Doctoral Dissertation
Doctoral Program PhD in Architecture. History and Design (32nd Cycle)

The Workspace [R]Evolution
The comeback of incubator and its role in new urban economy

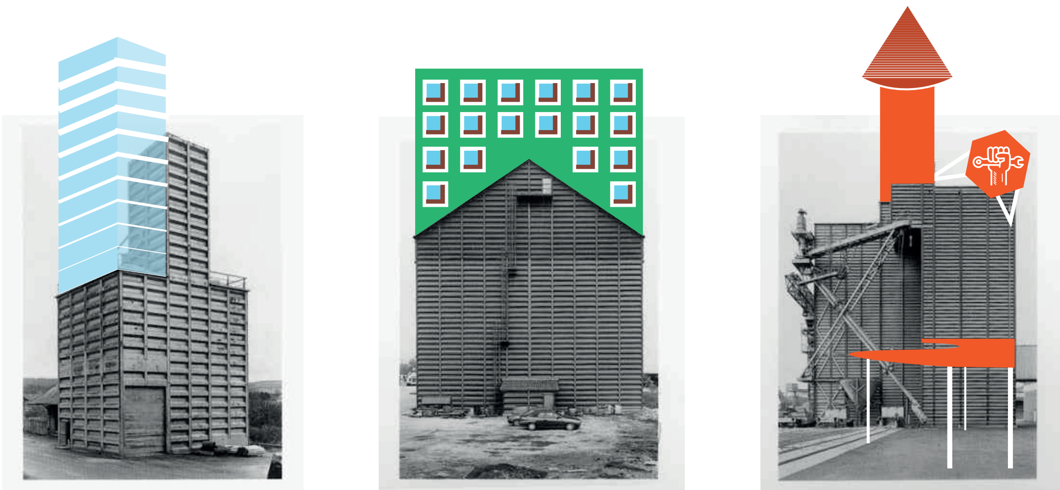
Protti Emanuele

* * * * * *

Supervisors
Prof. Matteo Robiglio, Supervisor

Doctoral Examination Committee:
Prof. A.B. , Referee, University of….
Prof. C.D. , Referee, University of…
Prof. E.F. , Referee, University of….
Prof. G.H. , Referee, University of…
Prof. I.J. , Referee, University of….

Politecnico di Torino
April 30, 2020



The Workspace [R]Evolution

The comeback of incubator and its role in new urban economy

INDEX

Introduction

1.1 Setting the context

As new and important debate on the future of manufacturing has emerged, local and transnational governments are turning back their attention to the dynamics subsisting between global production systems and the urban context. Industrial activity, increasingly spread through global value chains (Bruegel, 2013), has undergone relevant structural changes, demanding a new set of values inside its organisational and spatial form.

Manufacturing material goods is changing, overtaking the clear division with the service sector, supported by a growing knowledge intensity in production processes and a reorganisation of businesses in response to rapid market fluctuations (Sassen, 2009). Industrial firms increasingly outsource activities to services companies and buy services from independent providers as an intermediate input, or perform themself service activities (Helo et al., 2017; Illeris, 1996). The advance of digital technologies induced a horizontal reorganisation of companies in small and semi-independent units, taking the place of vertical bureaucratic structures not agile in dealing with fast-changing markets, technologies and labour structures (Winden et al., 2013).

In the same way, a pipeline of new technologies, under the concept of Industry 4.0, supports a tendency to modularisation, where final products are assembled from modules produced by the network of suppliers and subcontractors which therefore provide the most significant part of the value-added of the production (Berger, 2005). These include additive manufacturing, rapid prototyping, nanotechnology, robotics, smart communication systems, improving efficiencies in industrial processes (Drath & Horch, 2014). New technological innovations enable just-in-time and small batch production while reducing the entry barrier of new firms in the global market.

In the last decades, the transformation of the industry occurred in parallel with a drastic decline in the share of manufacturing activities in developed countries (Winden et al., 2011). Delocalisation led to the closure of industrial plants, supported by the rise of environmental awareness and spatial constraints caused by an increasing cost of land and by the conversion to more profitable uses of the industrial fabric by real estate development. This shift as particularly affected routinised activities, more easily standardised and transferable to lower-cost locations. On the contrary, complex manufacturing production or small firms which base their actions on in-depth knowledge and a constant R&D, are more difficulty to be delocalized, connected to a cultural and spatial legacy which they tend to enhance in a virtuous exchange of competences (Sassen, 2009).

