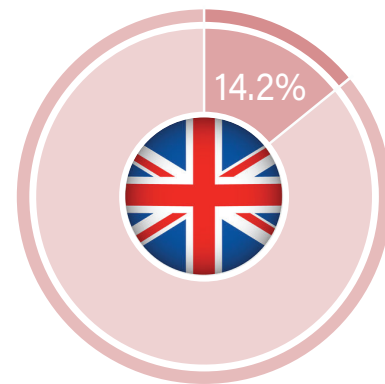


Figure-15. Creative industries' role in the UK economy. DCMS Sectors Economic Estimates 2016: Gross Value Added. (DCMS, 2016).

3.2.2 3D Printing & Mass Customization



Figure-16. A Lamp Made with the Help of a Robot (Laupman & Musial, 2015). Reprinted with permission.

While 3D printers can be traced back to 1984, they became widely accessible only in the past few years, thanks to the advances in technology. 3D printers can be traced back to the development of stereolithography by Charles Hull in his experiments with the first commercial rapid-prototyping technology (Nawratek, 2017). In the general understanding of any material-based processing, the procedures are either additive or subtractive of the initial masses.

Most of 3D printers follow the additive approach of creating tangible 3D objects from digital data (STL format). The system works by building up plastic material in three dimensions to create a real object. It is worth noting that 3D printing can also involve printing with metal powders. Nearly everything can be printed no matter how geometrically complicated the object is, but there are restrictions in terms of size (3D Systems, Hull, 2014).

While the first industrial revolution is associated with the emergence of factory production, which was located in urban areas, the second industrial revolution was based on the application of a spatial division of labour, production, and their markets for the sake of lower costs. The third industrial revolution is associated with the information technology, which has the possibility to transform the geography of production (Rifkin, 2011).

The technology can open, and has indeed opened multiple chances for development in various areas. 3D printers are widely used in the medical services, and have proven many advantages. It is extensively utilized in the automotive industry, the industrial arts and jewelry-making, the construction sector, and the restoration processes in the cultural heritage. This re-emergence of such manufacturing processes has important implications for cities, as it enables new forms of customized manufacturing to emerge, as well as increasing the potential of returning manufacturing processes closer to the consumers.

3.2.3 The Maker Movement



Figure-17. Handicrafts. (Jordanhill School D&T Dept, 2009).
CC BY 2.0.

Related to the interest in creativity, culture and technology in the 21st century is the emergence and growth of the maker movement.

The maker movement refers broadly to the growing number of people who are engaged in the creative production of artefacts in their daily lives and who find physical and digital forums to share their processes and products with others.

(Rosenfeld Halverson & Sheridan, 2014, p.496).

Do-it-yourself hobbyists, repair shops and science fair have existed for a very long time, but with the launch of Make: magazine in 2005 by Dale Dougherty, and the subsequent organisation of Maker Faires as DIY festivals, the maker culture became a collective concept and grew into a worldwide movement (Burke, 2014). The Maker movements is referred to as “a

new industrial revolution” (Rosenfeld Halverson & Sheridan, 2014).

Key characteristics of this movement are:

- *the use of digital tools
 - *a cultural norm of sharing design and collaborating online, and
 - * the use of common design standards to facilitate sharing and fast iteration.
- (Rosenfeld Halverson & Sheridan, 2014)

What separates it from the earlier Internet revolutions is the focus on the construction of physical products.

“The real power of [the maker] revolution is its democratizing effects. Now, almost anyone can innovate.” (Hatch, 2014, p. 10). This quote illustrates that with the computational and fabrication tools becoming more affordable and accessible to everyday people, personal fabrication or micromanufacturing are leading more and more to democratization of production. The relevance of the maker movement is becoming apparent even at higher political levels. For example, the former USA president Obama talked in his 2009 campaign ‘Educate to innovate’ about “the promise of being the makers of things and not just the consumers of things” (Washingtonpost, 2009). And in 2014 he proclaimed June 18 as the National Day of Making. Furthermore, more and more schools are finding ways of integrating making in education, and investing in makerspaces.



4

RE-USE OF INDUSTRIAL BUILDINGS

- 4.1 The Birth of Industrial Heritage
- 4.2 Conservation Practice in Sweden
- 4.3 Two Heritage Valuation Methods

4.1 THE BIRTH OF INDUSTRIAL HERITAGE

A large number of industrial buildings and sites that were built and used during the 19th century, when industrialization was blossoming in Europe, were left standing empty in the 20th century. The main contributors to this were changes in technological and economical trends that consequently resulted in moving the industrial activity away from the city centre to the periphery or overseas, where operational and labour costs were much cheaper (Rogic, 2009).

Since the 1960's there has been a shift in the interest in history, from an approach to the past that was striving to minimize emotions and bias, to one that seeks the emotional attachment and strengthening of the bias. This shift was the origin of the concept of 'heritage' as understood it in its contemporary meaning (Rogic, 2009).

'Heritage' comes from the Latin 'patrimonium', which is comprised of two terms: 'pater', which means father, and 'munus' which translates as 'duty'. Hence, it can be translated as 'things belonging to his father' (Selicato, 2016). Therefore, the original understanding of the term 'heritage' was "property that is or may be inherited" (Oxford Dictionary, 2018). Before the 1970's international conservation charters used the term 'historical monument' to refer to objects and sites that had artistic and historical value. During the 1970s the term 'heritage' starts gaining more importance, which is visible, amongst other things, in the title of a recommendation by the European Conference of Ministers in Brussels in 1969, i.e. Recommendation

of the European Conference of Ministers Responsible for the Preservation and Rehabilitation of the Cultural Heritage of Monuments and Sites. Furthermore, when UNESCO held the Convention Concerning the Protection of the World Cultural and Natural Heritage in 1972, it became an international term. Since then the concept of heritage, having been criticised for being too focused on monumental and aesthetic sites and places (Smith & Akagawa, 2009), has expanded to include natural heritage (e.g. landscape, natural sites, outstanding parks, etc.), intangible heritage (oral traditions, performing arts, social practices, traditional craftsmanship techniques, etc.) and industrial heritage (buildings in dock land, tools in old factories, coal mine sites, etc.).

As Lowenthal summarizes, the view on heritage had changed in three ways: "[...] from the elite and grand to the vernacular and everyday; from the remote to recent; and from the material to the intangible." (Lowenthal, 1996, p.14). The shift that lead to putting vernacular buildings under the concept of heritage was evident in the conservation charters from the 1970s and 1980s, when the focus changed from individual buildings to bigger sites. It is most likely that this expanded focus of interest resulted in industrial buildings, formerly seen as low-culture buildings, getting the attention of conservationists and starting to be viewed as heritage, thus getting included in national heritage inventories in Europe (Rogic, 2009).

4.1.1 Conservation Charters and Guidelines

The modern practice of conservation of protected built environment in Europe resulted from a combination of conservation work at national and international levels. After the Revolution in France, the first national register of protected buildings and art was developed in 1790. France was therefore the first country to introduce national legislation for the protection of the built environment, while other European countries followed in the 19th century. National initiatives were followed up by efforts at the international level. The first international document, the Athens Charter, was developed in 1931. After the end of the Second World War, international work for the safeguarding of the built heritage flourished, with the emergence of organisations such as UNESCO (United Nations Educational, Scientific and Cultural Organisation) in 1945, ICOM (the International Council of Museums) in 1946, ICOMOS (the International Council of Monuments and Sites) in 1965, and many others (Rogic, 2009). These international organisations define guidelines and recommendations for the care of the protected buildings and sites, which are universally valid. It is up to individual countries to integrate them in their national policies, thus making them legally binding. The international charters evidently serve as the basis for theoretical and practical conservation principles.

One of the earliest international charters, the Charter of Venice (1964), also known as the Bible of architectural conservation, is therefore one of the fundamental sources of reference in the field of conservation. It specifies, amongst other things, that:

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. [...] The common responsibility to safeguard [the monuments] for future generations is recognized. It is our duty to hand them on in the full richness of their authenticity.

and

The conservation of monuments is always facilitated by making use of them for some socially useful purpose. Such use is therefore desirable but it must not change the lay-out or decoration of the building. It is within these limits only that modifications demanded by a change of function should be envisaged and may be permitted. (ICOMOS, 2012, pp.3-4)

Therefore the basic principles laid down by the Venice Charter are that historic monuments should be preserved to relay the message from the past, that they should be preserved for the future generations in their full authenticity, and are in the best way conserved by being used, for a purpose that is 'socially useful', but that does not require changes to the built fabric.

Bell reviewed other international charters that came after the Venice Charter and concluded that four basic design principles for interventions into the built fabric of protected heritage have been agreed upon:

- a. any intervention should be only the minimum necessary for the site's survival,*
- b. only minimal loss of the existing fabric is acceptable,*
- c. any intervention should, as far as possible, be reversible, and*
- d. new work should be clearly differentiated from the old.* (Bell, 1997, p.1)

The charters also specify that an adaptation of the building or site is appropriate only when:

- i. the continuity of the traditional function is not possible, or*
 - ii. when the traditional function is causing damage to the historic integrity, or*
 - iii. when it is essential to continued use, or*
 - iv. when the conservation of the place cannot otherwise be achieved.*
- (Bell, 1997, p.42)

Since the industrial activities that represented the original function in former industrial buildings in Europe had moved away from the city- and town centres, and since the socio-economic circumstances are not favourable for the same industrial activities to be re-established on these sites, these buildings meet the conditions set by the charters to be adapted to other

functions. In this case, the charters specify that:

- i. consideration of new use should begin with respect for existing and original patterns of movement, layout and decoration, and*
 - ii. every reasonable effort should be made to provide a compatible use which requires minimal alteration.*
- (Bell, 1997, p.42)

In summary, international charters for the preservation and safeguarding of built heritage, that lay down the basic rules that guide the design of interventions in conservation projects and that shape national policies in the area of conservation, promote constant use of protected buildings as the best method of their maintenance and management. At the same time they want to protect these buildings and sites from changes to their built fabric. The apparent paradox poses issues in the conservation of industrial buildings and sites. On the one hand minimizing alterations limits the program that the buildings can be reused for, in that way also limiting the buildings' value for potential investors, which in turn is likely to lead to the buildings standing empty. On the other hand, the buildings need to be reused in order to save them from decay, and the constant use will inevitably result in changes to the built fabric.

4.2 CONSERVATION PRACTICE IN SWEDEN

In theory, all the international documents should be well-integrated with the practice in Sweden. The antiquarians educated at Gothenburg University or Uppsala University, take a basic course where all Swedish preservation is put in relation to the international charters and practices. This means that the antiquarians that have graduated in Sweden since the late 1970s are aware of these documents and how they affect the Swedish built- and cultural environment. The legislation put forth by the Planning and Building Act (Plan- och Bygglagen), the Cultural Environment Act (Kulturmiljölagen) and the Environmental Code (Miljöbalken) is also based on a common understanding of the international charters.

For example, the same conservation principles apply in Sweden as internationally: make as little intervention as possible with the same material as in the original and with the same type of craft that was originally used. Even the principles of documentation rest on internationally established standards, so that the renovation, restoration, remodelling, or dismantling can be followed up and executed in the future.

Conservation labels such as Q and q indicate that something is protected, but they do not have a meaning in and of themselves. To know the extent to which the building and its details are protected, one must read the explanation on the plan where the protected parts are listed.

(S.O. Ahlberg personal communication, August 21, 2018)

4.2 TWO HERITAGE VALUATION METHODS

Culture-historical valuation method

(Kulturhistorisk värdering av bebyggelse)

The culture-historical valuation method (Génétay & Lindberg, 2014) was developed by the Swedish National Heritage Board as an attempt to create a more clear building conservation policy that is based on clearly defined culture-historical criteria used for conservation assessment and subsequent protection, documentation and care.

In the first phase of the analysis, the important motifs are described in text and photos and are placed into two main categories: Document value or Experience value. The document values consist of historical characteristics, such as: buildinghistorical value, constructionhistorical value, patina, architecturehistorical value, societalhistorical value, sociohistorical value, personhistorical value, and technohistorical value. The experience value is focused on aesthetic and social characteristics: architectural value, artistic value, patina, environment-creating value, identity value, continuity value, and traditional value.

After this follows the refinement part of the valuation phase, which consists of weighing in reinforcing motifs. Furthermore, the building's culture historical value is evaluated locally, regionally and nationally. Finally, the level of ambition for the conservation is set and appropriate actions are proposed.

The SAVE-method

The SAVE valuation method (Høj & Stenak, 2011) was developed in Denmark, for the purposes of mapping of built structures on an urban level in order to give an overview of which buildings might be worth preserving, and to provide a foundation for local planning decisions. The method is based on thematic mapping of an urban environment based on three scales: Dominant features, Settlement patterns, and Elements of the Urban Environment.

Topographical, historical and architectural analyses are performed in order to map the built urban environment under the above-mentioned themes. However, the focus of the method is to capture the urban spatial qualities that are characteristic for the place in question. The overall assessment and conclusion is a summary of the topographical, historical, and architectural qualities that should be taken into account and can offer guidance and inspiration in future planning and development projects.

Either as a part of this analysis, or as a separate undertaking, a survey of individual buildings can be done. This involves registration and assessment of the buildings' conservation values, with the aim of identifying conservation-worthy buildings, formulating a conservation policy and preparing a conservation plan. The conservation valuation in the SAVE-method is based only on the building's exterior.

The assessment is based on five parameters: Architectural value, Culture-historical value, Environmental value, Originality, and Condition. Each of these parameters is given a score on the scale from 1 to 9, where 1 denotes the highest value. The values from the five parameters are summarized in a conservation value that the building in question is awarded. Scores 1-3 are considered a high conservation value, 4-6 mean conservation value, and 7-9 low conservation value.

Why these methods?

The touching point of these two methods is their ambition to identify the conservation values and create conservation and management plans. However, the Culture-historical method contains a lot more criteria used as the basis for the evaluation, and there is a mix of criteria that deals with the physical characteristics and the ones that are more historically- and culturally-oriented. This is a qualitative method, with a written document as the result. On the other hand, the SAVE-method has much fewer evaluation layers, and 4 out of 5 of them are focused on the physical characteristics. Apart from a written document, the result is also a quantifiable score that allows the buildings to be ranked and compared to each other. These two methods are on the opposite ends of the scale when it comes to how detailed an evaluation can be. Both have been criticized and have their disadvantages, but the choice of the method should be adapted to the aim of the evaluation.

5

CONCLUSIONS OF THE RESEARCH

- 5.1 Adjustments of the Urban Model
- 5.2 Adjustments of Urban re-industrialization Concept
- 5.3 Reflections on Real Estate Valuation Practices
- 5.4 Heritage Conservation and Restoration



5.1 ADJUSTMENTS OF THE URBAN MODEL

Most of the classic theories and principles of modern economics have been laid out in the early 19th century, and developed later in the 20th century as a response to the changes in the social, economic, and political dynamics of the society. The same applies to the principles of industrial and business management. These theories have been discussing the followed processes, the used technologies, and the choice of location.

These theories have been facing an increasing challenge since the beginning of the 21st century, with the rise of information age, along with other modern trends and shifts in lifestyles. That creates an enormous pressure to redevelop these theories, and adapt them to the ongoing social and entrepreneurial trends.

The thesis will be following the same principle that has been previously used to describe the modern economic phenomena, and the structure of the urban fabric. As a result of the research process, some adaptations and adjustments have been made to the classic theories to cope with the current changes in lifestyles, and the advances in technology, in relation to the industrial enterprises. The thesis focused on the three most discussed theories:

- i) Economies of Scale.**
- ii) Economies of Distance.**
- iii) Agglomeration Economies.**

i) Economies of Scale:

While some categories of industrial enterprises enjoy the benefits of the traditional approach of scale (Figure 18), other modern industries like the automated ones follow a different type of curvature between productivity (Q) and the labour involved (L), in which the produced amount is not solely tied to the size of labour, but to the type of manufacturing process as well. Therefore, the automated industrial processes form a clear demonstration of the new curvature of productivity (Figure 19).

Although, the cost of a well designed automated system adds up to the overall expenditures, the added value in return is an increase in productivity, efficiency, and flexibility. The cost then is compensated in the long term.

Due to the complexity and overlapping legal, social, and human aspects of the traditional manufacturing processes, the limitations then are much higher and harder to expect comparing to the automated processes. Hence, the latter is easier to predict, monitor, and control. For example, a well maintained robot can easily work more than 12 hours a day, and with the existence of a proper control system, it can also work in weekends, and holidays. Since the limitations of the automated processes are purely technical, a new type of highly educated and skilled labour is then required to manage such complex and sophisticated processes.

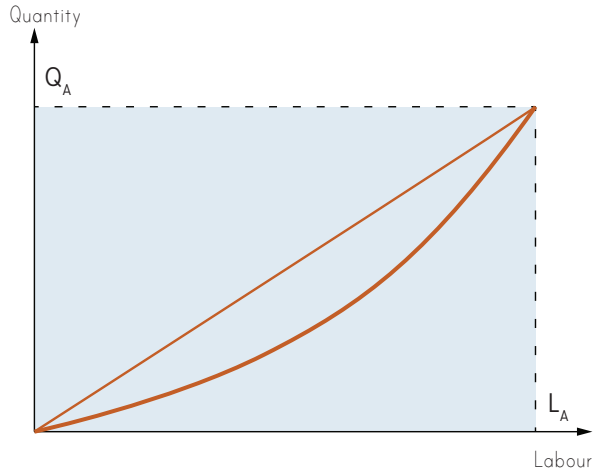


Figure-18. Graph showing the relationship between the produced quantity and labour, in the traditional manufacturing process. (Brueckner, 2011). Adapted with permission.

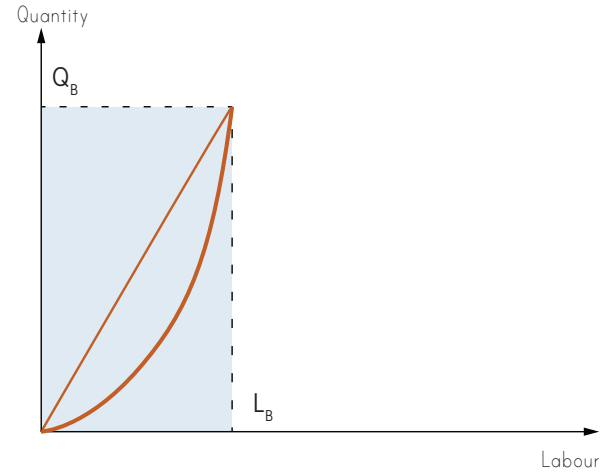


Figure-19. Graph showing the relationship between the produced quantity and labour, in the automated manufacturing process.

Consequently, the spatial and temporal requirements of the production spaces have evolved. An automated system does not require the exposure to daylight as in the manual one, unless it is required for the quality of the output. Moreover, the automated system does not necessarily have to be running in daytime at all, which means, a well designed manufacturing space can be multifunctional throughout the day. Additionally, the required space for circulation, rest areas, changing rooms, and other zones related to the human demands are no longer needed in an automated system.

A direct example of the shifts in the spatial requirements can be clearly observed while comparing the two processes in the automotive industry. Goodwood Plant is the main headquarters,

design/ and manufacturing centre for the Rolls-Royce Motor Cars, a well known British brand, famous for its mostly-handmade manufacturing process. The factory is accordingly designed with long linear buildings, massive windows, and enormous support spaces for the workers.

On the other hand, BMW Group Plant in Munich, is one of the biggest headquarters, design. and manufacturing centres for this German car maker. The centre is well known with its mostly-automated process, that results in reshaping the manufacturing spaces into more square-like geometry, higher ceiling to give more workspace for the robots and machines, and consequently much less windows, and support spaces, in comparison to the Goodwood Plant.

ii) Economies of Distance:

As organised by Marshall in 1920, there are three types of transport costs: the costs of moving goods, people, and ideas. All three types together form an enormous incentive for firms to locate themselves in the most reasonable location that reduces such costs. A fact that is no longer vital due to the rise of internet, and its impacts on the commuting patterns, which have consequently influenced the design and organization of modern workspaces, and the perception of the commuting costs.

Depending on the type of work, it has been reported in the Helsinki Metropolitan Area, that about 80% of employers in the service sector are permitting up to

50% of the work to be done from distance (Statistics Finland, 2018). This shift in lifestyle has a direct impact on reducing the commuting cost parameter (T), which may lead cities to spread out even more and become less dense in their centres.

If the internet is helping to eliminate the cost of transporting ideas, and decreasing the cost of commuting for workers, the cost of moving goods and materials remains as it is. Even though it is believed that the cost per km of shipping a ton of material declines with the distance shipped, the cost of moving goods still forms one of the largest cost components in most manufacturing processes.

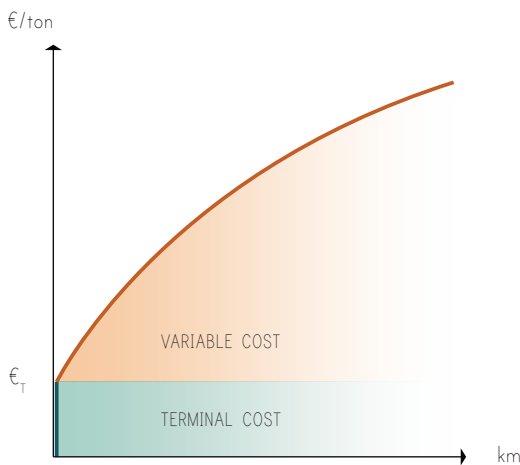


Figure-20. Graph showing the relationship between cost and distance, in the traditional manufacturing process (Brueckner, 2011). Adapted with permission.

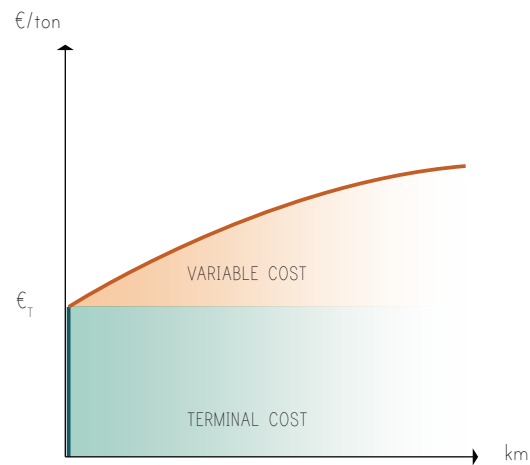


Figure-21. Graph showing the relationship between cost and distance, in the automated manufacturing process.

Figure-20 illustrates the relationship between the shipping distance and the total cost of production in the traditional process. The low value of Terminal Cost is the main incentive for industrial enterprises to allocate themselves overseas as discussed, due to lower rent rates, and lower wages for workers. However, the Terminal Cost component is lower in further distances, the overall cost is then balanced up by higher value of the Variable Cost. The latter component has different forms, such as: shipping expenses, relocating the labour force, higher charges in customs, and more taxations since the product is not locally manufactured. Yet, the biggest challenge for the traditional distanced production is the huge separation between the market place and production site, which isolates the product-making process from the consumer demands.

The same components of locally produced goods are illustrated in Figure-21. The Terminal Cost is much higher in comparison with the distanced production processes due to the increase in rent levels, and higher wages for workers. The first parameter can be reduced by allocating the production processes outside the capital regions. As for the second, it can be balanced by relying on automated production. On the other hand, the Variable Cost component here is much lower comparing to the distanced production due to the smaller shipping distances, cheaper means of transport, and lower cost per km. Additionally, the parameters of taxations, customs charges, and relocating the labour force are entirely diminished.

Bringing industrial processes closer to consumers enhances the relationship between the two ends of the process: production and consumption, facilitates any customization demands for the products, simplifies the integration of newly developed technologies into production processes, and boosts the entrepreneurial and enterprising behaviours in industrial innovation.

Despite the previously discussed advantages of short-distanced production processes, not all types of production can enjoy these benefits. Identified by researching, production processes of small sized, light-weight, handmade, highly crafted, or custom-made products may benefit from the short distance to agglomerated centres.

iii) Agglomeration Economies:

As previously discussed, industrial entities are usually concentrated geographically, since the principle of agglomeration increases the benefits gained by a firm when it locates among other enterprises (Marshall, 1920). The benefit can be a reduction in costs, gains in productivity, or sharing the advances in technology. One major consequence of that concentration, is the increase in rent levels due to the increase in demand, a traced phenomenon in the study of Silicon Valley in California (Saxenian, 1996). Hence, the creation of sub-centres is a must for start-ups to decrease their costs.

Figure-22 illustrates a traditional agglomerated centre, where industrial enterprises, allocate themselves closer to each other. In relation to the discussed sector of industry in the research, firms in the creative, and technology-based industries surely benefit from the agglomerated centres in metropolitan regions such as Stockholm. Since the capital region has the biggest concentration of population, it consequently offers the biggest market, with the highest rates of wages, and the widest spectrum of consumer choice which opens opportunities for more business enterprises, creative minds, and start-ups. On the other hand, the ongoing development plans in the region create an enormous pressure on the property owners to provide more housing units, office spaces, retail and other recreational facilities to support the continuously growing population. However, the prime yield of

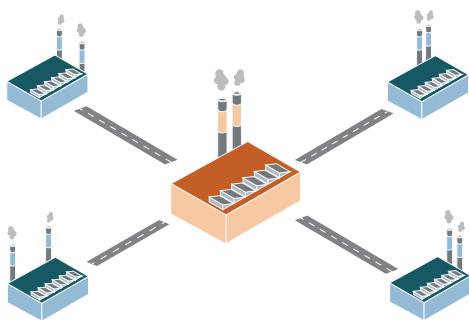


Figure-22. Graph showing the traditional form of agglomeration in the industrial property segment. (Brueckner, 2011). Adapted with permission.

industrial spaces is about 5.5% (JLL, 2017) which is higher than office spaces that stands at 3.7% for the same year. The vacancy rates of offices is much lower than that of the industrial spaces, which increases the risks of investing in the industrial section due to the scarcity of demand (Strand & Edman, 2017), Combined with the low rent levels, this consequently drives down the interest. That is the main challenge that most industrial properties in the Nordic context are facing.

On the other hand, Figure-23 illustrates the relatively advanced proposal of agglomeration which the research argues for. It simulates the traditional creation of sub-centres, but with much longer distances in order to increase the benefit of the low demands, and consequently low rent levels.

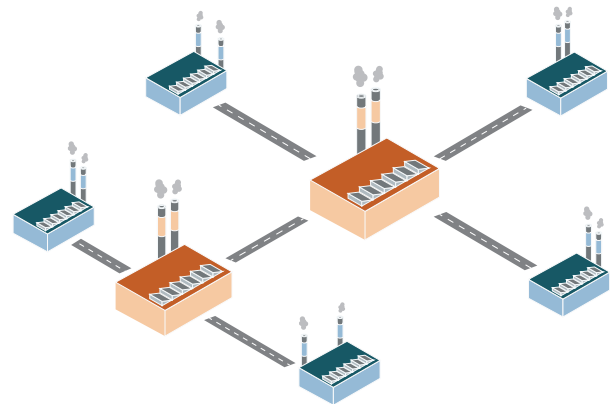


Figure-23. Graph showing the proposed form of agglomeration in the creative, and technology based industries.

5.2 ADJUSTMENTS OF URBAN RE-INDUSTRIALIZATION CONCEPT

The proposed creation of industrial-centres in medium and small sized towns is taking the most advantages of the available technologies in manufacturing and industrial management. The proposal is relying on the classic theory of separating the “office” and “factory”, but with reasonably justified distances. The suggested distance here should not exceed 200km, if the business is ought to enjoy the discussed benefits. The proposed commuting radius is adjusted to the geographical composition of the Stockholm capital region, and its surrounding municipalities. Based on the published market statistics and rent levels, the distance then is far enough for the firms to enjoy the low rent in municipalities such as Eskilstuna, yet not too far to increase the transportation costs of the finished products, nor taking too much time for the entrepreneurs and developers to commute between the two ends.

The proposal is calling for the reallocation of the manufacturing spaces only, while the management, development, and marketing are to stay within the bigger centres. In that way, the enterprises shall enjoy the benefits of both sides. As for the creative industry sectors, the proposal is arguing for the provision of rehearsing and practicing spaces, while the performance spaces remain closer to the capital regions, with its biggest concentration of population, and its varied spectrum of consumer choice.

The conclusion of the investigation landed on the fact that municipalities such as Eskilstuna, have good chances in developing new approaches of urban planning which provide different types of spaces and land-uses that may not exist in the capital region. The proposed development will not only help the town in attracting the missing demographic groups, but will increase its chances in facing the upcoming challenge of the aging population. Moreover, the development will enrich the composition of the economic fabric of the town, and will increase the diversity of its tax payers.

Eskilstuna and similar municipalities should work towards providing an entrepreneurial environment for automated industries, and creative business firms. By relying on thorough strategies, the town can eventually achieve the intellectual spillovers in certain fields, as previously achieved in Silicon Valley, California. Creating a technological agglomeration in Eskilstuna can be accomplished by organizing business fairs, hosting creative events, inviting start-ups and small industrial enterprises, and facilitating the conditions for urban regeneration and development. Keeping in mind the lesson from other technological agglomerations in which the size distinction of the city or town may be less relevant for knowledge spillovers. Instead, what matters is the extent of the town’s employment concentration of an industry in which such spillovers occur.

According to the discussed parameters, and the adjustments of the economic theories, the research landed on some lines of business, creative firms, and industrial enterprises that may benefit from the described advantages. These lines are extracted from the current practices and industrial enterprises of the Swedish economy (OECD, 2018):

- 3D printing enterprises
 - Cloud-based additive manufacturing
 - Rapid prototyping
 - Agile tooling
 - Automotive industry
 - Aerospace industry
 - Naval vessels manufacturing

 - Medical applications
 - Dental applications
 - Personalized implants
 - Compensatory implants
 - Orthopedic implants
 - Radiological purposes
 - Surgical guides
 - Pharmaceutical industries

 - Hardware manufacturing
 - Complementary accessories
 - Cell phones customization
 - Automated manufacturing systems
 - Building automation systems
 - Energy harvesting devices
- Research and education
 - Electric vehicles industry
 - Electric batteries manufacturing
 - Complementary devices
 - Home appliance prototyping

 - Architecture and design
 - Industrial arts and crafts
 - Antiques making
 - Jewellery making
 - Advertising enterprises
 - Publishing enterprises
 - Film making industry
 - Music industry
 - Television and radio
 - Performing art production

 - Apparel and the fashion industry
 - Mass customization for consumers
 - Personalized customization for athletes
 - Consumable art: edible products

 - Gaming industry
 - IT services
 - Software developing
 - Programming enterprises
 - Security and monitoring services

5.3 REFLECTION ON THE REAL ESTATE VALUATION METHODS

Analysing the valuation and its parameters, it becomes clear how the current practices in the real estate markets, that have been come across in the research for the thesis, do not include a parameter of aesthetic, or authentic values. The equation is based on the efficiency of the valued asset, its ability to produce income, the required expenses to operate the property, and other parameters on the macro scale, such as: interest rates, inflation, and the overall stability of the economy.

Various studies have been carried out to evaluate the correlation between the prices (value) of buildings, and their ages. As illustrated in Figure-24, the curve reflects the market behaviour towards buildings of certain age. The curve slopes down meaning a decline in price the older the building gets, until certain age when the price starts to increase. Just as it is nearly impossible to land on a specific percentage in the price of any building that exactly measures or reflects the aesthetic values of its design, it is equally as difficult to point out the exact year from which the building starts to gain more value due to its age. The general description of any building with a rich architectural value is summarized in 'beautiful old building'. The irregularity and inconsistency in valuing 'old' and defining 'beautiful' amongst the specialist of the built environment makes it even harder to set out a clear framework for such valuation processes.

Whether the valuer or the investor are interested in the architectural heritage or not, the aesthetic parameter is unmeasurable and determined by the individual's opinion. Therefore, the conservation charters should be integrated better in the economical valuation processes. Specifically when the valued building is carrying some aesthetic characteristics that may no longer exist in any other building. On the other hand, the conservation charters, as well as the local development plans should be constantly updated to take into consideration the changing and evolving economic forces and market dynamics.

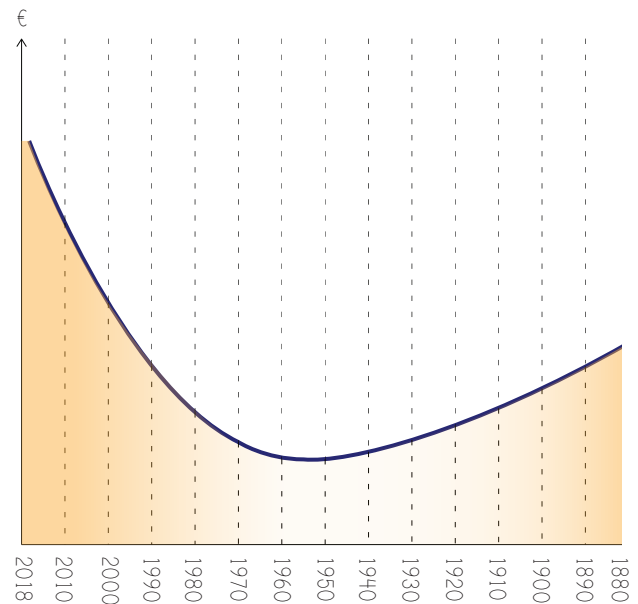


Figure-24. Graph showing the relationship between the building's age and its worth (etuovi.com).

5.4 HERITAGE CONSERVATION AND RESTORATION

International charters for the preservation of the built heritage, are very focused on the protection and conservation of the physical fabric, and they promote constant use as the best method of the buildings' maintenance and management. However, minimizing alterations limits the program that the buildings can be reused for, in that way also limiting the buildings' value for potential investors, which in turn is likely to lead to the buildings standing empty. Furthermore, even if the buildings are being reused, the constant use will inevitably result in changes to the built fabric.

Another question is, what actions should be undertaken if the heritage evaluation shows that the major part of the physical fabric is not in a good enough condition to be used and therefore not worth of preservation? One option is to restore the building to its original appearance. This option usually involves high costs, but, even more importantly, it freezes the building in time, restricting its development- and investment potential.

This thesis proposes an alternative to restoration, which is preserving the intangible values, i.e. the historical values and stories of the built environment, by telling them visually. The method is relying on the visualization and representation of events, facts, flows, etc. discovered during the research and finding a way to integrate them in the new design.

Not only would this preserve historical stories for the future generations, but it would also give more freedom to the design programs, thus increasing their profitability and attractiveness. Another benefit is boosting the creativity in the conservation process.

The conservation evaluation of the Slaughterhouse area started by using the SAVE-method to assess the conservation values of the buildings. The parameters or layers of the analysis are:

*** Architectural value**

(The general aesthetic value and the functionality of the building in the present.)

*** Cultural and historical value**

(The building's historical value, or any special characteristic it might carry, such as: special building technique, craftsmanship, materials or design innovations from a certain period. Furthermore, it evaluates how rare these values are in the Swedish context. The cultural value describes the significance of the building for the present society.)

*** Environmental value**

(The significance of the building for the immediate environment, in terms of its placement and visibility.)

*** Originality**

(How much of the original design and expression of the building are still present, and how well the changes have been adapted to the original.)

*** Condition**

(The present condition of the building's foundation, façades and roof.)

After each layer is scored on the scale from 1 to 9, the mean of all the scores gives the overall grade for the building. This method gives a quick overview of which parts and how much of the built environment is worth preserving.

This is followed by an identification process for the non-physical or intangible characteristics that carry important historical stories about the slaughterhouse, and the method of visualizing them in the proposal.

During our research, we have come across historical material that is not contained in the physical walls of today, such as the flows of movement, figures of the slaughtered animals, notes from the board meetings, etc. This material is regarded as carrier of the history, and therefore, it is treated as carefully as the built environment in the proposal. The result, hence, is a design proposal that represents a mix of old and newly built forms, whose walls and pavements carry the stories of the former slaughterhouse.



6

THE CASE STUDY

6.1 Eskilstuna

6.2 Eskilstuna Public Slaughterhouse





Industrial City 3.0

1000s: The English bishop Eskil is stoned to death in Strängnäs in 1080 and buried in Tuna.

1100s: St. Eskil's remains are considered holy and cared for by a Knight's Order called the Order of Johannite. The Johannite order founds a monastery in the Tuna area in the 1170s and the society that arises around the monastery is named Eskilstuna.

1650: Reinhold Rademacher gets permission from the Swedish state to start producing wrought iron in a manufacturing plant in Eskilstuna. With promise to help build a large manufacturing business, Rademacher receives sole privileges on a range of products; scissors, handbags, cutlery, etc.



1000s - 1200s

1500s

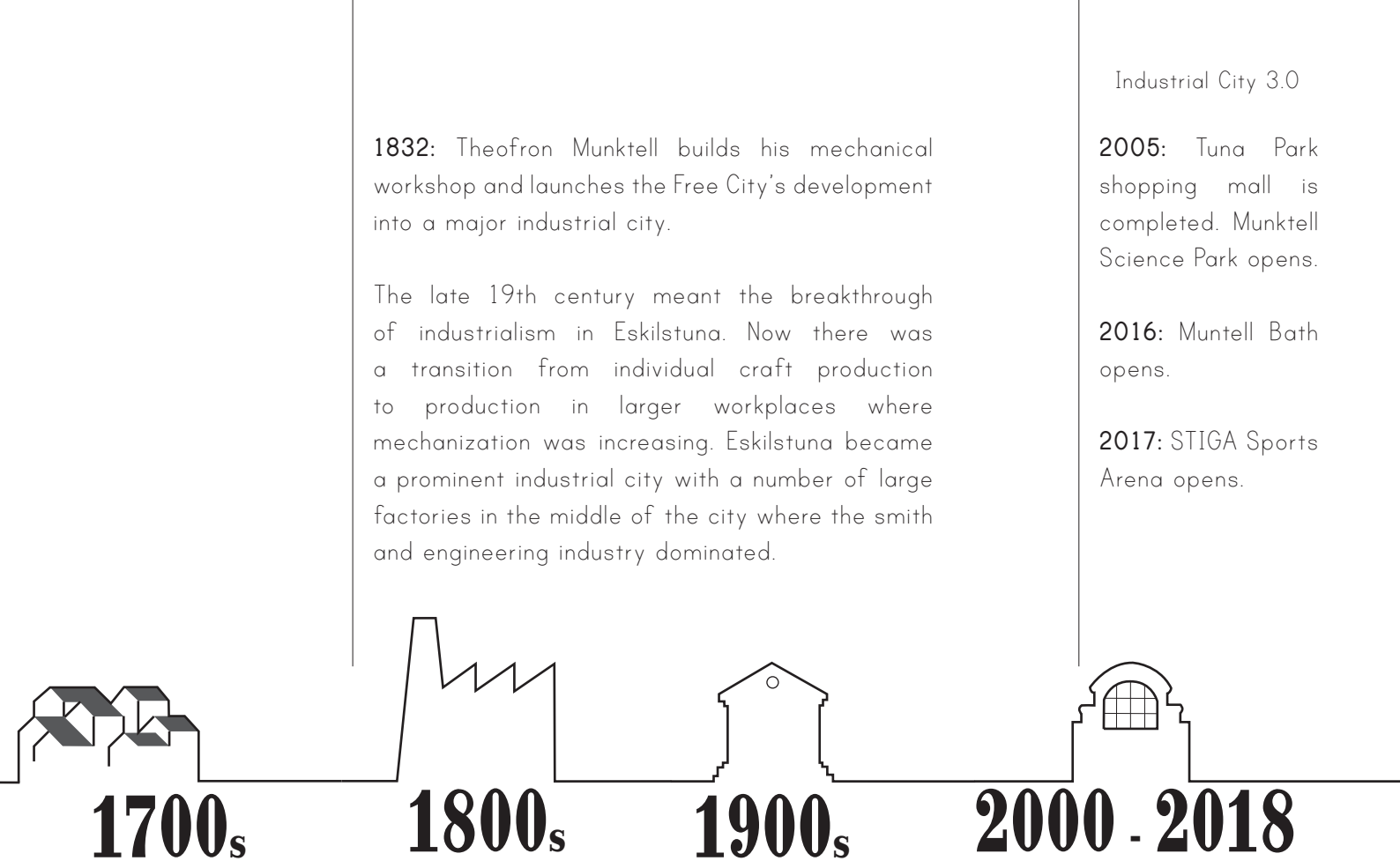


1600s

1200s: The St. Johannite monastery becomes widely known. It is visited by many pilgrims and a society begins to emerge along the pilgrimage trail by Eskilstuna River (Old Town Eskilstuna).

During the reformation under the leadership of King Gustav Eriksson Vasa the state takes control over the church as the country becomes protestant. The King tries to support development of the town by attracting professionals, especially smiths to the area.

*Figure-25. Overview of Eskilstuna's history.
(Based on information from Eskilstuna municipality, 2017).*



1832: Theofron Munktell builds his mechanical workshop and launches the Free City's development into a major industrial city.

The late 19th century meant the breakthrough of industrialism in Eskilstuna. Now there was a transition from individual craft production to production in larger workplaces where mechanization was increasing. Eskilstuna became a prominent industrial city with a number of large factories in the middle of the city where the smith and engineering industry dominated.

Industrial City 3.0

2005: Tuna Park shopping mall is completed. Munktell Science Park opens.

2016: Muntell Bath opens.

2017: STIGA Sports Arena opens.

1700s

1800s

1900s

2000 - 2018

1771: The government approves the establishment of Eskilstuna Free City. Smiths, led by Samuel Schröderstierna and Sven Rinman, could settle down and enjoy exclusive benefits. The guild constraint was lifted, tax breaks and certain duty-free imports were introduced. Next to the Fristad is the "Old City". Eskilstuna thus consisted of two relatively independent cities.

During the period between 1920 and 1960 between 60 and 70 percent of Eskilstuna's employment-active inhabitants were employed in industry.

1959: Rademachers forges Cultural Reserve opened.

1971: Eskilstuna, Torshälla, Husby-Rekarne, Västra Rekarne, Hällby, Kafjården and Ärla constitute Eskilstuna municipality.

1977: Mälardalens Univeristy started.

6.1.2 Urban Analysis

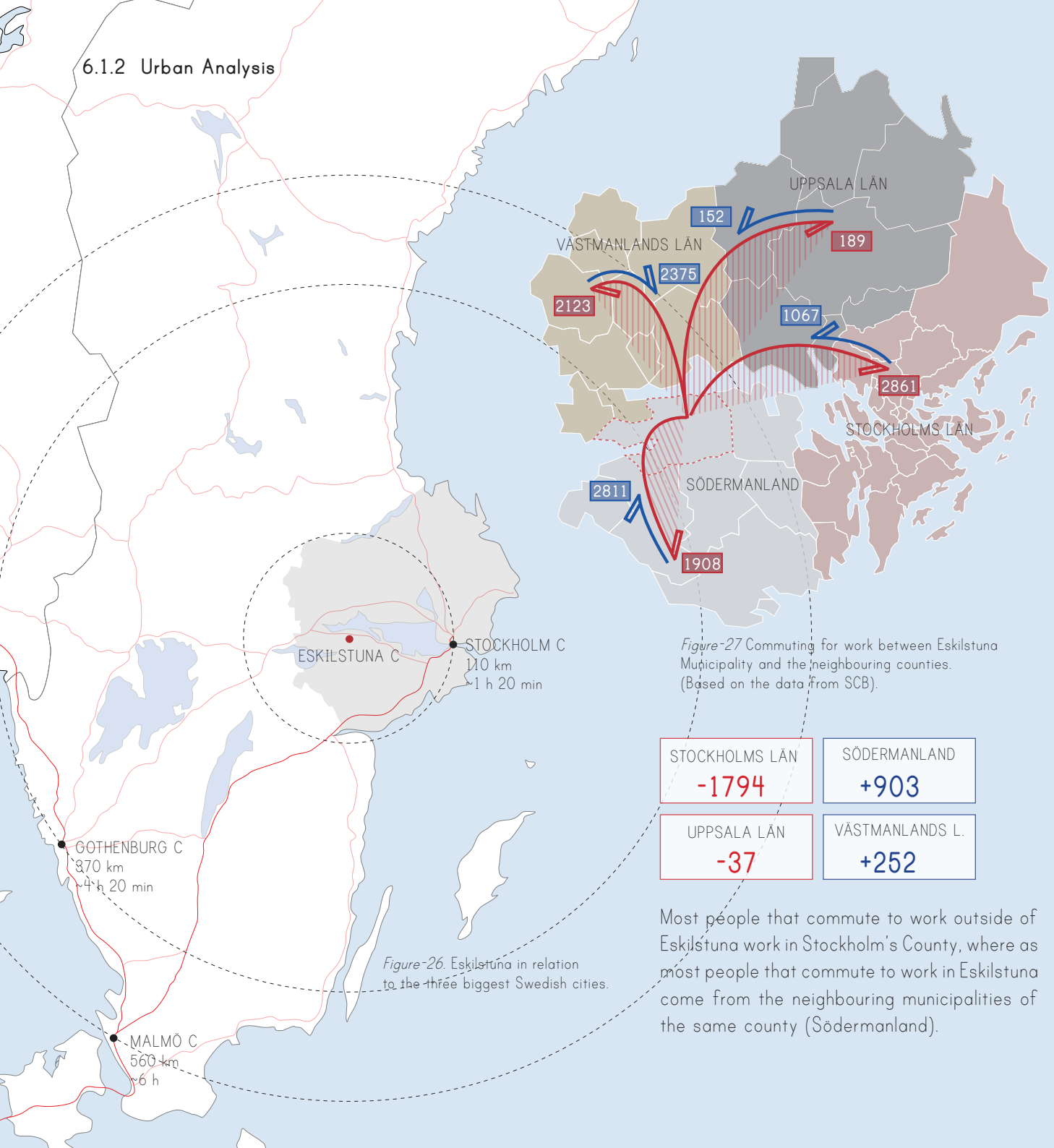


Figure-27 Commuting for work between Eskilstuna Municipality and the neighbouring counties. (Based on the data from SCB).