Studies on the relationship between industry and urban space undermined their common mismatch, arguing that manufacturing should not be de-linked from typically urban knowledge-based activities, due to their importance in promoting and improving high-level service and R&D (Hatuka & Ben-Joseph, 2017; Architectural workroom Brusselss, 2016; G. Leigh & Hoelzel, 2012). In a global competition to attract talent, resources and capital, cities need to maintain a solid manufacturing base for producing small batches of innovation and products, test concepts in practice, shaping a local “making knowledge”, and creating jobs. Research and production are two sides of the same process and need to remain in contact. Spatial proximity enables the creation of networks of learning and knowledge spillover, facilitates strategic interaction for fast time to market as trust and reputation mechanisms (Winden et al., 2013).

Space becomes a critical factor. Scholars argue that the network rather than the firm is the appropriate unit of analysis to study value creation (Castells, 2009). The physical space of the network is the enabling key for the creation of proximity relation patterns between activities, suppliers, customers and partners. A strategic issue to be critically examined from the scale of urban planning and city policies, which define zoning permission and strategic development plans, up to the fine grain of architectural studies to design and shape the next urban factory.

In relation to a revision of the dynamics between production and urban space, the thesis examines the incubator as a strategic tool for the reuse of vacant industrial buildings as space for urban manufacturing (Sassen, 2006) and creative industries (Howkins, 2001). The complex nature of the incubator has led scholars to develop different definitions, particularly emphasizing its administrative or business development services over geographical and physical characters. The research reclaims the importance of the incubator as a physical place, defining it as a multi-tenant building promoting affordable, flexible space and providing a variety of office and support services which shared the common purpose of sustaining the foundation and growth of new businesses.

The incubator was first developed between the 1960s and 1970s, formalized and institutionalized in the following decade (Campbell & Allen, 1987). The incubator pays significant attention to the role played by small enterprises, addressing the problem of new firm undercapitalization with the provision of affordable working space, business assistance and shared services. At the same time, physical relations and co-location favour the emergence of a supportive environment with the realization of a collaborative network between tenants, establishing profitable trading and relationships.

The research, through the analysis of four case studies of industrial incubators in Europe, aims to explore incubator common spatial and managerial characteristics, decoding their development path and their role in the urban ecosystem. At the same time, the high density and mix of light manufacturing, services and design activities promoted by the incubator ecosystem, permit an in-depth analysis of spatial and managerial needs of urban manufacturing and creative industries.

Collectively, incubator buildings are not definable as a singular architectural type due to the unique spatial solutions necessary for production purposes, resulting in a wide variety of geometries and functions. They are located in the dense city, eliminating the insurmountable division with other urban functions promoted by zoning regulations, integrating working, domestic and service functions with high spatial flexibility.

Flexibility, in terms of space and management, is a fundamental aspect for the success of an incubator. Buildings are designed to allow firms to move within them as they expand, while short term leases and deferred rental payments allow companies to cope with market changes efficiently.

Architectural strategies, implemented in the adaptive reuse of the urban industrial buildings selected, highlights the characteristics and spatial requirements of urban manufacturing and the potential to integrate light manufacturing activities with other functions. Furthermore, the active involvement of tenants in space organization created a sense of belonging to the place, a shared vision for its future, creating strong social bonds and reconnecting an abandoned area and to city life.

The results of the study highlight the importance the incubator in urban dynamics. The incubator has been identified as a "physical middle-ground", a catalyst for local innovation connecting the upper ground, composed by formal institutions, and the underground level, composed by creative individuals (Cohendet et al., 2010).

The value possessed by the incubator relates in its physicality, in being a "hard infrastructure", which determines its fundamental role in the relationship between the city and production. Spatial dynamics shown by pre-modern distributed urban production or industrial neighbourhoods, resemble current firms interactions that the incubator allows. In a renewed relationship between city and production, the incubator acts as a catalyst, where a change of scale and requirements of new forms of production (Rappaport, 2014) makes possible the elaboration of network dynamics that characterize today as the past culture of urban making. In the description of the anatomy of the city (Cohendet et al., 2010), the incubator assumed the role of a connective space, an interchange node of a more extensive system, the urban one.