Figure-26. Eskilstuna in relation to the three biggest Swedish cities.

Most people that commute to work outside of Eskilstuna work in Stockholm's County, where as most people that commute to work in Eskilstuna come from the neighbouring municipalities of the same county (Södermanland).

6.1 ESKILSTUNA

Eskilstuna municipality is located in Södermanland County. It was formed in 1971 by the merger of the town of Eskilstuna with the town of Torshälla, together with five other small towns (Husby-Rekarne, Västra Rekarne, Hällby, Kafjården and Ärla). Today it covers an area of 1,250 km².

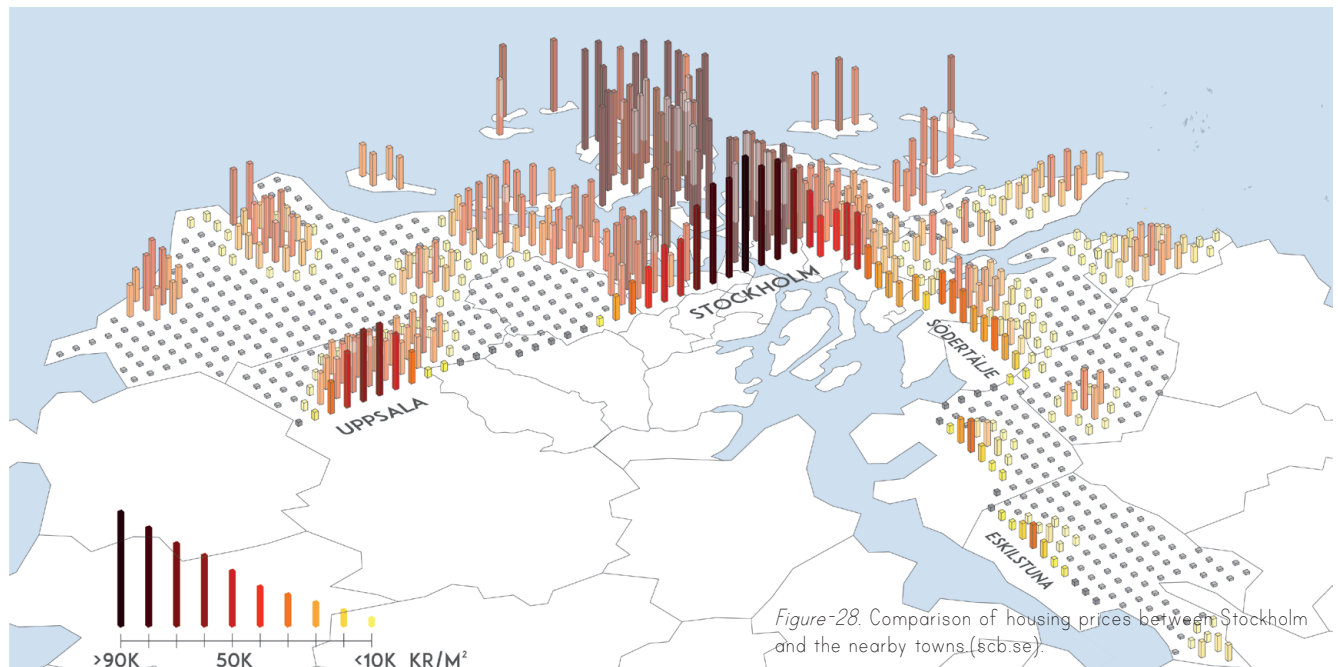
Eskilstuna town is the seat of Eskilstuna municipality. The town has a population of 60 000 inhabitants, which makes 65% of the population of the whole municipality (104 709 inhabitants). The town is located on Eskilstunaån, a river which connects Lake Hjälmaren and Lake Mälaren. (SCB, 2017; Eskilstuna.se)

6.1.1 Why Eskilstuna?

The reasons why Eskilstuna town was chosen as a case study for this thesis are multifaceted, and include: 1) Distance to Stockholm; 2) Monocentric urban structure; 3) Importance of industry for the town, and 4) Population composition.

1- Distance to Stockholm

The distance between Eskilstuna and Stockholm is 110 km. Therefore, Eskilstuna is not too close to become a sleeping town to Stockholm and be affected by the high prices of the capital region (Figure-28). It is also not too far away to notably increase transportation costs of the manufactured products to Stockholm.



2- Industry

Eskilstuna has a rich history of industrial manufacturing (Figure-25). The town was a sanctuary for blacksmiths, who were given different kinds of benefits in order to settle here. This is one of the main reasons for the growth of Eskilstuna in the early years. The industry was even more developed with the establishment of the Munktell mechanical workshop that was producing agricultural equipment.

Industry still plays a big role in Eskilstuna, witnessed by the existence of a number of big companies that have their manufacturing facilities here. Other than industry, one of the biggest employers in the municipality is Mälardalenssjukhus, the biggest hospital in the region, with ca 3000 employees. However, as visible in Figure-30, these companies are located either on the edges of or outside of Eskilstuna town centre. How important these sectors are for Eskilstuna municipality is reflected in Figure-29 that shows that the hospital and industry are the biggest employers in the municipality.

The context of Eskilstuna, with its industrial history, sets therefore good conditions for developing the concept of urban re-industrialization.

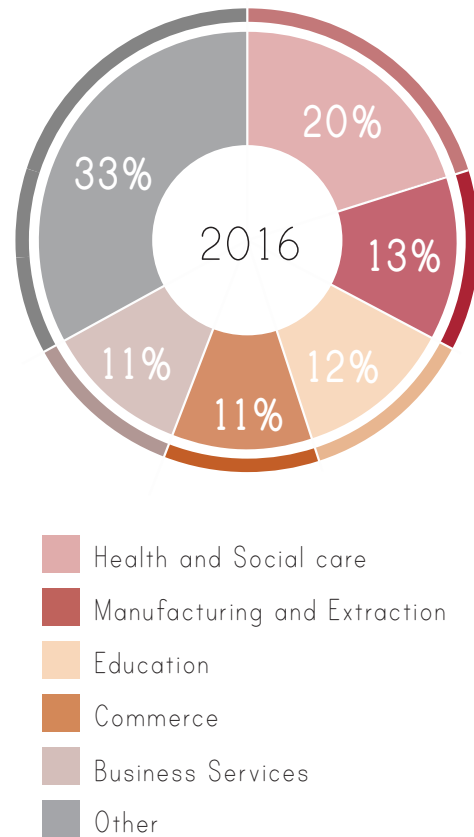
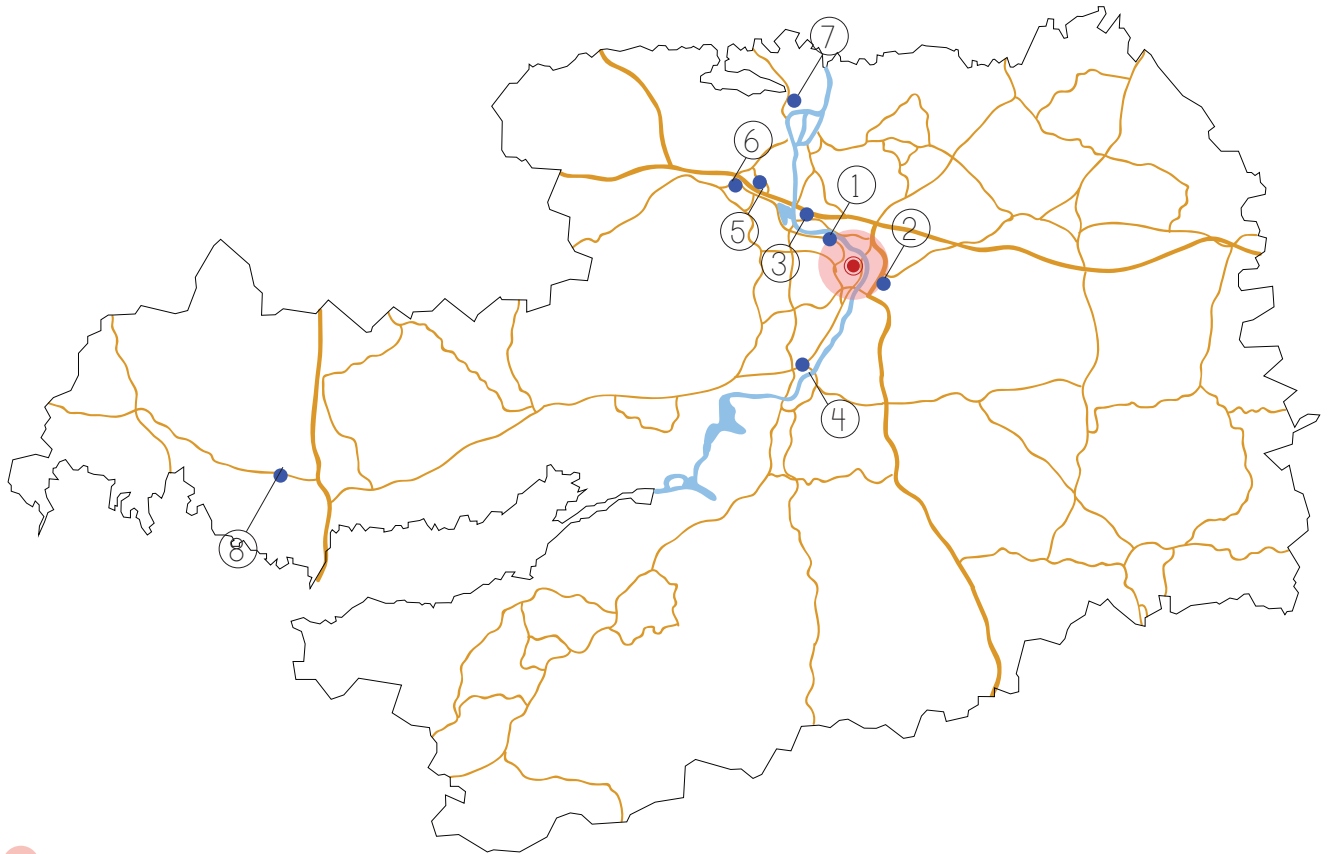


Figure-29. Employment by sector, 2016 (Eskilstuna municipality, 2017).



- ESKILSTUNA TOWN
- ESKILSTUNA CENTRE

Figure-30. Some of the biggest employers: industrial manufacturing and medicine.

- 1- ASSA Abloy Opening Solutions Sweden AB
- 2- Mälarhospital
- 3- Stiga Sports AB
- 4- Alfa Laval Tumba AB Manufacturing

- 5- Volvo Construction Equipment AB
- 6- Outokumpu Nordic AB
- 7- Outokumpu Stainless AB
- 8- Westermo Network Technologies



Figure-31. Building uses, Eskilstuna

3- Monocentric town

Being a small town, Eskilstuna has one centre where the majority of the businesses and public services are situated. The rest of the town is dominated by housing. By choosing Eskilstuna, which is a monocentric town, the thesis will explore possibilities to develop opportunities that can drive the demand. Once there is a demand, an opportunity is created to develop a new centre.

It is clear from Figure-31 that the public services have started spreading across the river. Green areas and activities have been planned on both sides of the river. This shows that instead of being seen as an obstacle, the river was used as an asset and a strategy to connect the town. The development in and around Munktellstaden can be seen as a beginning of an additional centre. With its design proposal the thesis aims to bring additional values to the area and help its establishment as the second centre.

4- Population Composition

Like many other municipalities in Sweden, Eskilstuna has a population composition that is not the best for its economy. Approximately 24% of the inhabitants are under the age of 19, and 20% of the inhabitants are above the age of 64. This means that 44% of the population are either too young or too old to work and contribute with taxations, and are in turn consumers of the social benefits. In Stockholm the same group corresponds to 34 % (Figure-33).

Furthermore, the annual population growth rate in order to sustain a growing population, is an increase of 3-5% (UN.org). As shown in Figure-32, Eskilstuna has in the recent years been growing with a rate of less than 3%. This means that if the same trend continues, in the very short term Eskilstuna will face a shrinking population.

Lastly, with the exception of Mälardalens Hospital, there is a lack of high educated skilled workforce, because they have moved away to bigger cities. Eskilstuna is, for example, missing the creative group and engineers, which are the groups that are targeted in the thesis.

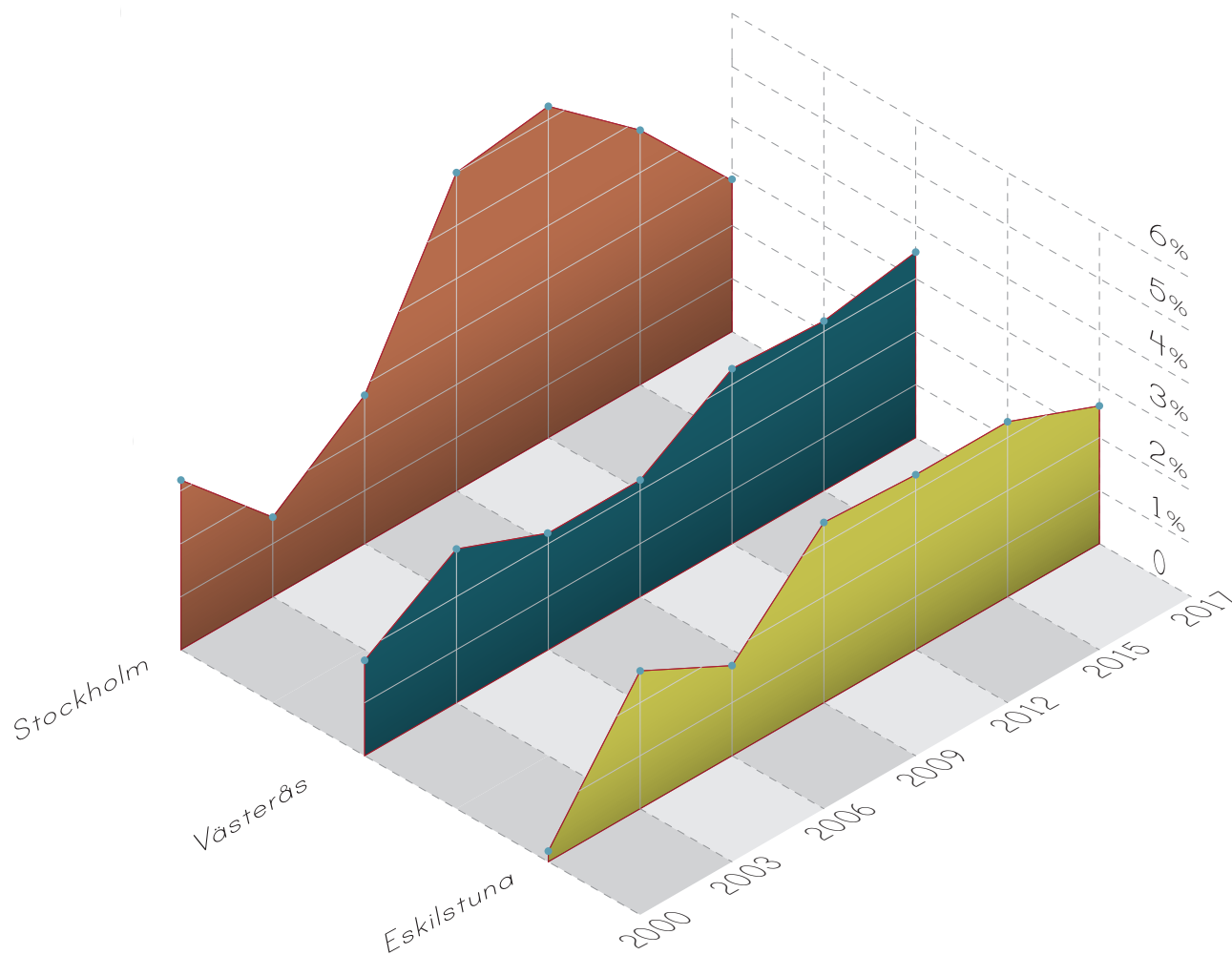


Figure-32. Population growth in three municipalities: Stockholm, Eskilstuna and Västerås, 2000-2017. (Based on the data from SCB).

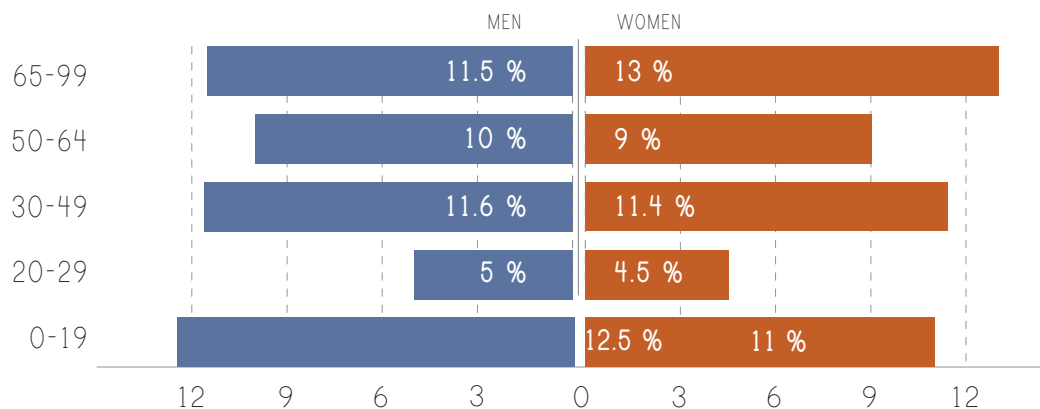
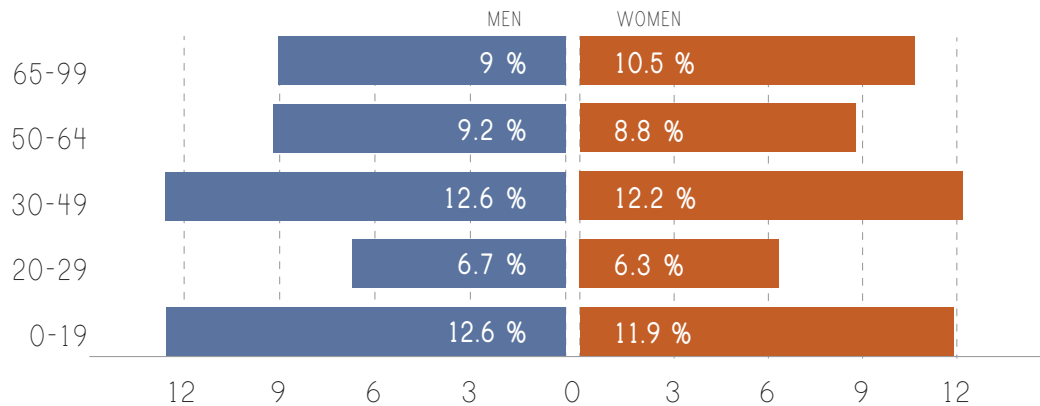
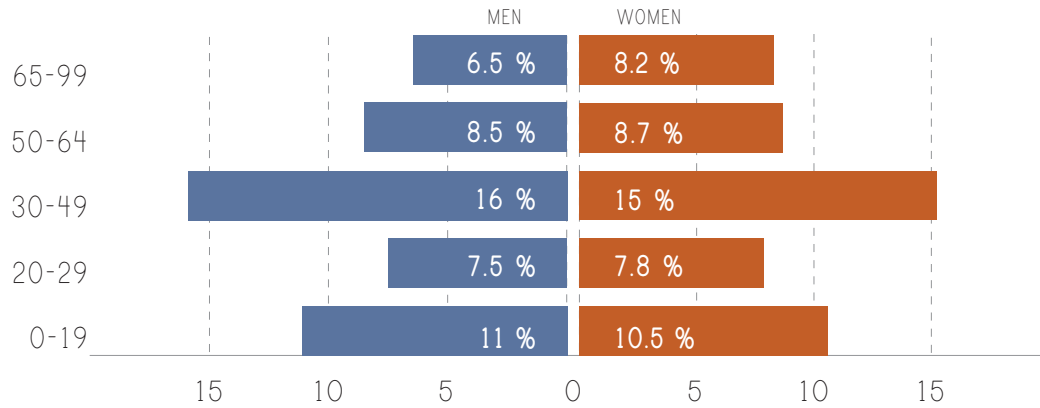
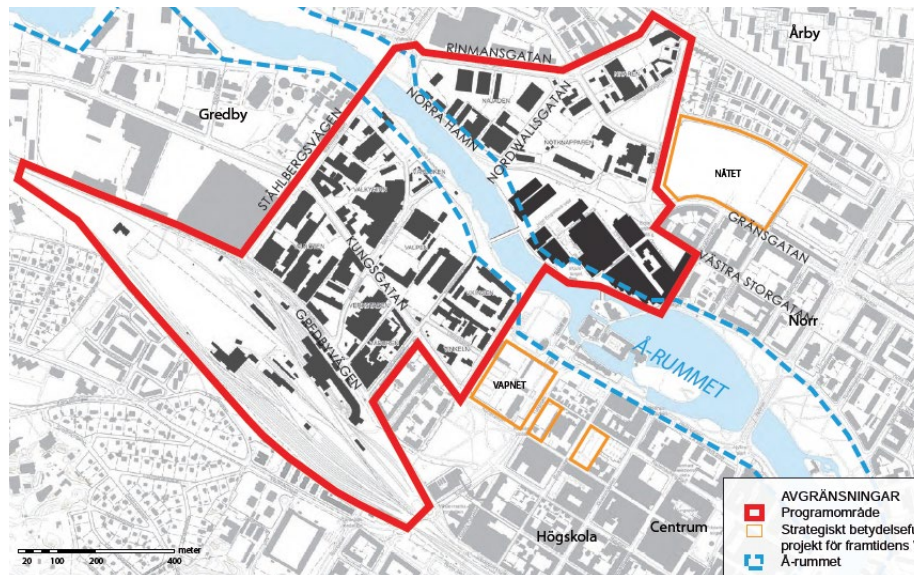


Figure-33. Age distribution in the population, 2017.(Based on the data from SCB).

6.1.2 Future Visions



Eskilstuna municipality has in 2011 published a document *An expanded program for the West*. The plan covers the area to the west of today's centre, and includes the former slaughterhouse area. The vision, summarized in 4 parts, describes the desired future image as a result of the transformation of this area by 2030.

Figure-34. The program area (Eskilstuna Municipality, 2011).

“The Lively District”

Mix of accommodation, work, service and leisure.

Mix of housing forms and business sizes.

Meeting places for people with different backgrounds, interests, and ages.

“The Pedestrian-friendly District”

The human scale as the basis for urban planning.

Richness of detail and variation in the built environment.

Proximity to the water and greenery.

“The Close & Integrated District”

Integrated with the centre and Munktellstaden by a fine network of streets and public spaces.

Easy to walk and bike. Proximity to the public transport.

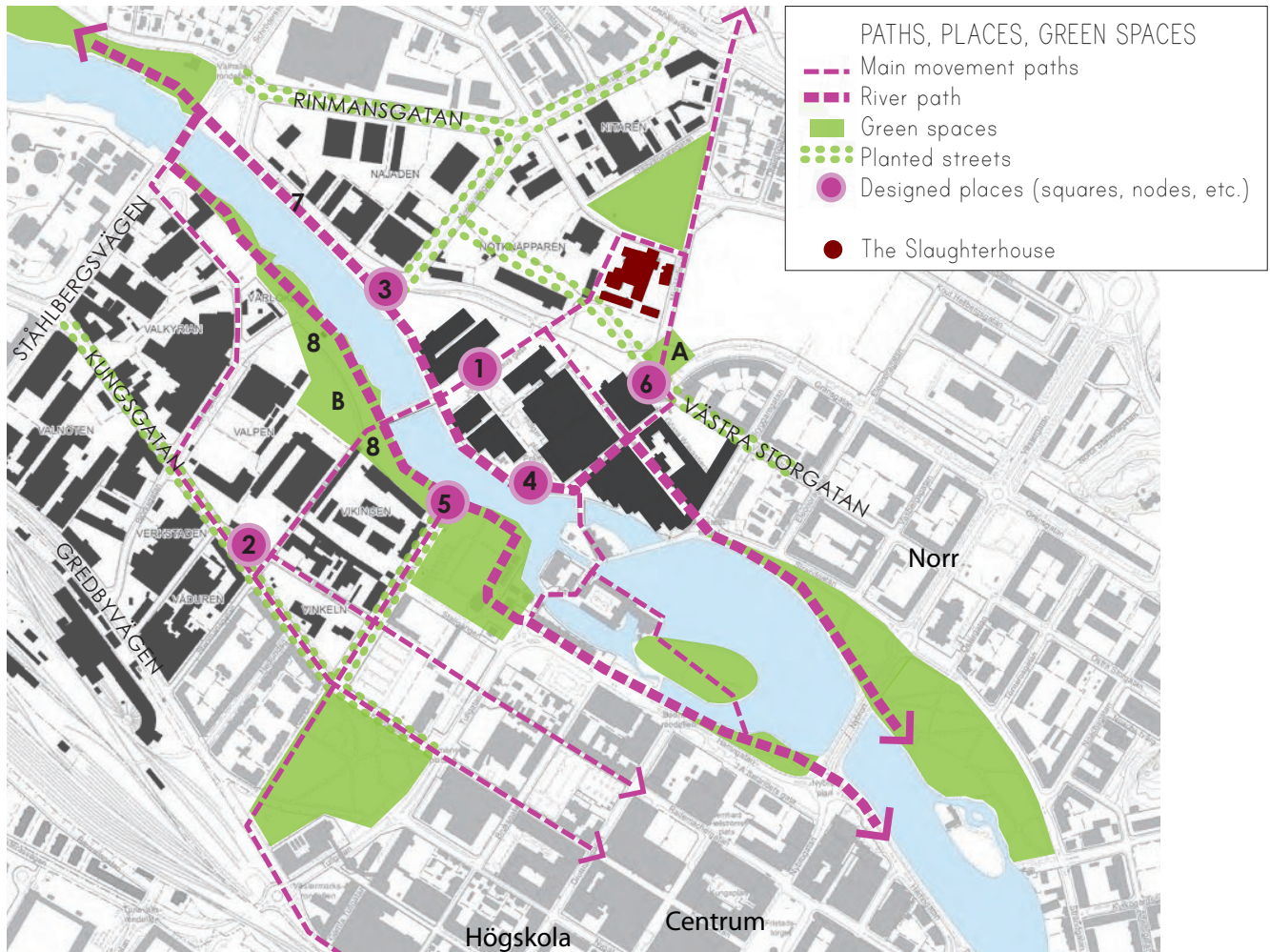
Perceived as safe, accessible and easy to understand.

“The Eskilstuna-unique District”

The “diversified” character unique for Eskilstuna is preserved.

Local initiatives and temporary use of spaces are encouraged.

Meeting between the old (history) and the new (contemporary).



This sketch shows in more detail the municipality's vision. The plan is to improve the quality of the urban spaces by adding and enhancing green areas around the river, creating social nodes, planting the streets, and improving the connection to and over the river. The design proposal in the thesis will draw inspiration from and aim to complement the municipality's vision.

Figure-35. Municipality's vision for West Eskilstuna. (Eskilstuna Municipality, 2011).

6.2 ESKILSTUNA PUBLIC SLAUGHTERHOUSE

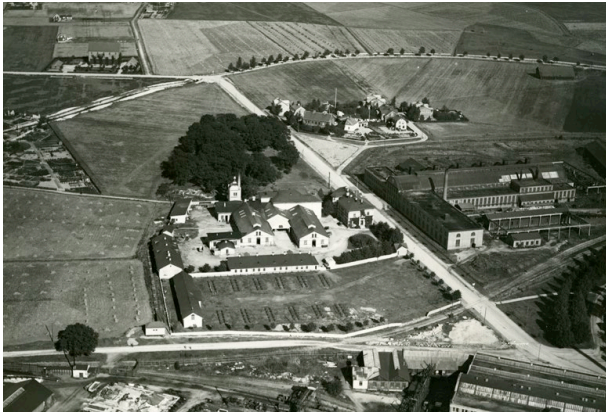


Figure-36 Aerial view of the slaughterhouse area, 1933.
(Aero Materiel AB, Eskilstuna city museum)
Reprinted with permission.

Due to lacking hygienic conditions in private slaughterhouses, the state decided to establish monopoly over the slaughter. The idea of a public slaughterhouse in Eskilstuna was born in 1897, and the it opened for business on 10 February, 1908 (Flyborg, 1933). The slaughterhouse in Eskilstuna was one of five Swedish public slaughterhouses that satisfied the statutory hygiene requirements set by the state (Nyréns Arkitektkontor, 2012). The concept of a slaughterhouse was relatively new in Sweden. There were only two slaughterhouses at the time, Malmö (1904) and Gothenburg (1905). Many people were sceptical to it, as they feared that the meat prices would rise. However, it soon became clear that the concentration of animal- and meat commerce to one place with free competition, and rational use of the cold storage had stabilizing effects on the animal- and meat market (Flyborg, 1933). The slaughterhouse operated until 1976-1977.



Figure-37. Street view of the slaughterhouse area, 1908-11.
(Unknown, Eskilstuna city museum.)
Reprinted with permission.

The slaughterhouse is located 4 minutes by bike and 5 minutes by car from the central station. Even though there is a pronounced industrial character, it is an “up and coming” area. A 1000 new apartments are being built to the east, a newly finalized sports arena lies to the west, and Munktellstaden to the south with an arena, museum, performing arts building, etc.

The area is today a part of the detail plan from 2013, developed for the new Stiga Sports Arena. In this document it is marked that none of the buildings that were a part of the slaughterhouse are allowed to be torn down, their renovation should take extra consideration of their culture-historically valuable exterior, and that the new buildings should be adapted to the specific character of the area.

6.2.1 Area Analysis

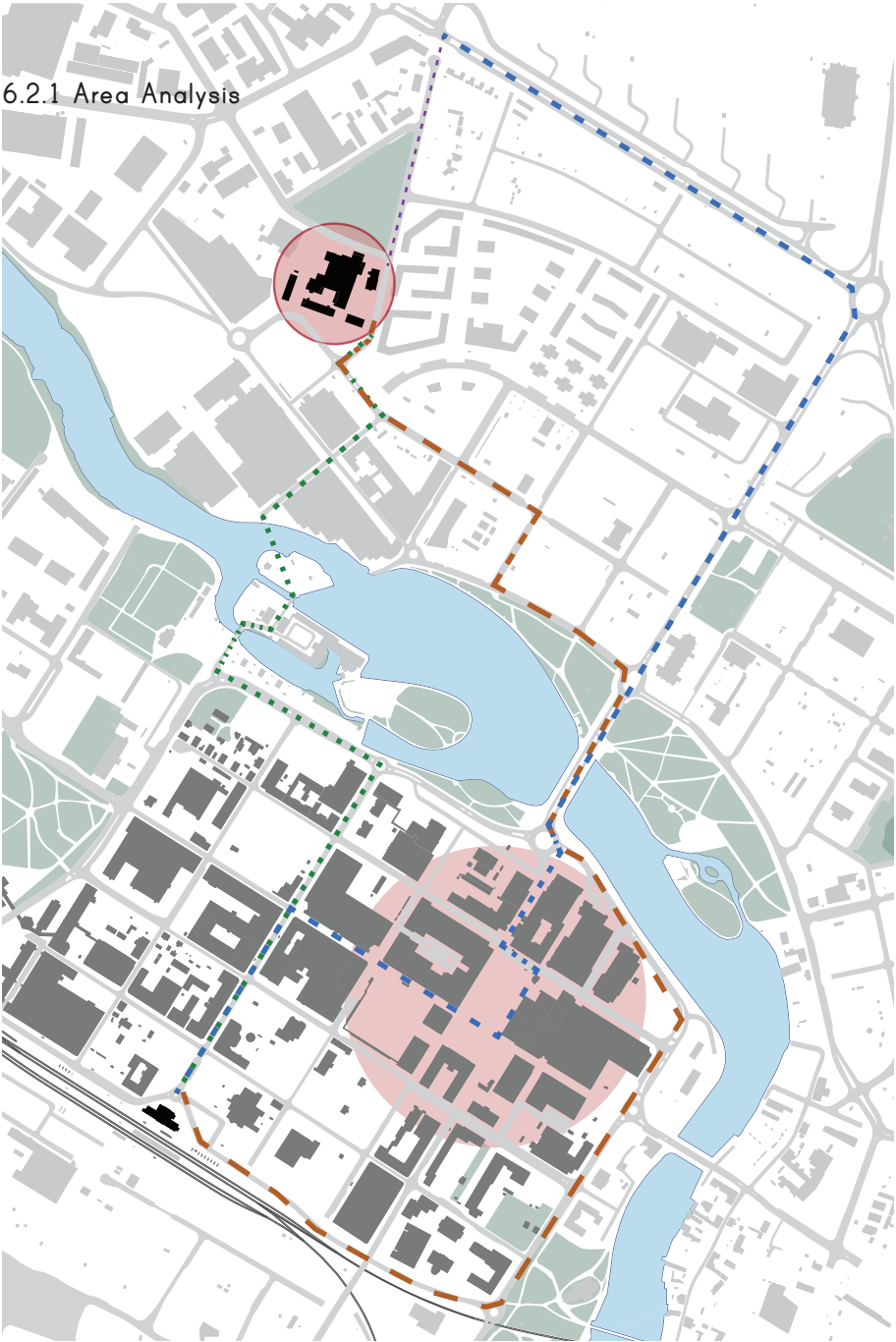


Figure-38. Travelling time between Eskilstuna central station and the slaughterhouse area.

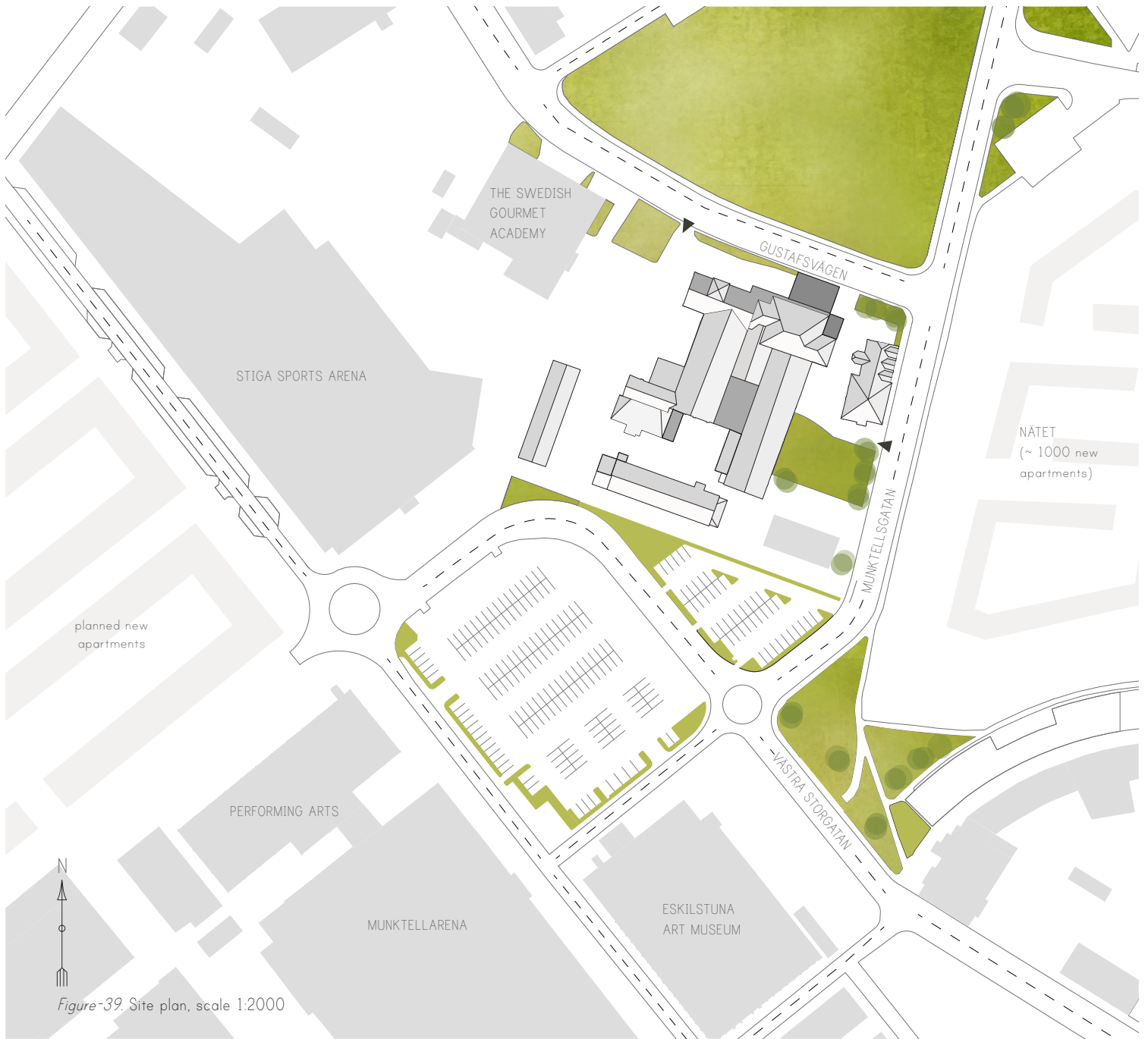


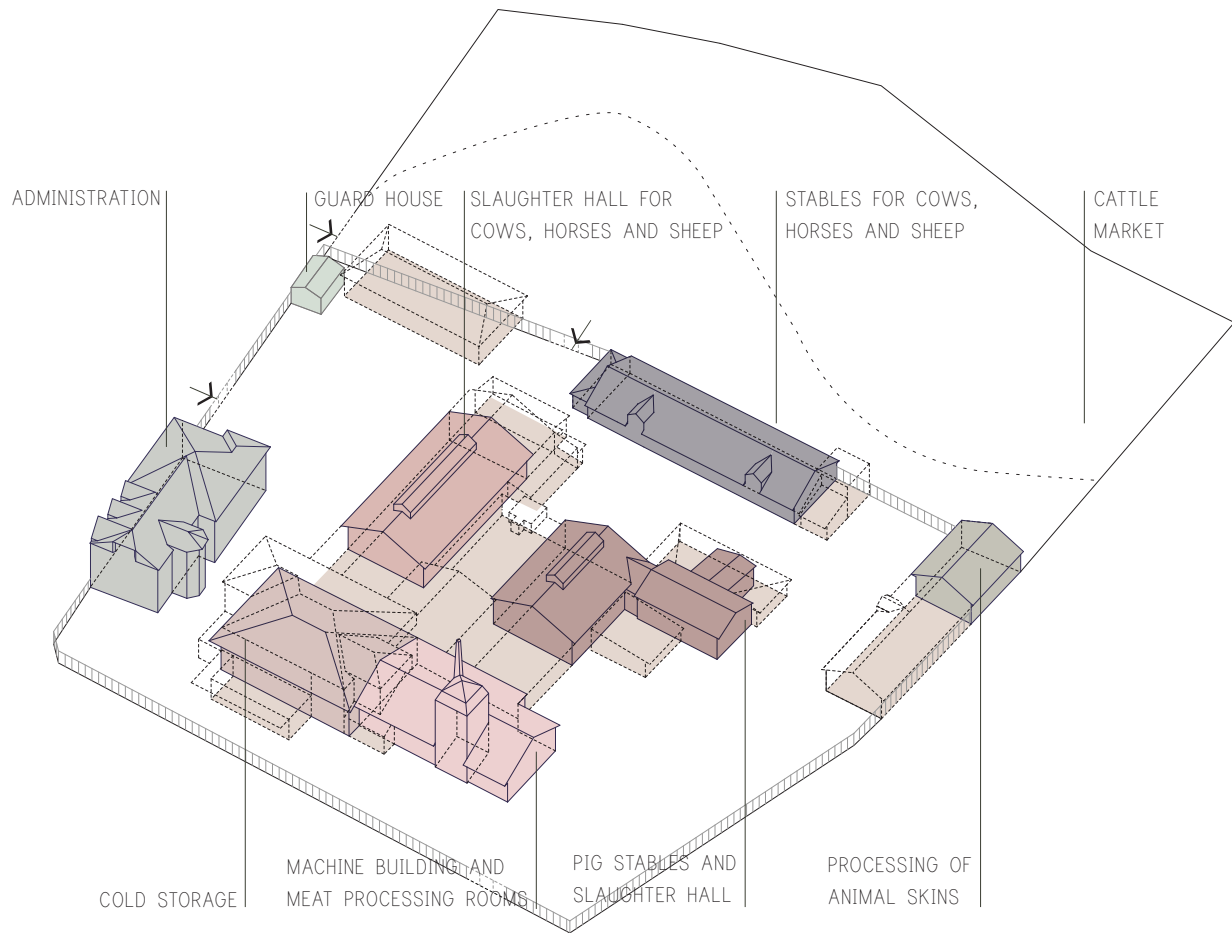
Figure-39. Site plan, scale 1:2000



	LOCATION	ECONOMY	SOCIAL ASPECT	LEGISLATION	NATURE	BUILDINGS	INFRASTRUCTURE
STRENGTHS	<p>Proximity to the city centre centre.</p> <p>Surrounded by residential area.</p>	<p>Various scales of enterprises.</p> <p>The area enjoys a high investment value</p>	<p>Growth of population in the surrounding areas.</p>	<p>Political desire to develop the area.</p> <p>The area is listed as heritage value.</p>	<p>Proximity to blue structures.</p>	<p>The area enjoys a high level of aesthetics.</p> <p>Human scaled urban context.</p>	<p>Existing networks.</p> <p>Pedestrian and bicycle lanes connecting to city centre.</p>
WEAKNESSES	<p>The area is isolated from any green structures.</p>	<p>Lack of development plans.</p> <p>High costs of maintenance and operation.</p>	<p>Lack of awareness towards food processes.</p> <p>The area has a limited access.</p>	<p>Unclear conservation plans.</p> <p>Lack of strategy and vision.</p>	<p>Lack of biodiversity.</p> <p>Mostly impermeable grounds.</p>	<p>Low quality additions to the original buildings.</p>	<p>poorly connected to public transportation.</p>
OPPORTUNITIES	<p>Proximity to blue structures.</p> <p>Closeness to public and sports facilities.</p>	<p>Increasing interest in local production.</p> <p>Increasing interest in the sustainability.</p>	<p>Increasing interest in new lifestyle trends.</p>	<p>The area has preliminary sketches for development.</p>	<p>Ongoing plans to develop the waterfront.</p>	<p>Flexible structures for transformation.</p>	<p>Proximity to blue structures.</p> <p>Nearby development projects.</p>
THREATS	<p>Unwelcoming spaces due to the mono-functionality.</p>	<p>Lack of development plans.</p> <p>Incompatibility between the tenants.</p>	<p>Slowly growing town.</p> <p>On the edge of population shrinkage.</p>	<p>Complicated process in development and social inclusion.</p>	<p>Loss of greenery and biodiversity.</p>	<p>Lack of knowledge about the structural status of the buildings.</p>	<p>Increasing demand for car-based infrastructure.</p>