The analysis of the incubator model is a critical factor in understanding the phenomenon of urban manufacturing today and at the same time, a fundamental tool for its development. The complexity and stratification observed in case studies are closely linked to the dynamics of urban space, a physical network, where the incubator, as a strategic hub, is a vital part.

The research is limited to the analysis of four case studies of industrial incubators, developed to host light manufacturing activities and creative industries within the European territory. The selected buildings are part of a broader panorama that the research has not been able to address in its broad spectrum. The study investigated the historical development of the incubator through an architectural and urban approach, laying the foundations for future research of this phenomenon in the field of architecture.

At the same time, the analysis implemented an experimental method for data collection and analysis. The goal has been to collect valuable data on the phenomenon of urban manufacturing and build a critical tool for its analysis. The results are limited to a partial view, due to the impossibility of collecting a sufficient number of data. On the contrary, results can provide valid support for the development of urban policies and more conscious development of urban productive activities.

1.2 Research design and methodology

The research identified in the European territory, characterized by the strong presence of small and micro enterprises (European Commission, 2018), the context for a case studies survey and analysis of industrial incubators. Case studies were identified in industrial neighbourhoods facing a transformation of the spatial and social apparatus, located in traditionally industrial metropolises in transition or small industrial cities. Moreover, the selected case studies relates to the recovery and re-use of industrial buildings for new production purposes linked to the definitions of urban manufacturing and creative economy. The attention paid to the strategies of re-use of the industrial apparatus highlights the spatial characteristics possessed by the incubator model and its flexibility in hosting light industrial activities as well as other public function.

In order to identify the spatial properties of urban manufacturing, the research distinguished three elements of analysis: space, processes and users. The first chapter focuses on the analysis of technological, economic and social processes affecting spatial production requirements and workers profile in the urban context. The first part of the chapter concentrates on how digitisation, servitization and technologies involved in Industry 4.0 are trasforming the contemporary factory and how its relationship with the urban context is changing. The second part analyses the characteristics of the creative economy and the creative city, the development of multi-local working dynamics, the rise of co-working and co-making spaces and the renewed relationship between education and craft culture.

The second chapter deals with the theme of space. The chapter highlights the evolution of spatial forms of production, starting from the characteristics of the artisan society, an urban production model based on the workshop environment or the domestic space. From proto-industry to the modern factory, the chapter focuses on the different spatial models assumed by urban production describing their characteristics and relation to the city. The chapter concludes with an analysis of the incubator, describing its main features, its historical evolution, first projects that led to its institutionalisation and the critical issues in the study of this model.

The third chapter outline the methodology applied in fieldwork. The research started from the assumption that the factory represents a socio-technical object constituted by three main elements: process, user and space. These three elements are recognised as fundamental subject to be evaluated in order to decode the complex realities of the incubator analysed. The research has individuated in the use of interviews and questionnaires, instruments capable of supporting the graphics apparatus in the analysis of case studies. Particular attention has been paid to the transformation of the place both at a spatial and managerial level, identifying critical and success factors as common patterns of development of industrial incubators.

The fourth chapter concerns the description and analysis of the case studies starting from the results of the spatial analysis and interviews carried out during the fieldwork. Each case was analysed taking into account the history of the building and the strategies adopted in its reuse as an incubator, the managerial system and internal social relations. Particular attention has been paid to the transformation of the place both at a spatial and managerial level, identifying critical and success factors as common patterns of development, recognizable as structural of the industrial incubators model. Drawings, photos, archive documents and maps, are reported in the appendix of the fourth chapter.

The fifth chapter reports the analysis of the data collected through the questionnaires. This tool made it possible to describe the object of analysis from a different point of view highlighting the characteristics of the companies located within the case studies and describing general characters of urban manufacturing.

The view from the factory. KANAL/Centre Pompidou. Former Citroën Factory. Bruxelles 2018

Chapter 1

The changing values in production environment

1.1 The return of production in the city

During the last century, the relation between production activities and the urban fabric has undergone continuous transformations, generating intense research in architecture and urban studies as in economic and political debates. *Production* has always taken on a fundamental role in cities dynamics, a cornerstone for the organization of individuals who share the ultimate goal of living within the same community, from the ancient city of Uruk, reputed by archaeologists and historians as the first documented example of an ancient city, to the complex megalopolis spreading nowadays around the world.

The division of labour and production specialization played a key role for the foundation and organization of the first cities, able to expand both in terms of population and spatial dimensions thanks to the social stratification that the control over subsistence systems had allowed. This close relationship between the productive apparatus and social organization is clearly visible in the spatial form of cities and has remained almost unchanged until the advent of the Industrial Revolution and the urban reforms of the early twentieth century.

From the early decades of the nineteenth century, manufacturing systems underwent a breakthrough transformation that modified the production processes, the type of labour required and the spatial characteristics necessary for the functioning of an apparatus that was becoming increasingly complex. In the architectural field and city planning, this transformation has led to the development of the modern factory and the reorganization of the relation between working and living activities through the season of great urban plan characterizing European cities such as Barcelona, Vienna, Paris or Amsterdam and a gradual but constant process of separation by zoning of domestic, services, and leisure activities from the working space, often confined to the perimeter of inhabited contexts.

Over the last twenty years, after the delocalization of major production activities in developing countries, the large European cities started an urban renovation program to become considerably more attractive. Many efforts have been made to recover cities as the preferred place to live, trade, shop and relax. Many wastelands from the post-industrial era have been successfully restored: brownfield areas have been transformed into a fresh-looking residential area, former factory buildings with any value have been given a new purpose, old wharves have become waterfronts. Examples as the Lyon-Confluence, the Het Eilandje in Antwerp, the Hafencity in Hamburg, the renovation of the Ruhr industrial area or the reuse of some iconic buildings as the Lingotto in Turin, have been conducted with a focus on a high urban mix, but this redevelopment under the motto of an urban mix turned out to be less mixed than it was expected. Nowadays, European and American cities are experiencing the end of a period of urban development that was typical of a post-industrial era, where "working in the city" was intended only as a service economy. Municipalities and city governments are becoming aware of the fact that production is something that resides in the city and that the city should not be purely a showcase for consumption. Twentieth-century paradigms are undergoing a new critical revision, putting production systems at the centre of the structural problems that afflict our cities, to which we are called, as architects and urban planners, to propose solutions.

In order to depict how industrial activities take part in the urban dynamics, the chapter proposes a review and a critical analysis of the transformations that are taking place in the industrial organization and how these is influencing the development and transformation of the urban contexts in which production activities are located. The chapter analyzes the strategic changes of production focusing on the system of relationships between processes, users and spaces and how structural changes in the production value chain affects the design of factory space and consequently cultural and social relation.

The description and analysis of a production system in its complexity is a challenging task: each process is subject to technical, spatial and social factors that define its specificity, producing unique choices on raw materials used, on production technologies, labour force or strategic markets, where finished products will be sold. In the same way, the analysis of present conditions cannot take place without an in-depth and inclusive knowledge of the actions and choices that occurred in the past, as these are the foundations on which present circumstances are based. Social sciences and economics have coined the term Path Dependence to depict this phenomenon. As described by Liebowitz and Margolis in the Encyclopedia of Law and Economics, Path Dependence explains how the set of decisions one faces for any given circumstance is limited by the decisions one has made in the past or by the events that one has experienced, even though past circumstances may no longer be relevant[1].

Development and growth of production activities in the city are subject to path dependence phenomena as to the spatial legacy that is still present in the urban context. Urban form, infrastructures, and buildings typology are an influential legacy for the possibility of developing productive activities within the city limits. Material forms that the relationship between city and production has left behind during the last century, from small workshops to large urban factories, are characterized by a potential for transformation and reuse capable of sustaining a heterogeneity of use that already Jane Jacobs defended as a fundamental value for urban development. In particular for small and medium-sized enterprises, generally more linked to a network of local contacts, the possibility of localizing in urban contexts is as strategic as it is particularly tricky, due to the continuous reduction and transformation of industrial areas. From an economic and social point of view as well as for its infrastructure and building legacy, once an industry is pushed away or cancelled, it is extremely challenging to bring it back.

First in America and today also in Europe, cities are working to bring productive activities back into the urban context, experimenting innovative solutions to promote a new functional mix for a more inclusive and resilient city able to sustain entrepreneurship and new local jobs. This type of industrial activity, finding its perfect environment in the urban context, has been defined as Urban Manufacturing, a complex phenomenon characterized by traditional as innovative production, service-oriented and fast-changing.