Figure-40. SWOT analysis of the area

Area uses 1908



→ Entrance

▤ Additions and extensions over the years

Figure-41. Building functions in 1908

Area uses 2018

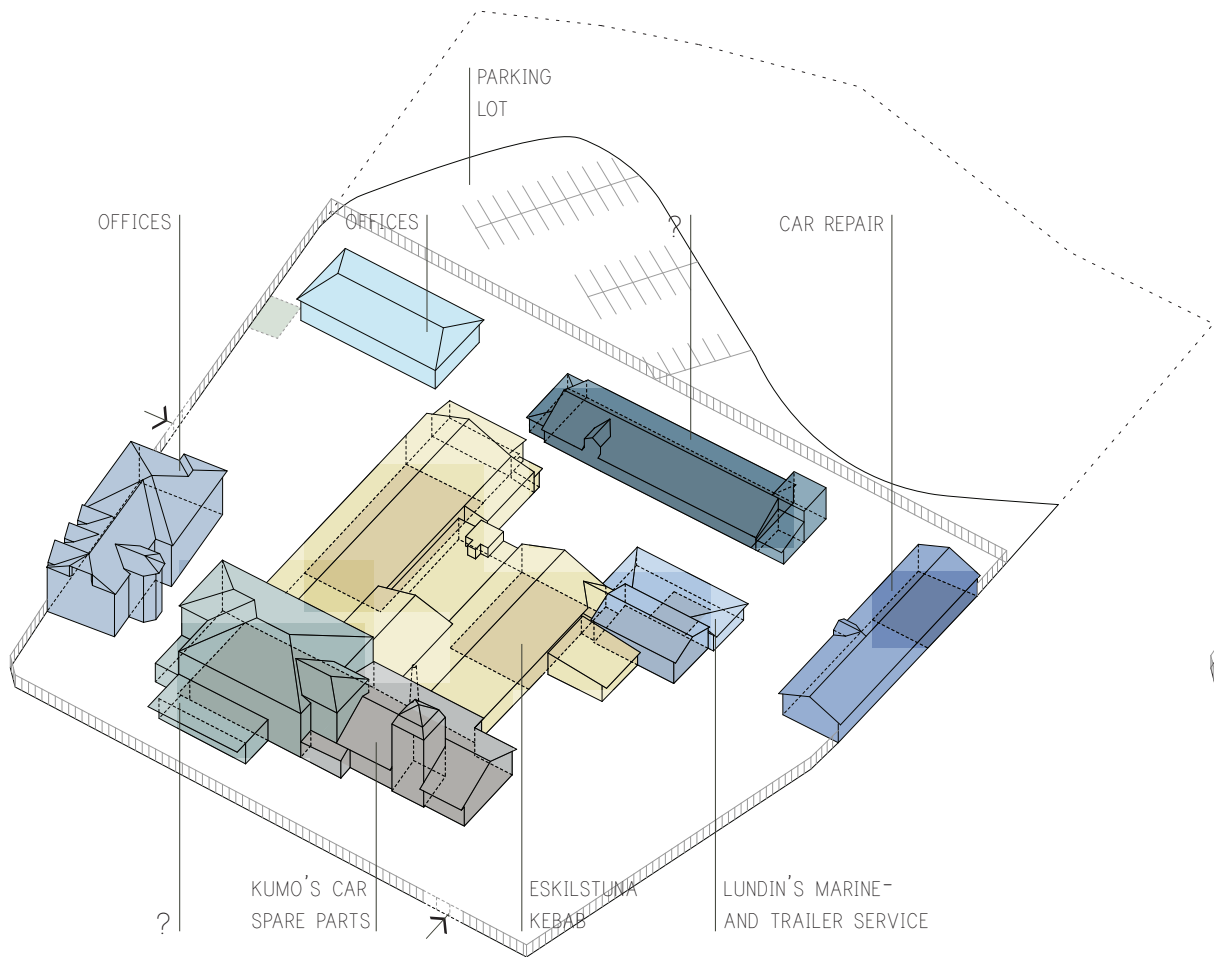


Figure-42. Building functions in 2018

Animal- and Product Flows,
1908

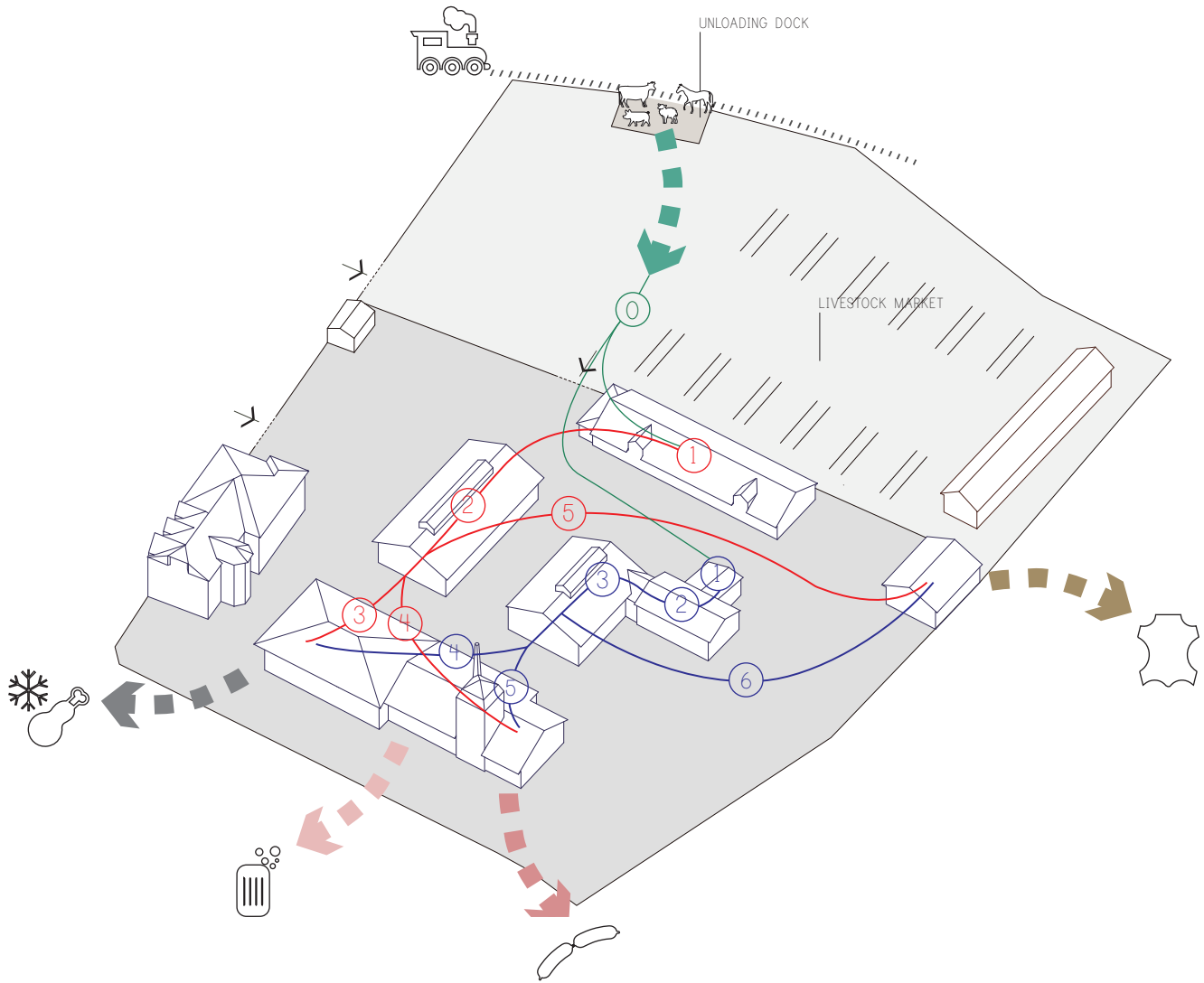


Figure-43. The slaughter process.
(Based on the information from Flyborg, 1933.)

- ① The animals usually arrived with the train from the countryside.
 ② They were unloaded and taken to their respective stables.



- ① Cows, horses and sheep were kept in the same stable.
- ② They were transported to the slaughter hall where the animal was first made unconscious with anaesthesia. After the slaughter is done, a cart takes the meat from the slaughter place to the middle of the building.
- ③ A ceiling midrail leading from the slaughter hall transports the meat to the cold storage building, where it is frozen and stored.
- ④ Other animal parts were taken to the machine building. Amongst other functions, there was a sausage factory, a room for cleaning and processing of the intestines, a room where the waste parts were boiled to extract fat and tallow, and a tower with ovens for smoking the meat.
- ⑤ The skins were sent to another building, where they were sorted and salted.



- ① Pigs were kept by themselves in a separate stable, that was attached to the slaughter hall for pigs.
- ② The slaughtering started by leading the pig into the scalding building where they were given anaesthesia and the neck was cut open to let the blood out. This building was also used for removing the hairs from the pig's skin using hot steam.
- ③ The pig was then put in a cart and moved to the slaughter hall, which was separated from the scalding area by a passage with closed doors, in order to keep the warm air out, for hygienic reasons. The body was then hung on a hook that was attached to a midrail in the ceiling.
- ④ After the slaughter, with the help of the midrail, the meat was transported to the cold storage building.
- ⑤ The intestines and unusable parts were transported to the machine building.
- ⑥ The skins were sent to another building, to be sorted and salted.

Apart from the meat, the outputs coming out of the slaughterhouse were animal skins, sausages and other processed meat, fat and tallow that was sold for technical use (e.g. to make soap), and a mixture of waste (meat and bones) sold as food for pigs and chickens.

6.2.2 Discounted Cash Flows (DCF) of Nötknäpparen (Current State)

As part of understanding the chosen site, a market valuation was carried out using the Discounted Cash Flow method. The valuation was calculated based on 5 years period to decrease the uncertainty of forecasting. The DCF was based on the published market analysis and property outlook of Q2, 2018 by NEWSIC, CATELLA, and JLL. The three organizations are one of the most well-known financial advisors and asset managers specialised in real estate property markets, additionally, they analyse the property markets in their quarterly reports.

Broadly speaking, there are two ways to conduct the DCF valuation, either real or nominal. "Real cash flow does not consider inflation whereas nominal cash flows include expectations regarding inflation" (IVSC, 2017, p38). This valuation will consider the projected inflation, hence it will be nominal discounted.

The general equation for the valuation will be (RICS, 2018):

$$PV = FVN / (1+r)^N$$

Therefore, when valuing the present value based on 5 years:

$$PV = [CF1 / (1+r)^1] + \dots + [CF5 / (1+r)^5]$$

PV: Present Value

r: Interest Rate

CF: Cash Flow

TV: Terminal Value

As highlighted, the timing of the valuation is crucial for the process. This valuation was based on the cash flows of the property until 01.10.2018 and relied on the market analysis of the second quarter of 2018. The general assumption for the cash flows that it occur in the end of the periods, that is 31.09, assuming the year starts by 01.10 of each period.

i) Assumptions and Forecasts

Due to lack of cooperation from the municipal company which is managing the property (Kommunfastighet), the valuation process relied on the available market data which might have limited the accuracy of the valuation. Some of the market reports were summarizing the Swedish market in 2017, and others were focusing on the second quarter (Q2) of 2018.

The vacancy rate of the property has been assumed by observing the facilities while visiting the site in September 2018, and it has been estimated as 30% of the spaces are vacant. And for simplification, the general assumption that the vacancy will remain at the same level for the next 5 years.

The market rent values for the office and industrial spaces were collected from the published reports for the year 2018. It has been assumed that the prices will follow the overall inflation rate, with no major increase or decrease. The same assumption was applied to the operation expenses (OPEX) of both types of spaces.

Property Area	12,420 m ²	Inflation Rate	2.1%	Yield: Industry	6.50%
Leasable Area	6,750 m ²	Cash Flow	5 Years	Market Rent	700 SEK/m ²
Land Rent	0,00 SEK	Vacancy	25%	Operation Ex.	140 SEK/m ²
Offices	2,450 m ²	Yield: Office	8.25%	Yield: Housing	4.25%
Industry	2,300 m ²	Market Rent	800 SEK/m ²	Market Rent	890 SEK/m ²
Storage	2,000 m ²	Operation Ex.	350 SEK/m ²	Operation Ex.	425 SEK/m ²

(Datscha, 2018; Catella, 2018; CBRE, 2017; Newsec, 2017)

Since the property is being managed and operated by (Kommunfastighet), and owned by the municipality of Eskilstuna, there is no rent for the land on which the property exist.

However, most of the buildings were used as storage spaces, the valuation counted them as industrial spaces which gave them higher value. Additionally, the assumed rent per sqm are slightly higher than the average market levels, and the operation costs are slightly lower than the average market prices. Both assumptions were used to boost the current value of the property, in order to decrease the investment risk while comparing with the post-development value.

However, a damage and maintenance report for the site was addressed by a construction consultancy, the property manager did not share the result. Hence, the valuation did not take any major renovation costs into consideration, despite the impact of such component on the valuation.

ii) Valuation of Nötknäpparen (Current State)

The valuation of the property is amounted to:

41,306,100 SEK

Despite the accuracy and sophistication of the income approach, another valuation has been carried out using the (Direct Capitalization) method for affirmation, which follows the equation:

$$PV = \text{Net Income} / \text{Yield}$$

The valuation of the property is amounted to:

39,018,200 SEK

The deviation between the two valuations is less than 4%, which indicates that the true value of the property can be considered as an average between.

6.2.3 Heritage Evaluation

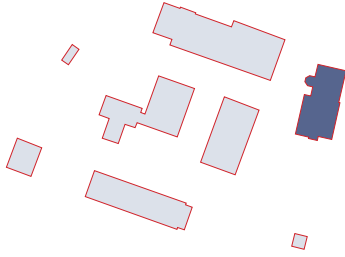


Figure-44. Site plan from 1906.

BUILDING 01: ADMINISTRATION BUILDING

Original design and function

The building was a part of the original layout of the area. The floor plan drawings, signed by the city architect of that time, Emil Befwe, date from 1905. The main entrance to the area was situated by the administration building, and it was therefore important as the symbol for the slaughterhouse. The building served as administration building with some industry-related rooms. It housed a meeting room, an office for the slaughterhouse director, a room for a veterinarian, as well as a room for meat inspection on the bottom floor. On the 2nd floor there were apartments for the director and the hallmaster, while the accommodation for main machinist was provided in the attic (Flyborg, 1933). The functions and symbolism of the building explain why, compared to the slaughter halls, this building looks more monumental. The building façades were covered with light-grey silica stone. Three horizontal lines in red brick wrap around the building, together with red sheet metal wrapping around the middle.



Figure-45. Part of the facade toward Munktelligsgatan (Eskilstuna municipality archive).

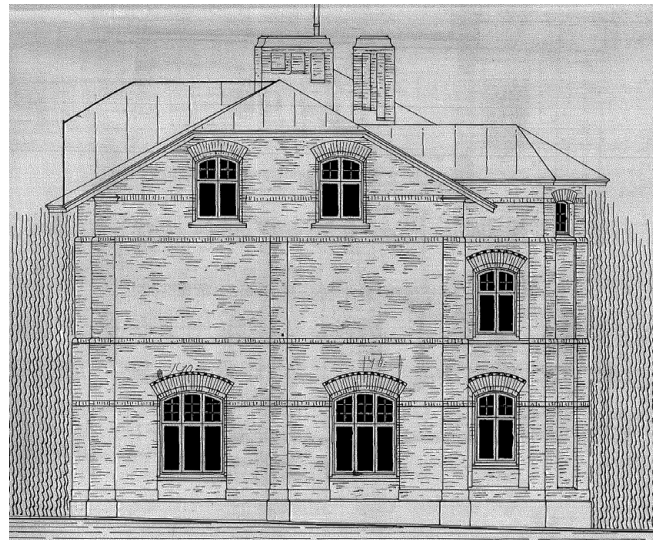
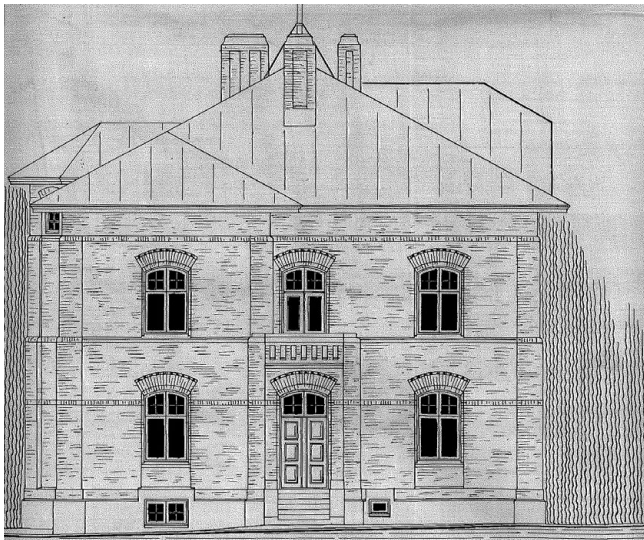


Figure-46. Original south and north façades of the administration building. (Eskilstuna municipality archive). Reprinted with permission.

Today

Appearance/Changes

Very well-preserved building.
 No later additions.
 Silica stone facade as well as most of the original wooden windows are well preserved.
 Balcony railing replaced with one in metal.
 Minor changes to some of the openings on the facade toward Munktellsgatan.
 The roof is also metal and appears to have been recently replaced.

Materials & Colours

Light grey SILICA STONE- facade
 Red WOOD- doors & window frames
 STEEL-roof and balcony.
 Dark grey GRANITE- foundation

Function(s)

Offices for:
 IF Metall Mälardalen
 Mälardalens Byggnads
 OGP Scandinavia AB
 Promet Precision AB

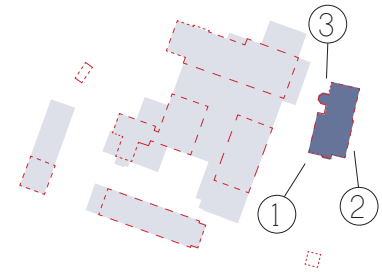


Figure-47. Site plan, 2018.



⊗ Damages

Figure-48. Photos from the area, September 2018.

CONSERVATION VALUATION: BUILDING 01

2.5

Architectural Value

2

Aesthetic value (2)

Very well preserved facade in the original building material. The arched openings give the building authenticity. The aesthetic integrity is reinforced by the colour of the mortar, the red wooden doors and windows, and the facade decorations in red brick. The gabled dormers sticking up from the roofs add a picturesque feeling. The new doors and windows do not match the overall buildings aesthetics.

Function (2)

The building is rented out and used for offices. This contemporary use relates to its original function, in that way providing historical continuity.

Cultural and Historical Value

3

Historical Value (2)

The public slaughterhouse in Eskilstuna was one of five Swedish public slaughterhouses that satisfied the statutory hygiene requirements.¹ This building, with its placement and the aesthetic grandeur, is a good example of the main administrative point in a slaughterhouse area. The very well preserved silica stone facade was a modern material for its time and was used for many industrial buildings during that time in Sweden.²

Cultural/Social Value (4)

The administrative building has one function today- a workplace. It is therefore not a place of casual and spontaneous social meetings.



Environmental Value**3**

The building plays an important role as the visual anchor of the area, and is still the most dominant building visually in the area. It is in the best condition, compared to the other buildings, and the highest one (excluding the tower). The vegetation around the administration building covers it up partly, but the colour and the material make it stand out.

**Originality****2**

The silica stone facade is very well preserved. Most of the original wooden doors and windows, with the exception of three windows and one door on the east facade, still remain. The roof and the balcony fence have been replaced.

**Condition****2.5**Foundation (4)

Based on naked-eye observations, no major visible damages have been noticed. Some discolouration in proximity to rain drain pipes.

Façades (2)

A good overall condition of the façades, with the exception of small cracks, probably due to material breathing and expanding. Small parts of the south facade replaced with concrete where the bricks were damaged.

Roof (2)

Appears to be recently replaced and in a very good condition.



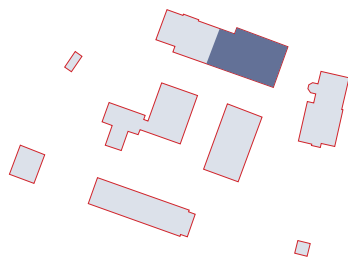


Figure-49. Site plan from 1906.

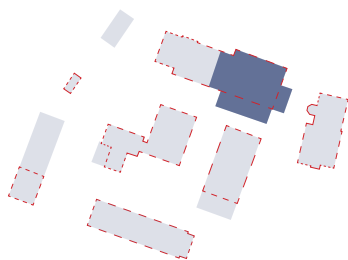


Figure-50. Site plan from ca 1956.

BUILDING 02: COLD STORAGE BUILDING

Original design and function

This building, although in a simpler shape, was a part of the original layout of the area. Like the administration building, the floor plan drawings from 1905 were signed by the city architect of that time, Emil Befwe. Originally there was only one storey that contained rooms for cooling, freezing, and salting. In 1917 a second storey was added with more rooms for freezing and cold storage. The frozen meat could be kept in the storage for 4-5 weeks. This made it possible to avoid occasional fluctuations in the meat market (Flyborg, 1933).

This was one of the buildings visible from the street which would explain why the facade drawing after the second storey addition in 1917 shows facade decoration on the facade facing the street. However, there are no traces that the arches in the facade were ever built. Instead three horizontal lines in red brick wrap around the building. The facade is covered with light-grey silica stone and red mortar. The existence of very few and small windows is related to the building's function as a cold storage facility.

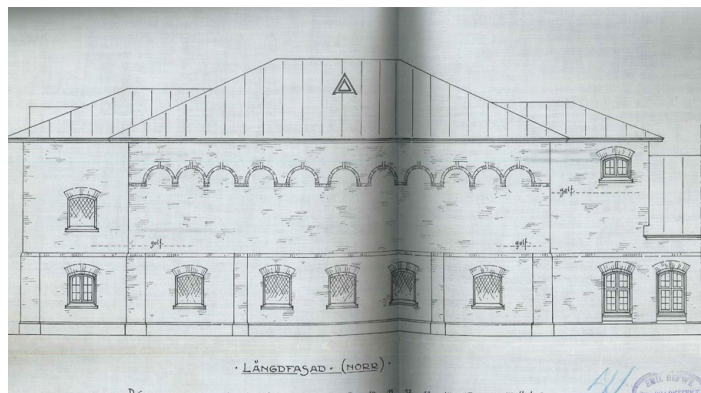


Figure-51. North facade, 1917.
(Eskilstuna municipality archive). Reprinted with permission.



Figure-52. Cold storage building, 1956.
(Eskilstuna municipality archive). Reprinted with permission.

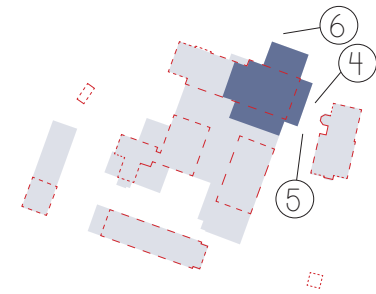


Figure-53. Site plan, 2018.

Today

Appearance/Changes

The building has over the years been extended with an extra cooling room to the south, and an addition in yellow brick to the north, with an overhanging roof protruding from it. The silica stone facade is rather well preserved, with some places where the original stones have been replaced. Two original windows remain, the rest have been replaced, and one has been closed. The roof appears to have been recently replaced.

Materials & Colours

Light grey SILICA STONE- facade,
 Red WOOD- window frames,
 Grey STEEL- roof,
 Dark grey GRANITE- foundation.
 Yellow BRICK- addition

Function(s)
 ?



⊗ Damages

Figure-54. Photos from the area, September 2018.



CONSERVATION VALUATION: BUILDING 02

4

Architectural Value

5

Aesthetic value ③

Rather well preserved facade in the original building material. The arched openings give the building authenticity. The two horizontal straps on the facade visually connect it to the administration building. Later additions, that hide parts of the original façades, and changes that resulted in protruding pipes from the walls, have distorted the building's original volume and aesthetics.

Function ⑦

Unknown. But judging by the windows without frames and the bad maintenance of the addition on the north, it does not seem like this building is highly used.

Cultural and Historical Value

5.5

Historical Value ②

The public slaughterhouse in Eskilstuna was one of five Swedish public slaughterhouses that satisfied the statutory hygiene requirements. The rather well-preserved silica stone facade was a modern material for its time and was used for many industrial buildings during that time in Sweden.

Cultural/Social Value ⑨

The building does not seem to have any function today nor any meaning for the citizens of Eskilstuna.

Environmental Value

4

This building is attached to the building next to it that was used for machinery. Together they create a body that is a bit drawn in from the street, but is very well visible from Gustafsvägen. However, there is an impression that it is the building's backside that is visible from the street, since it is the recent additions and a facade with two small windows that face this way.

**Originality**

3

The silica stone facade is well preserved. All additions have been made in beige brick. Earlier additions have the same arched openings as the original, where as the later ones have rectangular windows. Two of the original windows have been preserved, while the rest have been replaced and are left standing without frames. The roof has been replaced.

**Condition**

25

Foundation (3)

Based on naked-eye observations, no major visible damages

Façades (3)

Good condition of the facade. Most of the silica stone is intact. Some holes in the facade left by the damaged stones. Some of the damaged stones have been replaced with a differently coloured brick. A pipe in the south facade protruding through the wall.

Roof (2)

Appears to be recently replaced and in a very good condition.

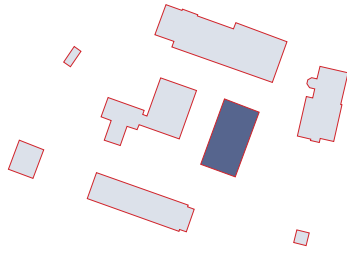


Figure-55. Site plan from 1906.

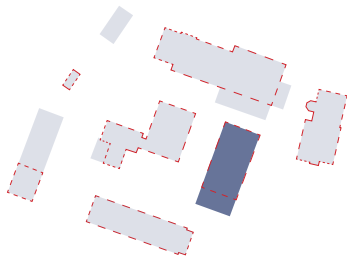


Figure-56. Site plan from ca 1956.

BUILDING 05: THE BIG SLAUGHTER HALL

Original design and function

The big slaughter hall was originally used for the slaughter of cows, horses and sheep. The slaughter of pigs was carried out in a different building. There were 10 slaughter stations inside the building initially. Due to the increased supply of animals to the slaughterhouse, the building eventually had to be extended. The addition was completed in 1932. The building's low height and elongated form is typical for a slaughter hall. The skylight, number of windows in the facade and their repetitive placement provided the daylight necessary to carry out the work, and it reflects the industrial production processes conducted inside.

Like the rest of the original buildings in the area, the silica stone material was used for the facade of this building as well. This, together with the two red horizontal lines in the facade connects the buildings in a unity.



Figure-57. The big slaughter hall, 1956. (Eskilstuna municipality archive). Reprinted with permission.

Today

Appearance/Changes

Several additions over the years have resulted in the slaughter hall merging with the cold storage building. The different brick materials are evidence of this. Only one complete facade is visible from the outside. The facade does not contain many apparent cracks. The gabled facade that can also be seen is partially blocked by an addition covered in plaster. The gabled facade that can also be seen is partially blocked by an addition covered in plaster. The

skylight has been removed and the roof seems to have been replaced recently.

Materials & Colours

Light grey SILICA STONE- facade,
 White PLASTER- addition
 Yellow BRICK- addition
 GLASS BLOCKS- windows

Function(s)

Eskilstuna Kebab AB

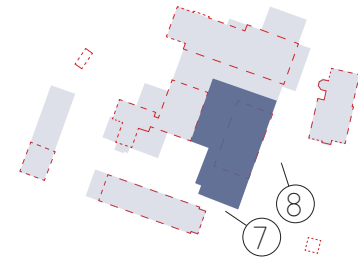


Figure-58. Site plan from 2018.



X Damages

Figure-59. Photos from the area, September 2018.

CONSERVATION VALUATION: BUILDING 05

4.5

Architectural Value

4

Aesthetic value (4)

The silica stone facade is rather well preserved, compared to the other slaughter hall or the stables. Together with the facade material and its proportions, the arched window openings and their rhythmic placement create aesthetic unity with the other buildings, and speak of the building's historical use

Function (4)

Used by Eskilstuna Kebab.

Cultural and Historical Value

4

Historical Value (4)

The building's historical use as slaughter hall for big cattle, and its original architectural language with the silica stone facade, the arched window openings and the elongated form give it historical value in the context of the slaughterhouse as a complex.

Cultural/Social Value (4)

Used by Eskilstuna Kebab factory that provides many jobs.

Environmental Value

6

The building is in the middle of the slaughterhouse area and therefore not very conspicuous from the street. However, due to its elongated form it helps define the linear outdoor area around it.



Originality

4

The silica stone facade is well preserved on the facade to the south-east. The roof has been replaced recently, but the original gable roof form has been kept.

Condition

4

Foundation (5)

Based on naked-eye observations, no major visible damages have been noticed.

Façades (5)

Apparent good condition of the silica stone on the accessible facade. A few visible cracks. Some openings have been filled with glass blocks and some closed completely. Some glass blocks and one closed window openings have been destroyed to make holes for the protruding pipes that are related to the current function.

Roof (2)

Appears to be recently replaced and in a very good condition.



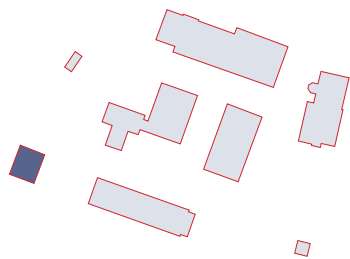


Figure-60. Site plan from 1906.

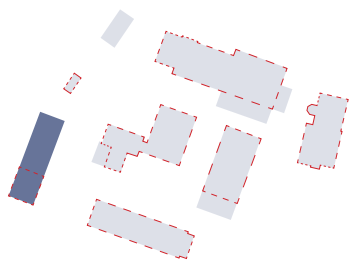
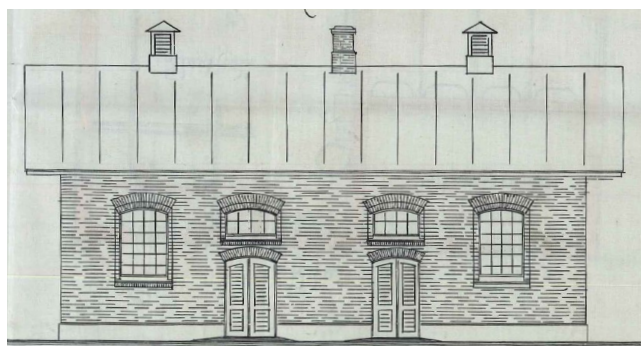


Figure-61 Site plan from ca 1956.

BUILDING 06: HORSE SLAUGHTER HALL

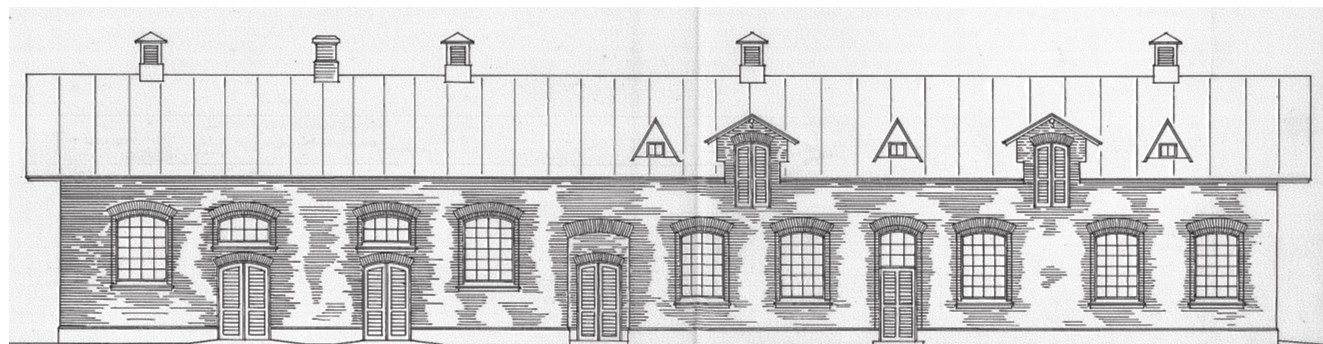
Original design and function

Similar to the other original buildings façades in the area, this building's facade was also silica stone. However, it is missing the horizontal lines in red brick found on other buildings. When the building was erected in 1908 it was intended to be used for the slaughter of horses. However, it soon became clear that there was a need for a bigger area for salting, processing and storage of animal skins. The extension was therefore built for this purpose in 1912. The architect decided to keep the same architectural language, so more of the same type of windows and doors were used in the extension. Two gabled dormers were also added.



(Right) Figure-62. East facade, 1908.
(Eskilstuna municipality archive). Reprinted with permission.

(Below) Figure-63. East facade, 1912.
(Eskilstuna municipality archive). Reprinted with permission.



Today

Appearance/Changes

Radical changes in the facade. Many window openings have been completely closed and with other material than silica stone. Big garage doors have been put in, causing the need for reinforcing beams above the openings. Several visible cracks on the side façades. Gabled façades seem to be in a better condition than the side ones. The roof looks to have been recently replaced. One of the gabled dormers has been removed.

Materials & Colours

Light grey SILICA STONE- facade
 Red STEEL- doors
 Grey STEEL- roof
 Red WOOD- window frames
 Yellow BRICK- old windows
 GLASS BLOCKS- windows

Function(s)

Car repair workshop

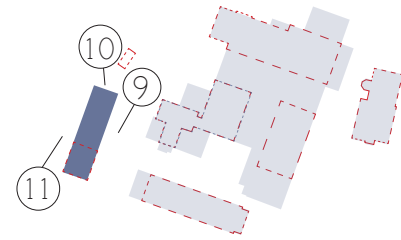
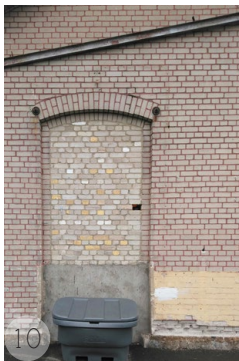


Figure-64. Site plan from 2018.



X Damages

Figure-65. Photos from the area, September 2018.

CONSERVATION VALUATION: BUILDING 06

5

Architectural Value

4.5

Aesthetic value (5)

The silica stone on the gable façades is in a better condition than the side façades. The arched window openings, the gabled roof and the roof dormer suggest the original/early design. However, the condition of the facade and the many changes over the years decrease its aesthetical value.

Function (4)

Used as car repair garage. (Kumo's Car Repair).

Cultural and Historical Value

4

Historical Value (4)

The building's historical use as stables for the horses and storage for skins, together with its original aesthetics (the silica stone facade and the arched windows) give it value in the context of the slaughterhouse as a complex, and aided by the fact that this was one of five Swedish public slaughterhouses that satisfied the statutory hygiene requirements.

Cultural/Social Value (4)

Used by a company that services and repairs cars. Therefore it means that it provides jobs.

Environmental Value

6

The building is visible from Västra Storgatan, but it is inconspicuous and hidden by the other buildings.



Originality

7

The silica stone facade is generally not well preserved. Several of the door openings have been modified over time. The roof, with the original gabled dormers, has been modified. The gabled roof form is kept, but the roof has been replaced recently.

Condition

4

Foundation (5)

Based on naked-eye observations, no major visible damages have been noticed.

Façades (5)

Based on naked-eye observations, apparent good condition of the silica stone on the gable façades, compared to the rather bad condition of the side façades, where there are several visible cracks. Some window openings have closed completely, in a different material than the facade. Big garage doors have been put in at some point, causing the need for reinforcing beams above the openings, where the changed bricks are visible.

Roof (2)

Appears to be recently replaced and in a very good condition.



SUMMARY OF THE EVALUATION

	BUILDING 01	BUILDING 02	BUILDING 03	BUILDING 04	BUILDING 05	BUILDING 06	BUILDING 07
ARCHITECTURAL VALUE	2	5	6.5	6	4	4.5	7
CULTURAL AND HISTORICAL VALUE	3	5.5	5.5	5	4	4	7.5
ENVIRONMENTAL VALUE	3	4	7	7	6	6	6
ORIGINALITY	2	3	7	7	4	7	8
CONDITION	2.5	2.5	7	7	4	4	8
CONSERVATION VALUE	2.5	4	6.5	6.5	4.5	5	7.5



Conservation Value 1-3
High preservation value

Conservation Value 4-6
Medium preservation value

Conservation Value 7-9
Low preservation value

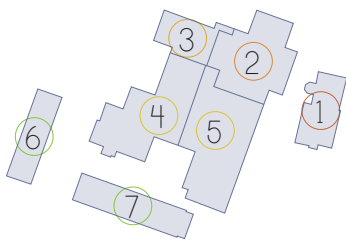


Figure-66. Summary of the heritage evaluation of the Slaughterhouse.

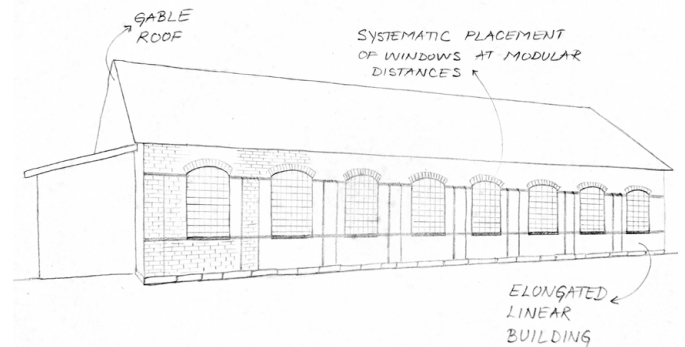
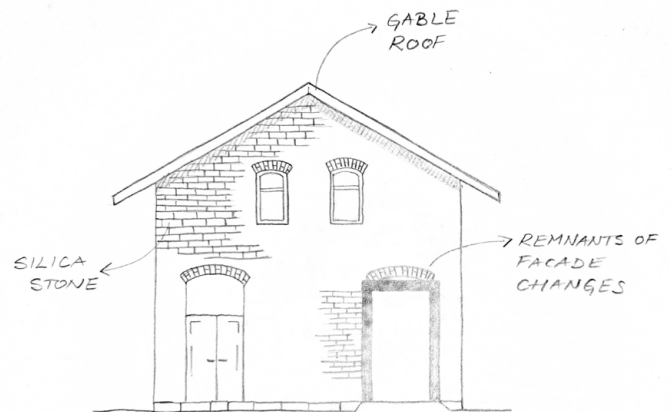
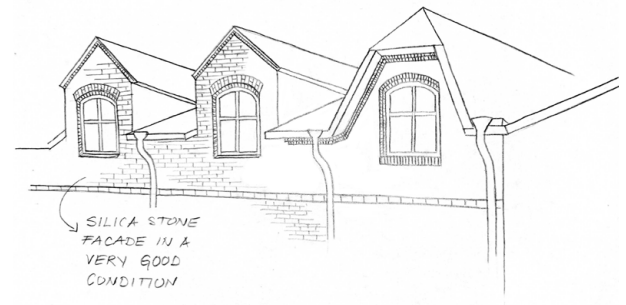
Buildings with the highest value (1) are most often, but not always, be protected buildings or churches. Buildings 2-4 are the buildings that due to their architecture, cultural history, or craftsmanship are prominent. They might also be , due to their location, valuable for the whole. Buildings with preservation values 5-6 are nice-looking buildings, where unsuitable replacement and rebuilding drags down the appearance. Simple and thoughtful renovations could often strengthen the expression of the building. Buildings with preservation values 7-9 are often buildings without particular architectural expression or without significant historical significance. These can also be buildings that are so remodelled or that have so many replacements that they have lost their origin (Høi & Stenak, 2011).

PRESERVED BUILDINGS AND CHARACTERISTICS

The heritage evaluation presented on pages 82-96 shows the process of describing the buildings in the slaughterhouse area according to the five main parameters, which helped obtain conservation values for each building. Since this process was intended to be working material, rather than presentation material, only the evaluation process of the buildings that are going to be kept entirely or partly is shown.

The conclusion of the evaluation is that building 01 (the administration building), and building 02 (the cold storage building), with exception of the additions that do not match the original architectural style, will be kept in their entirety. Parts of buildings 05 (the big slaughter hall) and building 06 (the horse slaughter hall) that are in a good condition, and that carry special characteristics, will be preserved and restored to their original state. The characteristics we find interesting to preserve in the area are seen to the right. It is clear from the table to the left that the four buildings that are kept have a conservation value of 5 or lower.

As the table shows, the rest of the buildings (building 03, 04 and 07) have a conservation value of 6 or higher. They are in a rather bad condition, and they do not carry any special characteristics that cannot be found in the buildings we are preserving. It is therefore not economically justifiable to preserve them and to invest a lot of money into restoring them.



6.2.4 Intangible values

As previously illustrated, the heritage evaluation based on the SAVE-method revealed that the greater part of the slaughterhouse area's building stock cannot be preserved. An approach to preserve the cultural and architectural heritage of the slaughterhouse area is to identify the intangible values, i.e. the historical values and stories of the built environment, and preserved these by telling them visually.

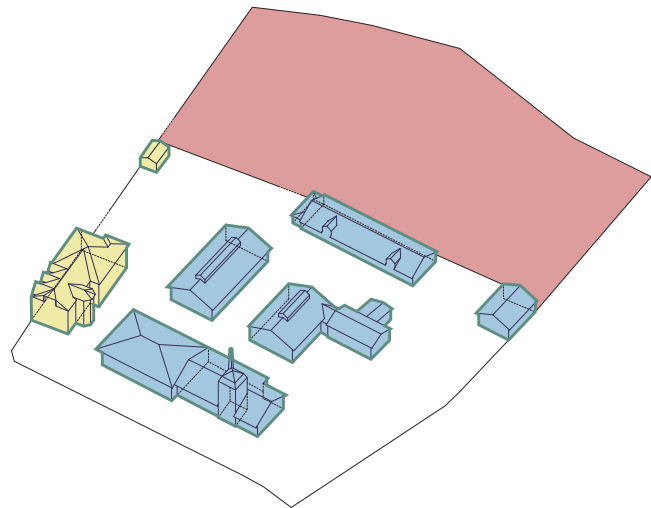
Not only would this preserve historical stories for the future generations, but it would also give more freedom to the design programs, thus increasing their profitability and attractiveness. Another benefit is boosting the creativity in the conservation process.

During our research, we have come across historical material that is not contained in the physical walls of today, such as the flows of movement, figures of the slaughtered animals, notes from the board meetings, etc. This material is regarded as carrier of the history, and therefore, it is treated as carefully as the built environment in the proposal.

Three of these historical stories that we have identified and that we are planning on translating into design in the proposal for the transformation of the slaughterhouse area are presented here.

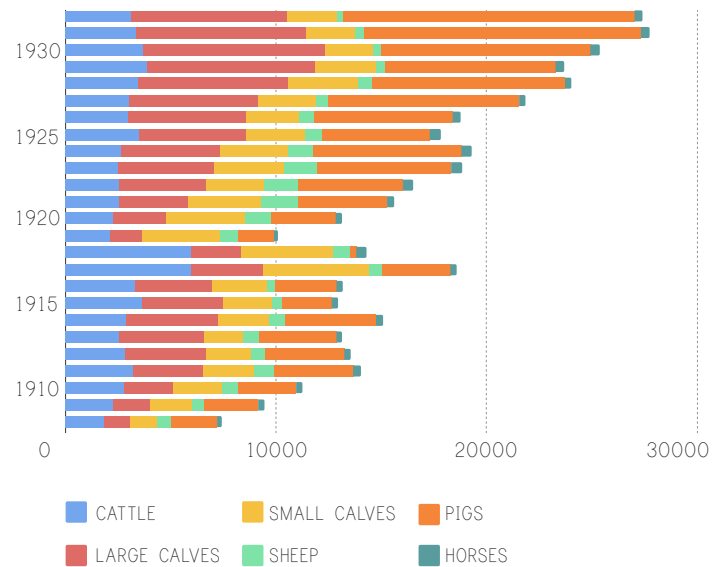
1. The program

The slaughterhouse was an industrial production site, including buildings for administrative work, that offered job opportunities. On special days there was also an outdoor market place where people could meet and socialize. These values, *production site+food security+work place+meeting place*, are preserved as criteria that dictate the program in the design proposal.



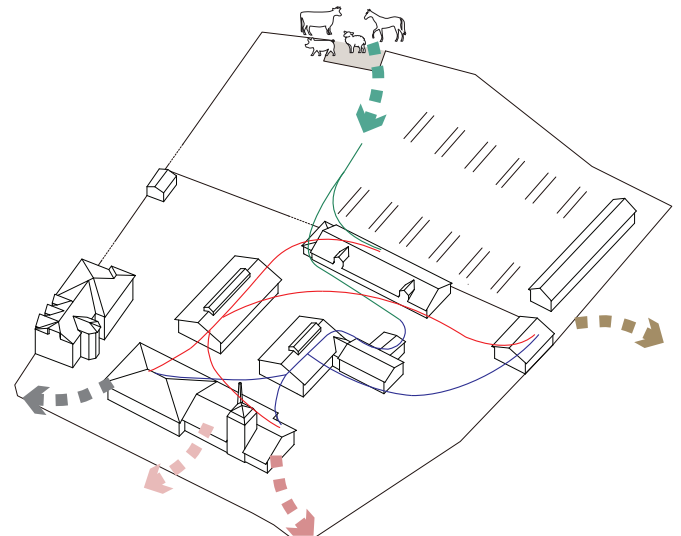
2. Livestock supply to the slaughterhouse 1908-1932

The graph shows the supply of different types of animals to the slaughterhouse from its opening in 1908 and 25 years afterward. The increase in the supply of livestock each year shows the increasing importance of the slaughterhouse for Eskilstuna and its neighbouring communities. It is difficult to imagine this seeing the seemingly deserted area today. Hence, this diagram is important for the preservation of this story and can be integrated in the pavement or a facade in the design of the new proposal.



3. The flow of animals and products

The movement of animals, from the point when they were brought in, to the point when the various animal products left the area, affected the layout of the buildings. These flows cannot be directly copied and applied in the new proposal, but the interdependent relationship between the buildings can be kept. Furthermore, the story of the flow of animals and products can be kept in the form of a light installation in the ground, where a red light pulsating along the lines of flow is a reminder of the movement that used to be an essential part of this area.





7

DESIGN PROPOSAL

ESKILSTUNA FRAMTIDSFABRIKEN

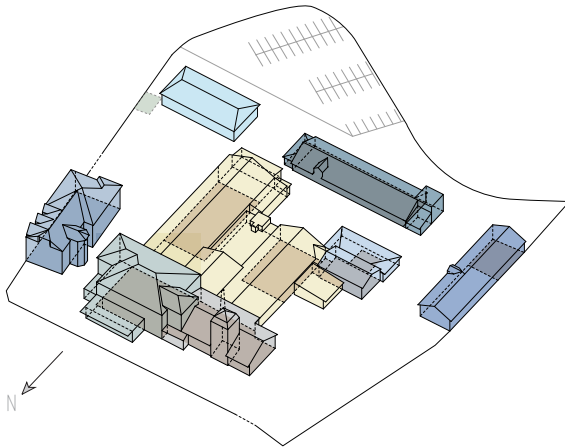
A MODERN INDUSTRIAL CENTRE, EMBRACING THE FUTURE AND PRESERVING THE HERITAGE.