The following paragraphs, through the analysis of trends influencing work system and production models, provide a starting point to define the characteristics of this phenomenon, analyzing how these transformations affect the design of the contemporary factory and its relationship with the urban context.

1 For more information and an accurate explanation of the term Path Dependence see Liebowitz, S.; Margolis, S. (September 2000). Path Dependence. In Bouckaert, B.; De Geest, G., (eds.) "Encyclopedia of Law and Economics", Volume I. The History and Methodology of Law and Economics. Cheltenham: Edward Elgar. p. 981-998

1.2 Process.

1.2.1 Introduction: Technology and Economy are changing

The renewed attention to the relation between urban space and production has its roots in the technological and economic transformations that industrial field has faced since entering the digital age. The widespread use of digital systems has replaced part of the spatial infrastructure necessary for the exchange of information and materials, questioning the decisive role of localization of production respect to sales market (Easterling, 2016).

In addition to a geographical position, the introduction of new technologies has a substantial impact on the spatial qualities that industrial activities require. The image of the nineteenth-century factory, the sooty and polluting manufacturing plant in the suburbs of European cities, still very present in the collective imaginary, is a remote remembrance from the current characteristics of manufacturing spaces. A light and clean production, organized and hyper-connected through the digital infrastructure (Rappaport, 2014), capable of controlling the processes from raw materials to the sale of the finished product, has opened the frontiers for a complete redesign of production chains and of the spaces in which they occur: the modern factory.

In the last decades, the introduction of technologies undermined the restrict separation between production and city space, suggesting a different integration of these activities within the dynamics of urban life. The declared advent of Industry 4.0 together with the phenomenon of servitization, which has become essential also for those companies that most appeared to be far from the use of services within their manufacturing activity, are the supporting elements of a new reconfigured relationship between urban dynamics and production.

1.2.2 Digitalization

In the last thirty years, Internet and Digitization have played a fundamental role, becoming part of all the activities we carry out. An immaterial but continuous presence, with which we interface through objects that are constantly present in our daily life, aiming to complete connectivity with the environment surrounding us.

Digital infrastructure has set the built space in crisis, bringing the bond between uses and space to the extreme consequences, giving a new impetus to the critical debate on the relation between the form of the building and the evolution of the uses that take place within it (Tschumi, 1994). A substantial disjunction from the famous modern maxim of Louis Sullivan "*Forms ever follow function*"[2], which profoundly

---

2 The phrase has become a symbol of the modern movement and of the conception of architecture as a shell that communicates through its form what it contains. The phrase was first used in Sullivan,

influenced the twentieth-century architectural thinking and production, subtending a different causal relationship. From the change of means of communication and relation, different uses emerge within the same space, an operation that comes directly from users, due to an imminent, inevitable necessity of adaptation of living practices to the exploding digital dynamics. The digital structure becomes the medium of interaction, configuring itself as the element of conjunction between space and users, providing an instrument for the organization of experimental practices that moved away from the traditional idea of living. A phenomenon visible in the spaces of the residence, as the impact of Airbnb have shown, in services through sharing platforms particularly effective for urban transportation, in public spaces where the phenomenon of multi-local working (Marino & Lapintie, 2018) change the requirements that users are looking for, and in working practice through the expanding phenomenon of co-working and co-making spaces.

In this context, we have witnessed the fluidification of the workspace, starting from the office, the first to be colonized by digital technologies, making it possible to work from home or public places, remaining connected to a global infrastructure[3]. What happens? The workspace loses its spatial coding, a recognizable spatial layout, the cubicle, the furniture system configuring its functioning and the social relations that accompanies it.[4] The system becomes fluid as the cultural values accompanying it. We are moving, or maybe we are returning, to ambivalent situations where the codes of behaviour and relations are not tied to the rigidity of space but rather to its flexibility as a practical value for the production of space.