Objectives:

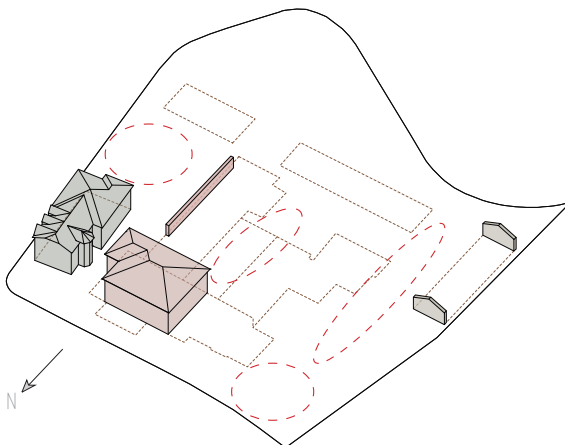
1. Preserving the industrial heritage of the area without freezing nor limiting the site's potentials for future development, by integrating the existing buildings in the proposed plan, boosting its market value, and creating interdependency amongst all structures.
2. Enriching the demographic fabric of the town by creating incentives for the missing groups, such as: production engineers, IT specialists, researchers, scholars, entrepreneurs, and workers within the creative industry, to reallocate themselves to Eskilstuna.
3. Providing the conditions for technological agglomeration, which can lead to knowledge spillovers, by bringing the industrial production and enterprises back to the town's urban fabric, and creating a hub equipped with the latest 3D printing technologies and studios.
4. Opening up the area, and integrating it with the immediate surroundings, and the rest of the town, by providing spaces and functions for the public uses and benefits.
5. Improving the spatial conditions for social interactions, exchange of knowledge, and prioritizing the human scale, by creating a rich variety of urban spaces and structures.

Proposal Development

1. The Slaughterhouse Area, 2018
with the original footprint highlighted, 1908



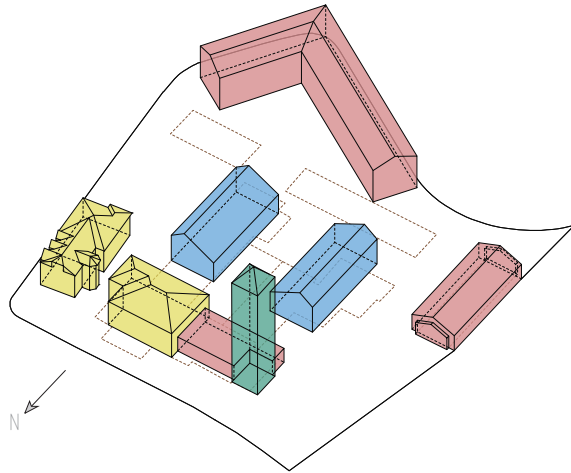
2. The Preserved Buildings, Spaces, and Elements
with the existing footprint highlighted



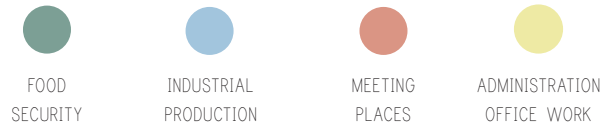
Since the buildings are over 100 years old, their structural condition is quite poor. The area houses a variety of functions, most of which are not connected to the original use. Based on the opportunities and strengths (discussed in the SWOT-analysis, p. 75) the area has a lot of potential for development. According to the municipal planning authorities, the detail planning for the area is officially starting in the spring of 2019, with an overarching vision to connect the slaughterhouse to the river promenade towards the south, add greenery within and around the area, and establish several nodes as meeting places in close proximity to the area and its surroundings.

Based on the analysis of the heritage evaluation, very few buildings scored higher than 4 on the SAVE-method scale. The preserved buildings/building elements are the administration building, the cold storage building, the eastern wall of the main slaughter hall, and parts of the horse slaughter hall. They are all in a good condition (with some need of restoration) and carry special characteristics which define the identity of the area. Moreover, the footprint of the original and existing buildings were used as guidelines for the new proposal, but they were not strictly followed, in order to meet the contemporary demands. In addition to the built elements, the proposal will maintain the spatial qualities of the urban spaces between the buildings (marked in red) as well.

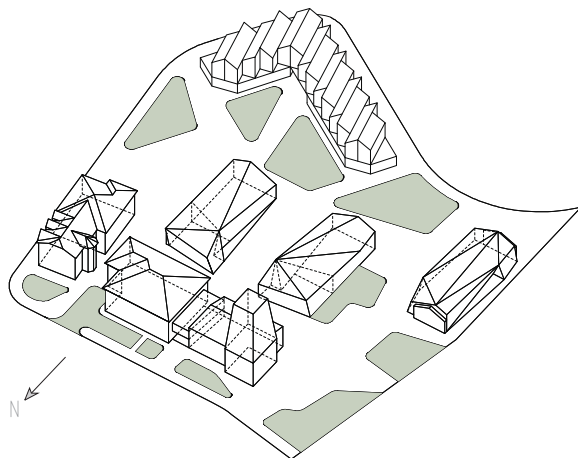
3. The Conceptual Program and Masses with the preserved intangible values highlighted



The conceptual massing of the proposal is relying on three aspects. First, is the preserved buildings and the previously described elements. Secondly, the spatial qualities of the original urban spaces, and reclaiming the southern space which used to host the weekly cattle market, and is today a parking space. Thirdly, recreating the intangible values from the original slaughterhouse, which can be defined as (Food Security + Industrial Production + Meeting Spaces + Administration). These values were the cornerstone for the proposed program and functions.



4. Eskilstuna Framtidsfabriken



After estimating the necessary volume for the new program, in order to lift up the value of the property, the buildings were significantly enlarged from the original footprint, while respecting the proportions of the original forms (explained thoroughly in p.110). The fundamental objective of the massing design is to give the area an overarching characteristic of futurism, which is believed to reflect the proposed program of the area. Moreover, the area will be renamed from Slakthuset to Framtidsfabriken as a statement for the development.



0 10 20 25 50 m

Site plan, scale 1:1000

Industrial City 3.0

Program

HOTEL HOUSING
2150 M² : 2.5 FLOORS
38 APARTMENTS

SHARED FACILITIES
920 M² : 1 FLOOR
STREET LEVEL

INDUSTRIAL SPACES
480 M² : 2 SPACES
VOLUME OF 2880 M³

INDUSTRIAL SPACES
480 M² : 2 SPACES
VOLUME OF 2880 M³

INDUSTRIAL EDUCATION
520 M² : WORKSHOPS
280 M² : CLASSROOMS

OFFICE SPACES
840 M² : 2.5 FLOORS
60 EMPLOYEES

RESEARCH SPACES
1160 M² : 2.5 FLOORS
72 SCHOLARS

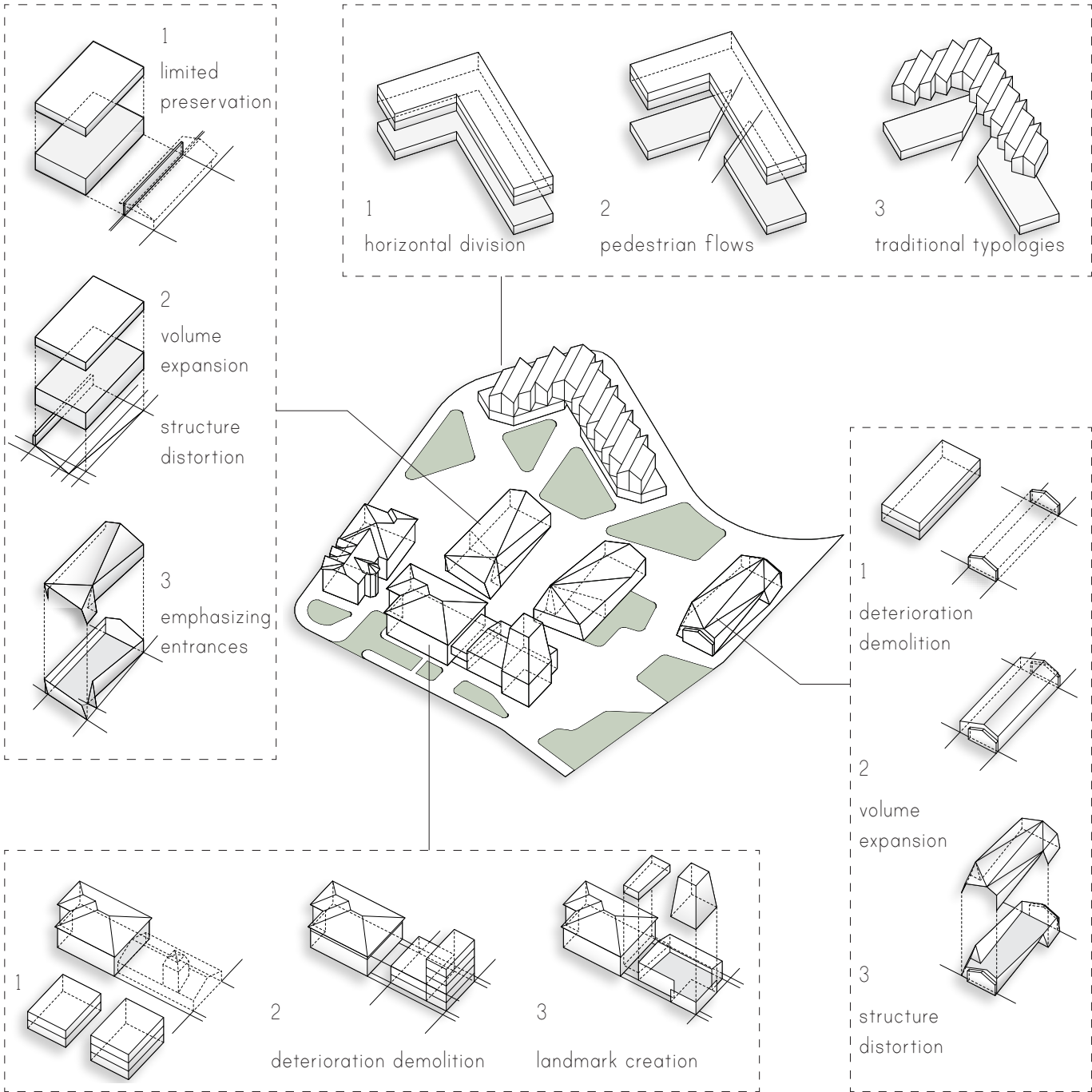
CREATIVE SPACES
210 M² : STUDIOS
VOLUME OF 840 M³

CAFE & KITCHEN
260 M² DINNING SPACE
260 M² COMMON KITCHEN

FOOD LAB
VOLUME OF 3550 M³
3140 M² CULTIVATION



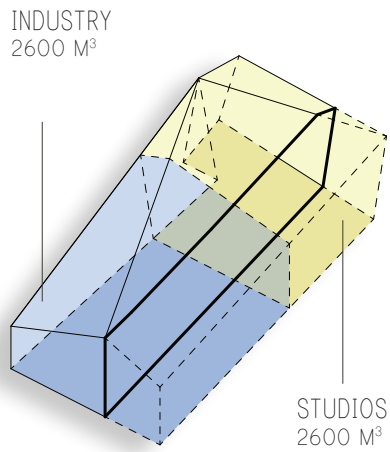
View from the northern entrance to the site, located along the green path connecting the area to the waterfront towards south. The Vertical Food Lab (to the left) showcases the futuristic techniques of food production, alongside the Automated Factory.



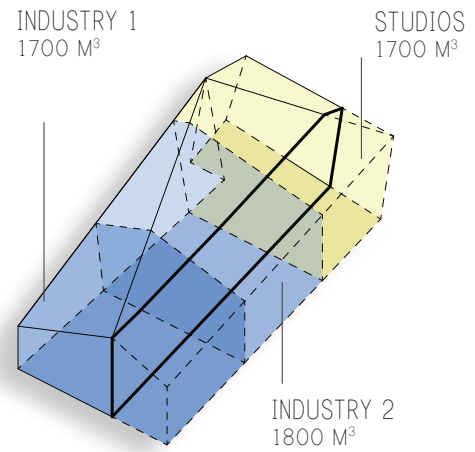


The view from the eastern entrance shows the complex with most of its components: the preserved administrative building as an office space, the twin factories with the preserved wall, and a flexible open space as a connection and a buffer zone.

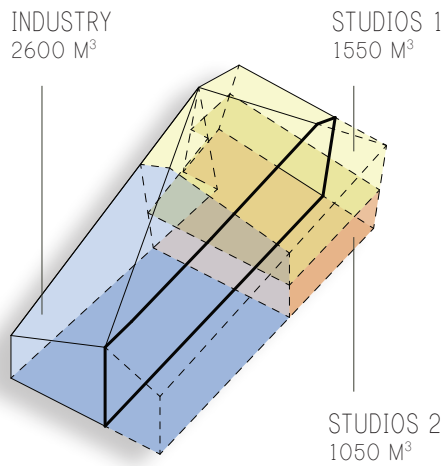
Volume Flexibility



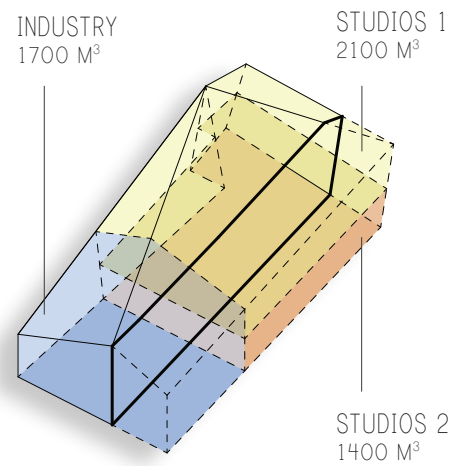
Scenario 1



Scenario 2



Scenario 3



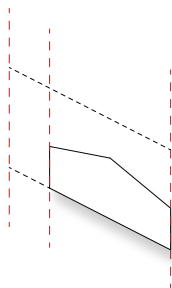
Scenario 4



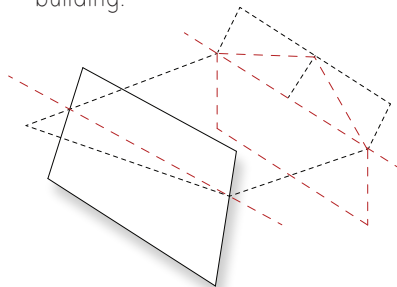
View from the Hotel Apartments towards the twin factories, with the Food Lab as a backdrop. The pulsating red light on the ground represents the original flows of movement from the slaughterhouse period of the site, recaptured in a playful way.

Factory Building Design Process

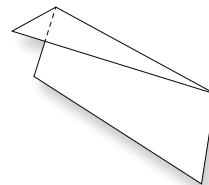
Analysing the proportions of the original facades, and its modular system, in relation to the new volume.



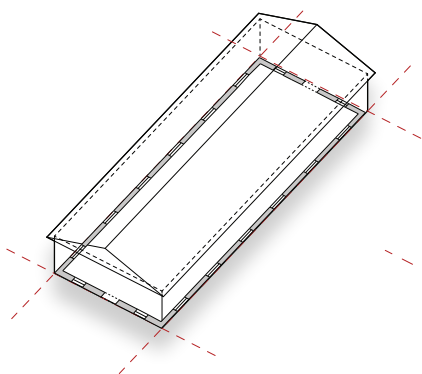
Limiting the facade height to the top elevation of the opposite preserved building.



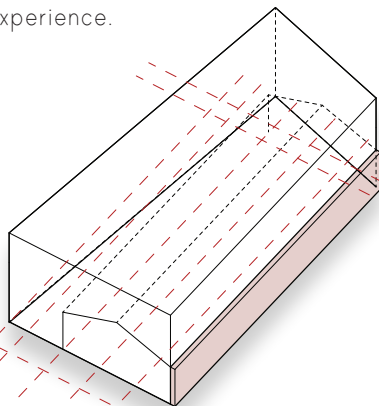
Folding the facade with the same gabled roof's angle of the opposite building.



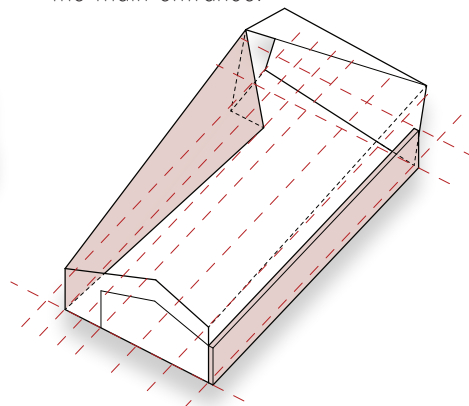
Understanding the original proportions of the floor plans, its modular system, and the increase of space.



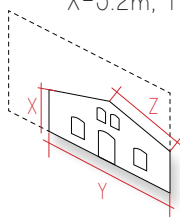
Tilting the new volume according to the original grid, to enrich the spatial experience.



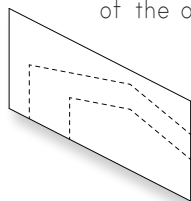
Leaning the western wall, as non-euclidean element, resulting in the carving of the main entrance.



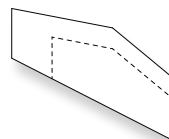
Analysing the proportions of the original facades, $X=5.2m$, $Y=12.4m$, $Z=7.2m$

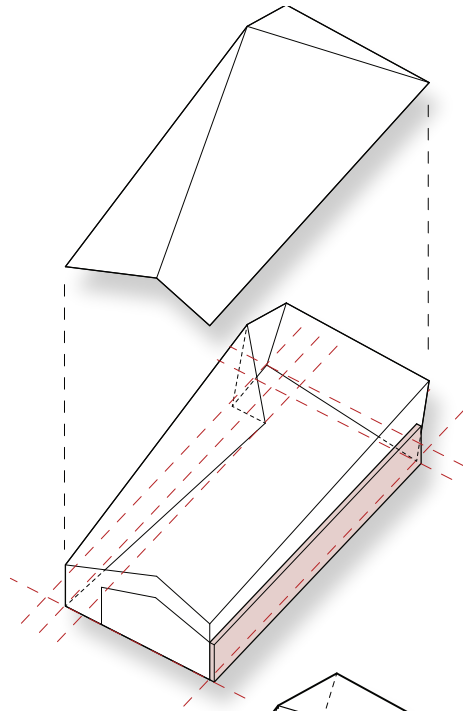


Limiting the facade width to one extra modular unit of the original dimensions.

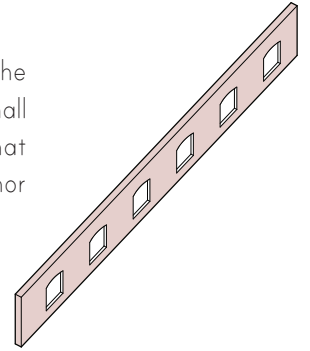


The original proportions have been applied on the new facade, by using two different materials.

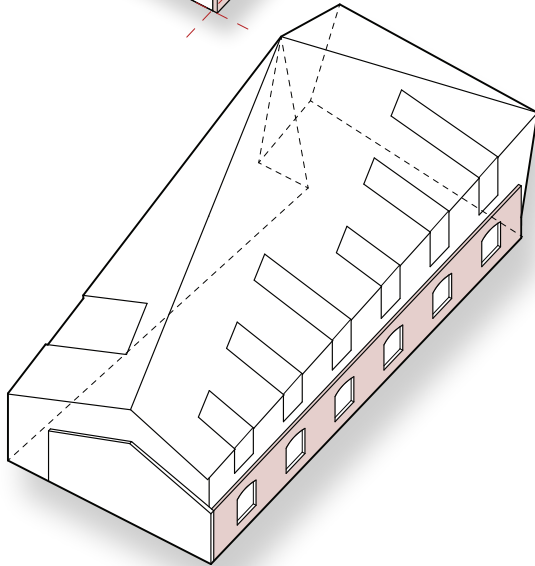
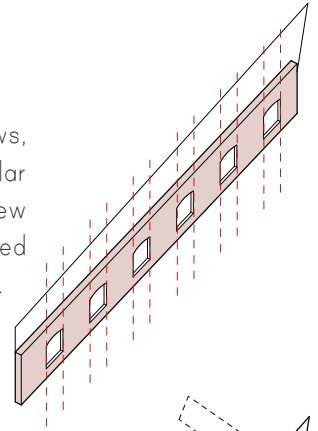




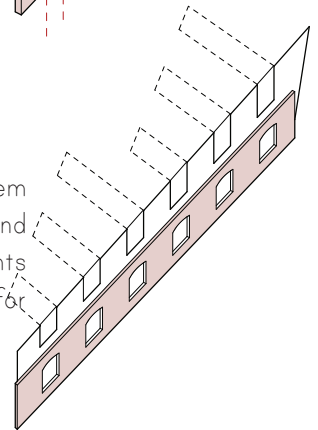
Based on the heritage evaluation, the eastern wall of the main slaughter hall scored higher than 4, meaning that it will be preserved, with some minor restoration works.



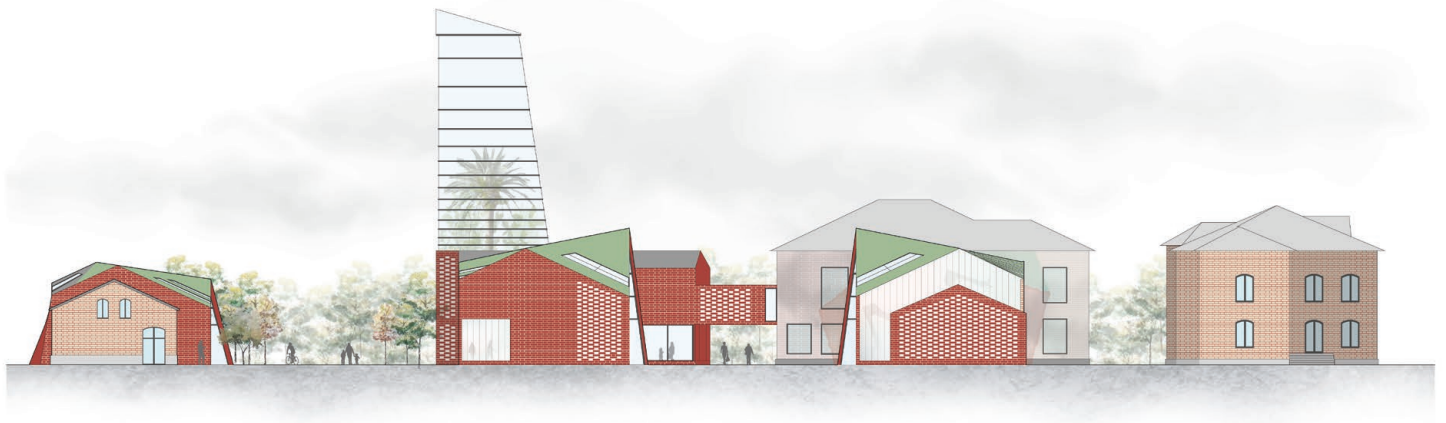
The facade contained 6 windows, placed systematically on a modular grid, which will be followed for the new windows. The new wall was pushed inside to highlight the original facade.