From domestic and working space to the whole city. In a process described as *Global Cities Phenomenon* (Sassen, 1991), digitalization has configured the city as a space of flows, of information, of people, of ideas and goods favouring the transition of the twentieth-century manufacturing centres into centres for control and coordination of global production. In his book *"The rise of the Networked Society"*, Manuel Castells supports the idea of a *"network logic"* imposed by the information revolution. Castells argues that, in the industrial sector, the old Fordist model of mass production only allowed serial relationships of a very linear nature. In today's world, pervaded by high-tech technologies, information extracted through the internet has allowed the creation of a more flexible social, economic and cultural *"architecture and geometry"* (Castells, 2009). In short, Castell claims that global cities are located within a *"space of flows"* rather than in specific places. In this vision, cities are not perceived as places within specific geographical limits but more as places that are important for the things that flow through them, such as ideas, people, financial and cultural flows.

"The Tall Office Building Artistically Considered", pp. 403–409.

3 The digitalization of the office space has been prsented and interpreted by Stone and Luchetti in their article "*Your office is where you are*" appeared on Harvard Business Review in 1985.

4 Nikil Saval in *"Cubed. A Secret History of the Workplace"* offers an informative look into the history of the cubicle and the white-collar workplace. He described the layout evolution of the office as its social and political impact.

The advent of digital space has brought two important revolutions. The first has been the suspension of the perception of distance: data, information, images, places, people thanks to the digital coding move from one place to another through the network, overcoming physical barriers (Easterling, 2016). In the industrial field, this condition made it possible to eliminate part of the decision-making and production process through the direct exchange of virtual information between headquarters and plants located in different places in the world.

Secondly, the digital network has democratized access to information. (Rifkin, 2013). Jeremy Rifkin defines this phenomenon as “the era of access”, which consists in the advent of a new mass society, no longer constituted by anonymous consumers, but by small financial operators, business inventors, digital artisans, outsider to the traditional industrial cycles, inventing flexible and constantly evolving forms of work and business. They successfully enter the market of technological, aesthetic and commercial innovation using IT technologies as a new condition of independence in the workplace, producing new metropolitan services and virtual relationships in the world of e-commerce. (Branzi, 2006)

1.2.3 Servitization

In the expansion of markets and global competition, digital network has favored an increase in the range of services offered by a manufacturer, a phenomenon defined as Servitization (Ward and Graves, 2007). The term indicates a process by which a product is no longer offered or sold alone, but delivered in combination with a service. Ren and Gregory define servitization as: *“a change process wherein manufacturing companies embrace service orientation and/or develop more and better services, with the aim to satisfy customers’ needs, achieve competitive advantage and enhance firm performance”* (Ren & Gregory, 2007)

The shift of manufacturing to service is not a recent phenomenon. However, an exponential increase enabled by information and communication technologies as by real-time access to data is expected. Nowadays companies have realized that improving their product offer beyond manufacturing, if not necessary to stay on the market, is at least a profitable development path and an effective way for increasing profits and staying ahead of competitors.

Even if the process of transition to an intense implementation of services has always been seen as a prevalent phenomenon of western economies, due to a slowdown in industrial production, even the economies of the growing countries are facing a shift towards an increase in GDP generated from services. (Baines et al., 2013)