Following the original modular system while placing the new windows, and connecting them to the skylights required to provide a neutral light for the upper spaces.



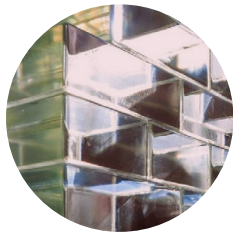
Facades



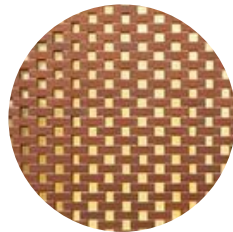
Long facade from the south
scale 1:750



SILICA STONE



RED GLASS BRICK



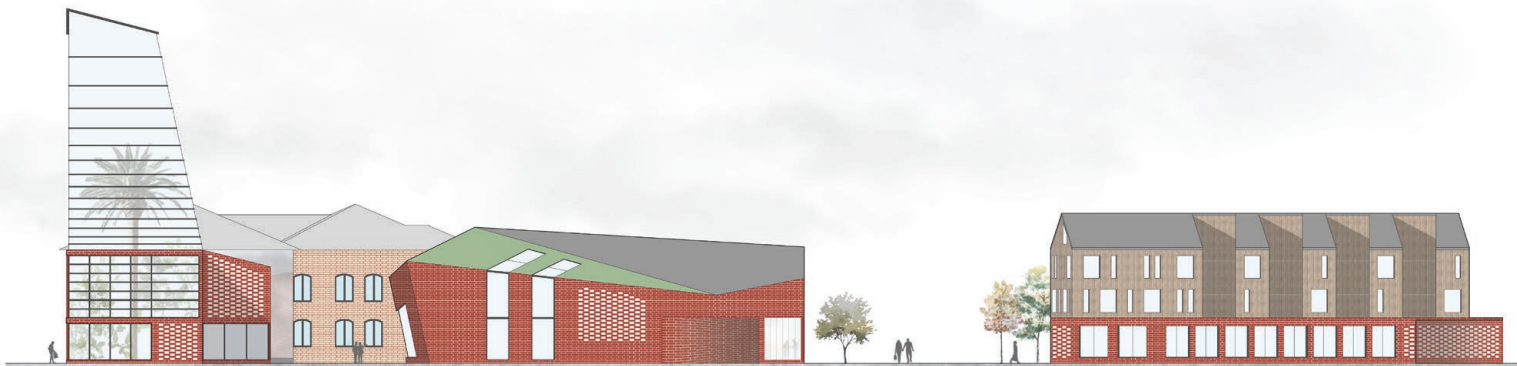
PERFORATED GLASS BRICK



HIGH-REFLECTIVE
METAL SHEETS



TRANSPARENT GLASS
PANELS



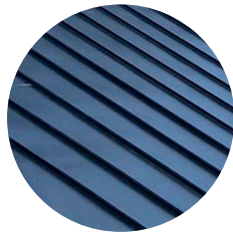
Long facade from the west
scale 1:750



TRANSLUCENT U CHANNEL
GLASS



LIGHT GREY
METAL ROOF



HIGH GLOSS
ZINC ROOF



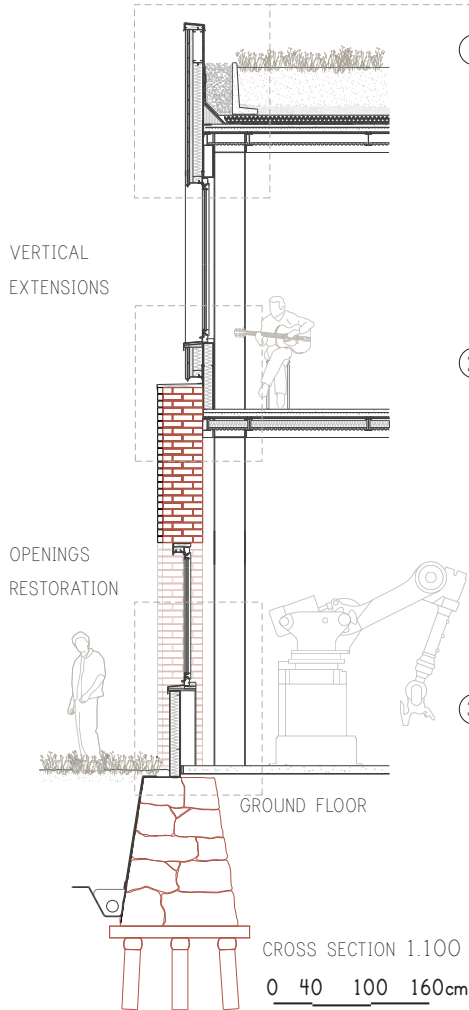
GREEN ROOF



VERTICAL
WOOD PANELS

Cross Section & Details

ROOF EXTENSIONS

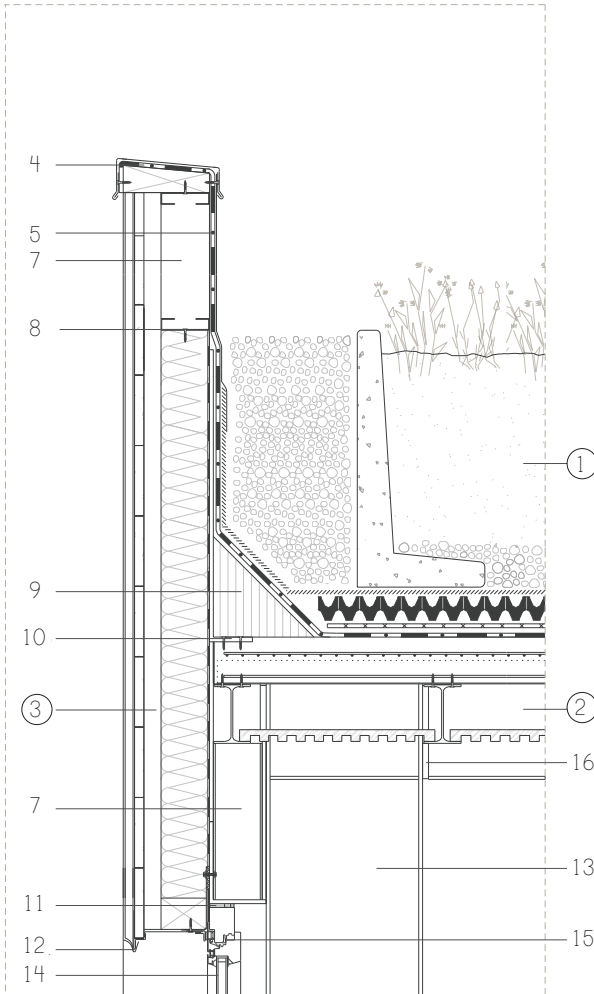


- ① Green Roof Structure:
 Plantation
 Substrate (soil) 500mm
 Mineral substrate 100mm
 Filter sheet
 Drainage layer
 Protection fibre mat
 Waterproof and root barrier

- ② Composite Steel Deck Slab:
 Concrete flooring 60mm
 Welded wire reinforced mesh
 Galvanized steel sheet 60mm
 Perforated acoustic panels
 Steel girder IPE 160
 Perforated acoustic wood ceiling panel 25mm
 Steel rafter IPE 270

- ③ Structure of the Vertical Extension:
 Metal cladding cassettes
 Cladding support structure
 Air membrane and wood vertical support 40mm
 Insulation 100mm
 Waterproof layer
 OSB panel 10mm

ROOF EXTENSIONS 1:20

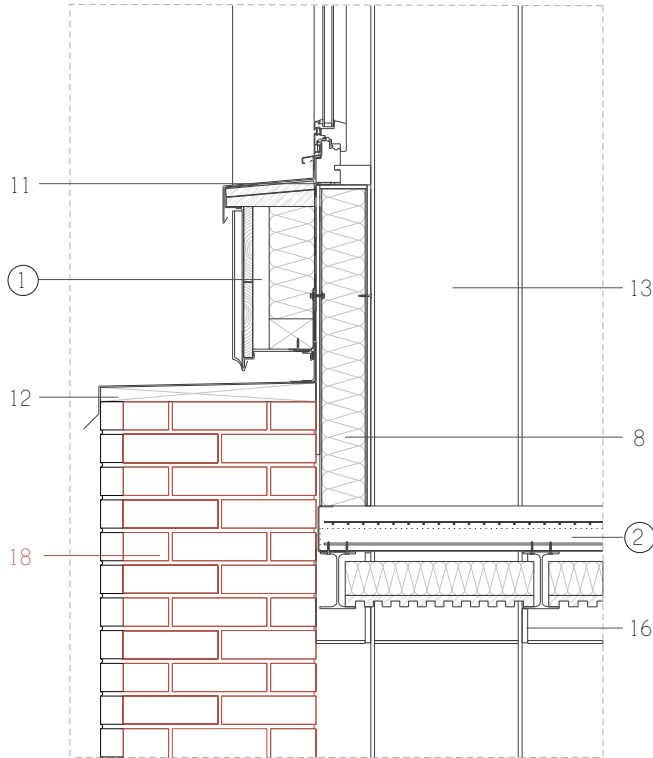


- 4 Metal cap flashing
- 5 Vapor retarded layer
- 6 Waterproof layer
- 7 Steel stud
- 8 Steel shelf angle

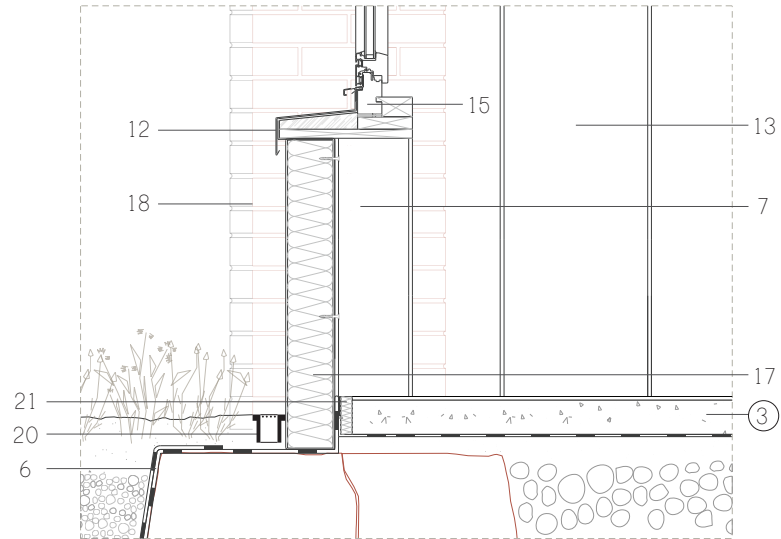
- 9 Rigid insulation cant
- 10 Steel flange
- 11 Silicone sealing
- 12 Steel flashing
- 13 Structure system

- 14 Glazed window
- 15 Steel window frame
- 16 Welded steel frange

VERTICAL EXTENSIONS 1.20



OPENINGS RESTORATION 1.20



- | | |
|-------------------------|-----------------------------|
| 4 Metal cap flashing | 13 Structure system |
| 5 Vapor retarded layer | 14 Glazed window |
| 6 Waterproof layer | 15 Steel window frame |
| 7 Steel stud | 16 Welded steel frange |
| 8 Insulation 100mm | 17 Insulation joint |
| 9 Rigid insulation cant | 18 Brick 7,5x12x25 cm |
| 10 Steel flange | 19 Metal cladding cassettes |
| 11 Silicone sealing | 20 Metal grill |
| 12 Steel flashing | 21 Expansion joint |

- ① Expansions Wall Construction:
 Corrugated black steel panelling
 Wood stripes
 Air membrane and wood vertical support 40mm
 Insulation 100mm
 Waterproof layer
 OSB panel 10mm

- ② Composite Steel Floor-deck Slab:
 Concrete flooring 60mm
 Welded wire reinforced mesh
 Galvanized steel sheet 60mm
 Steel girder IPE 160
 Thermal insulation 100mm
 Perforated acoustic panel 25mm
 Steel rafter IPE 270

- ③ Ground Floor Construction:
 Polished concrete finish 10mm
 Reinforced concrete slab 100mm
 Waterproof layer
 Sand 50mm
 Gravel 300mm

Discounted Cash Flows (DCF) of Nötknäpparen (Post Development)

As part of evaluating the proposed development plans, and the economic efficiency of urban re-industrialization as a design concept, a market valuation was carried out using the Discounted Cash Flow method, the same method was used to value the current state of the area. The valuation was calculated based on 5 years period to decrease the uncertainty of forecasting, and was based on the published market analysis of Q2, 2018.

As previously discussed, the valuation considered the projected inflation, hence it will be nominal discounted.

The general equation for the valuation will be (RICS, 2018):

$$PV = FVN / (1+r)^N$$

Therefore, when valuing the present value based on 5 years:

$$PV = [CF1 / (1+r)^1] + \dots + [CF5 / (1+r)^5]$$

As highlighted, the timing of the valuation is crucial for the calculation. This valuation was based on the cash flows of the property starting from 01.01.2022, as the development process will take 4 years until completion. The market rents, inflation rates, and the prime yield used in the valuation have been discounted according to the forecast.

i) Assumptions and Forecasts

The biggest impact on the property's valuation resulted from the increase of the leasable spaces, which is currently amounted to 6,750 m², while in the proposal the leasable spaces boosted to 10,800 m². Furthermore, the surface area of the property has been increased by 16,170 m² to reach 16,170 m² in the proposal, resulted from the addition of the triangle shaped space by the southern edge of the property which used to belong to the former slaughterhouse. The valuation did not assigned any rent for the land, since the property is owned and managed by the municipality.

Moreover, the structure of the premises has been redistributed to fulfill the desired program, this change impacted the (Net Operating Income) and the (Operation Expenses) of most spaces. The office spaces have increased by 400m² to reach 2,850m² in the proposal. The area has been provided with newly built research and education spaces which will enjoy a rent rate close to the office rates, but with higher operation expenses. The area has been provided with extra 840m² for industrial activities to reach 3,240m².

The single component with the biggest impact on the valuation was the addition of 2,760m² for hotel-housing, a newly developed expression that describes the short-term living with some extra services from the traditional residential buildings.

Property Area	16,170 m ²	Research	1,170 m ²	Yield: Industry	6.50%
Leasable Area	10,800 m ²	Cash Flow	5 Years	Market Rent	850 SEK/m ²
Offices	2,850 m ²	Vacancy	10%	Operation Ex.	340 SEK/m ²
Industry	3,240 m ²	Yield: Office	8.25%	Yield: Housing	4.25%
Housing	2,760 m ²	Market Rent	800 SEK/m ²	Market Rent	1,140 SEK/m ²
Retail	780 m ²	Operation Ex.	350 SEK/m ²	Operation Ex.	625 SEK/m ²

(Datscha, 2018; Catella, 2018; CBRE, 2017; Newsec, 2017)

Hence the rent per sqm per year of such places is amounted to 1,140 SEK/m² instead of 890 SEK/m² in the traditional spaces. The same for its operation expenses, while the average market price stands at 425 SEK/m², the proposal has assumed 625 SEK/m² per sqm.

The valuation did not include any costs for neither the renovation of the preserved structures, nor the construction of the proposed buildings. However, based on the average construction prices per sqm in the Swedish market, the project is estimated to cost about (9,500 SEK per sqm) for high standard renovation, and (22,500 SEK per sqm) for special construction technique. The at would lead the overall cost of the project to (210,500,000 SEK), according to the current market prices.

The vacancy rate of the property has been assumed to decrease, reaching only 10%. And for simplification, it is assumed that the vacancy will remain the same.

ii) Valuation of Nötknäpparen (Post Development)

The valuation of the property is amounted to:

71,530,400 SEK

Despite the accuracy and sophistication of the income approach, another valuation has been carried out using the (Direct Capitalization) method for affirmation, which follows the equation:

$$PV = \text{Net Income} / \text{Yield}$$

The valuation of the property is amounted to:

74,164,300 SEK

The deviation between the two valuations is less than 3%, which indicates that the true value of the property can be considered as an average between.



8

SUMMARY & REFLECTIONS

Summary of the conclusions

Upon the completion of the research, it appeared that concepts such 'Urban Re-industrialization' could be economically sufficient enough to attract developers, business owners, and entrepreneurs. Towns that are facing an aging or shrinking population, like Eskilstuna, could benefit from these concepts by providing an entrepreneurial environment for automated industries, and creative business firms. Creating opportunities for modern industrial investments could result in forming incentives for the younger generations to live and work in such towns. By relying on thorough strategies, the town can eventually achieve the intellectual spillovers in certain fields.

The proposed creation of industrial centres in medium and small sized towns is taking the most advantages of the available technologies in manufacturing and industrial management. The proposal is relying on the classic theory of separating the "office" and "factory", but with reasonably justified distances. The suggested distance here should not exceed 200km, if the business is ought to enjoy the discussed benefits. The proposed commuting radius is adjusted to the geographical composition of the Stockholm capital region, and its surrounding municipalities. Based on the published market statistics and rent levels, the distance then is far enough for the firms to enjoy the low rent in municipalities such as Eskilstuna, yet not too far to increase the transportation costs of the finished products, nor taking too much time for the entrepreneurs and developers to commute between the two ends.

Another part of the research is regarding the current conservation practices of the built industrial heritage. Conservation charters and practices put a lot of focus on the protection of physical and tangible elements of the built environment. The recommendation for the transformation of older (protected) buildings is to minimize the changes to the built fabric. These recommendations tend to freeze the building in the past. Furthermore, these restrictions often push away potential investors, leading to the buildings standing empty and falling into decay. Obviously, some buildings are so valuable that they should be granted the highest protection status, but many others that are protected, are not. This does not mean disregarding architectural and cultural heritage completely, but rather finding other ways to preserve and showcase it.

One of these ways, is capturing and preserving the intangible values. The research of the slaughterhouse uncovered stories that are just as important to preserve as the built fabric. A selection of these stories has been incorporated in the design of the new proposal for the area transformation. The functions of the original area have governed the program for the new proposal; the flow of animals has been represented in a pulsating light installation in the ground; and the pavement patterns were used to illustrate the increasing supply of animals to the slaughterhouse. By INTEGRATING these stories with the design from the beginning, as opposed to adding them onto the finished buildings and pavement, they become a permanent storytelling element in the area.

i) Specific Recommendations for Eskilstuna

Since the analysis model is generic, and is relying on the tri-fold approach of society, economics, and heritage, the findings of the societal and economic analysis are applicable on most properties within the town, as long as the parameters of distance, connectivity, production processes, space efficiency, market rent level, and operation costs are met. The model should maintain its profitability, and the suggested businesses and industrial enterprises can enjoy the discussed benefits at any similar property. On the other hand, the results of the heritage analysis are only relevant to that specific property, and consequently the design of structures, and the overall concept of the site.

ii) General Guidelines for Similar Towns

The tri-fold approach of societal-, economic-, and heritage analysis used in the method of the case-study can be applied to other towns and properties with similar conditions: mono-centric towns, with shrinking or aging population, that enjoy a rich architectural history, and within a distance range of 150 km to 450 km to the nearest growing city. (The hatched area in green on the map). Each town or site is carrying special characteristics which directly and indirectly affect the results of the analysis, and therefore can adjust its potential targeted groups of businesses and industrial enterprises to be appropriate for its case and location.

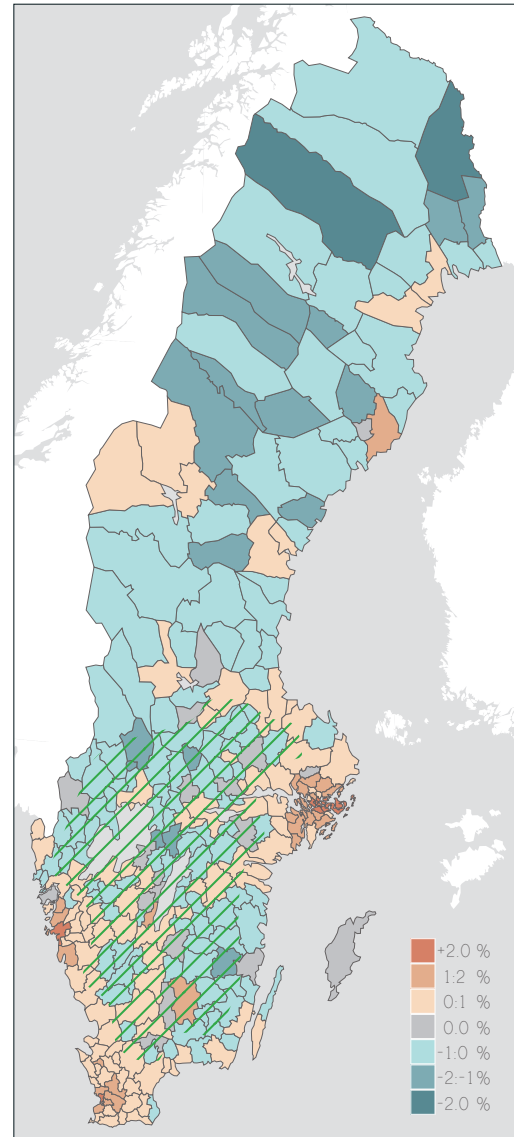


Figure-67. The hatched area in green marks the municipalities that the results of the thesis could be applied to.

Further studies

Due to the scope of the thesis and the available time, some important points have not been dealt with and would make a great research topic for further studies, such as:

- * An analysis and evaluation of the impact that this urban planning proposal would have on the urban, economic and social fabric of Eskilstuna municipality.

- * Based on this research, creating a list of municipalities in the Nordic that are similar to Eskilstuna, and creating a methodological framework that could be used by these municipalities to counteract the shrinking population phenomenon.

- * An important factor in the cost of the transformation of the area is the renovation of the buildings that are kept. Boverket (National board of housing, building and planning) does not at present have energy declaration figures for the buildings in the area so it is impossible to know how much energy they consume today. However, given their age (110 years), it would be logical to assume that they do not perform in accordance to today's energy standards. Furthermore, according to naked-eye observations no changes (other than the new roof) have been made that would improve the buildings' energy consumption. Therefore, renovation costs, including measures to improve the buildings' energy efficiency, will have an impact on the total cost of the area transformation. Further studies could explore energy efficiency improvement methods that would impact the buildings' aesthetics the least, as well as combining these methods with sustainable energy sources.



9

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