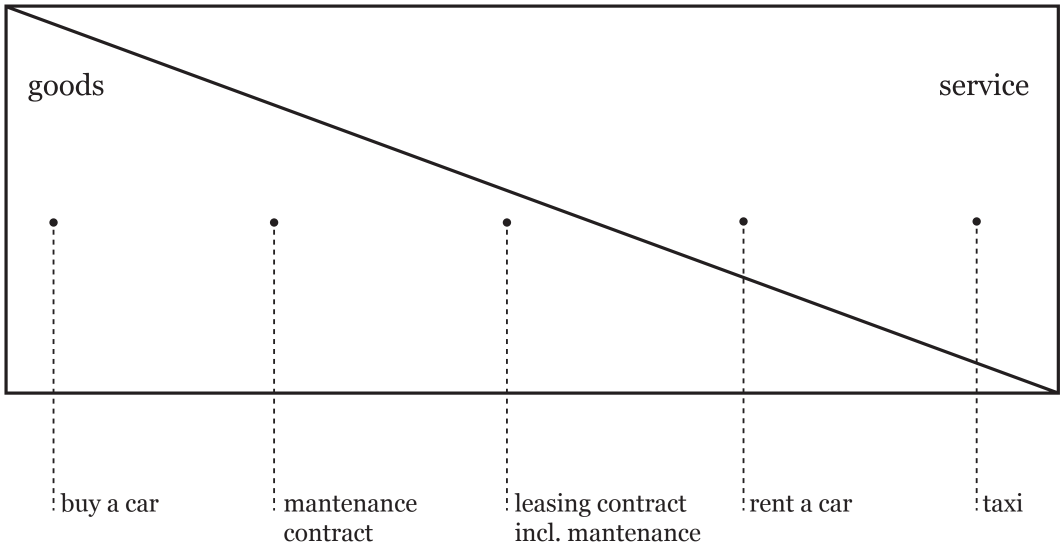


Figure 1: Products are defined by goods and by its related services. Servitization is the process that moves from left to right of the scheme. Adapted from Helo et al. (2017)

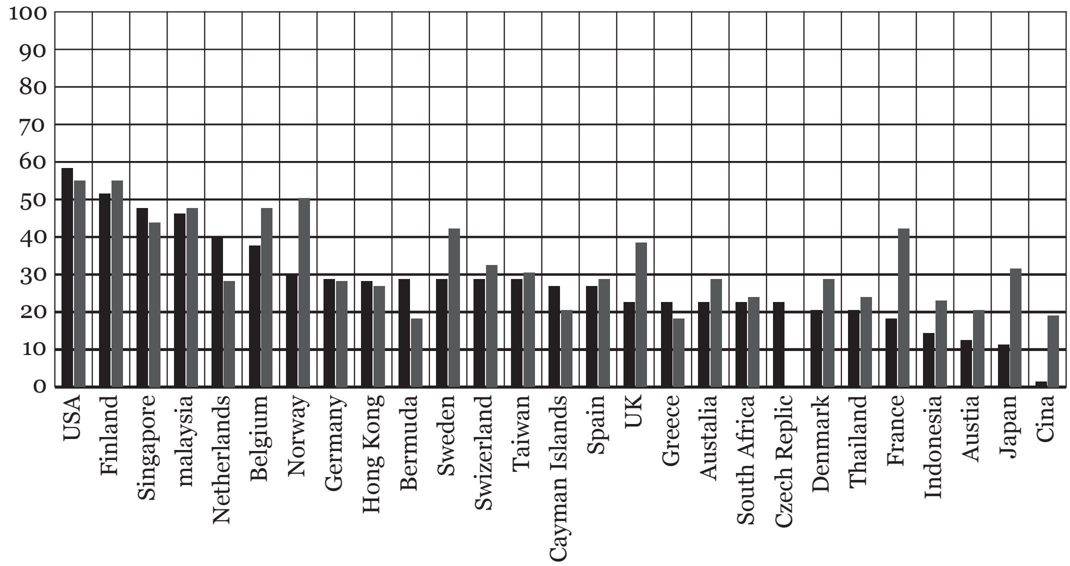


Figure 2: Percentage of manufacturing companies that have shifted to offering services in the years 2007–2011. Adapted from Neely et al. (2011)

Looking at the studies carried out by Neely, Benedettini and Visnjic on the percentage of manufacturing companies which have shifted to offering services in the period between 2007 and 2011, they show that the degree of servitization has increased in most of the featured countries (Neely at al., 2011). USA and Finland are the leading countries, followed by European countries, Singapore and Malaysia in Asia; even China, a country traditionally dependent on manufacturing as the main driver of economic growth, have now noticed an increase in generating services. (Figure 2)

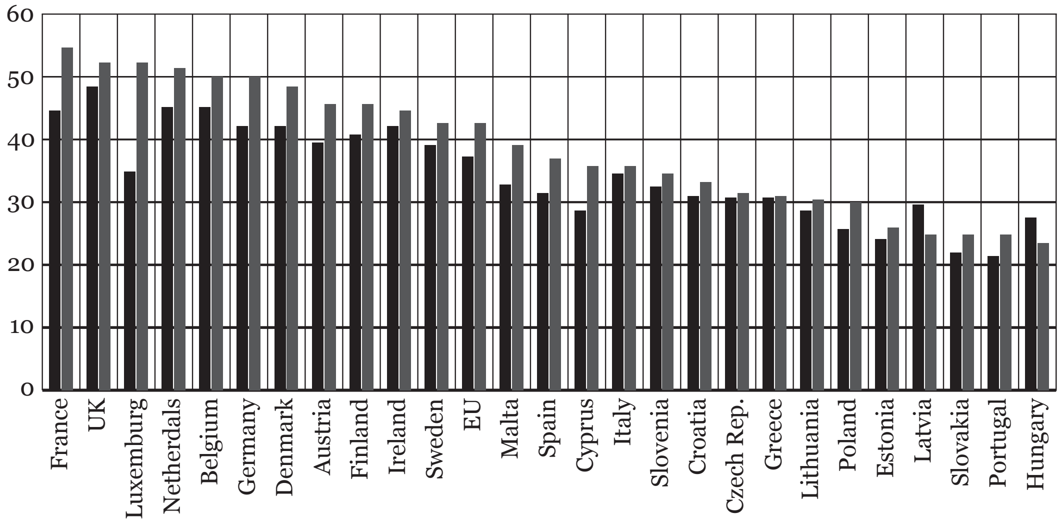


Figure 3: Share of service related job in the manufacturing sector in 2008 and 2012. Adapted from Bruegel based on EU LFS. (Barbiero et al., 2013)

To illustrate the increasing importance of service activities performed by manufacturing firms, Figure 3 looks at service-related jobs in manufacturing. It proves that in Europe about 40 percent of the jobs in the manufacturing sector involve service-related occupations, a share that is continuously growing in most countries. The share of jobs in manufacturing that can be considered as services-related ranges from about 50 percent in the UK and recently also in France, Belgium, Germany, Austria, the Netherlands, and Denmark, to about or below 30 percent in countries such as Greece and Portugal. (Barbiero et al., 2013)

The expansion of servitization inside customer business and business to business produces a cultural transformation in the value given to objects. Botsman, using the example of the automobile, suggests a transition inside the cultural vision of object from the property towards the purchase of a service (Botsman & Rogers, 2010). This transition has already been applied in other economic sectors: a clear example is the music sector. From the ownership of an object, like vinyl or cd-ROMs, to the possession of audio tracks on digital platforms as iTunes and Google Play Music, to unlimited access to all the music on the platform at no additional cost on Spotify. Users moved from the ownership of a material object to the use of a service which benefits them by making available a wide range of musical genres and artists in any place, requiring only a connection to the digital network.

This cultural transformation, accelerated by the sudden change in the business of intangible goods such as music, films, newspapers, is changing the habits and expectations of consumers, encouraging this transformation towards the provision of services even in sectors historically more firmly anchored to a possessive vision of the object.

«Consumer businesses are teaching to the masses the benefits of technology-enabled services. [...] Supply chain structures and key performance indicators are affected by these changes. For these reasons industrial service models are shaping future supply chain architectures» (Helo at al., 2017, pp. 6)

To generate a competitive advantage, companies look at innovation as a tool for such achievement, requiring continuous development, which corresponds to a high human and technological capital. According to Saskia Sassen, the servitization process, through the competitive advantage it conveys, modifies the historical relationship between manufacturing and service sector. In the analysis presented in the Annals of the American Academy, Sassen describes how cities arose as strategic economic spaces also for the most material sector as mine, factories, transport system, and construction due to the expanding demand of intermediate service sector which accompanies the growing complexity of strategic operations both in customer business and in business to business.

Sassen describes this change through the recognition of a specific production, called *Urban Manufacturing*, as a sector intimately linked to advanced services as to urban location. *«[urban Manufacturing] inverts the historic relationship between services and manufacturing (historically, services developed to serve the needs of manufacturers) in that it serves service industries.» (Sassen, 2016, pp. 65)*

These conditions moved Sassen's reflections on the relationship between urban space and advanced service economies. *«[Urban service economy] Its sharp concentrations of both high- and low-income jobs and high- and low-profit firms, along with their specific multiplier effects, reshape the built environment of cities. Office districts, residential spaces, and spaces for consumption and entertainment all are at least partly reshaped by this new structural development. This also explains the renewed importance of architecture and urban design since the 1980s.» (Sassen, 2016, pp. 54)*

Sassen refers to intermediate service as a key sector of the structural changes happening in the urban realm. To explain this relationship between the growth of the intermediate economy and the urban environment, Sassen refers to three factors. First, the complexity of the operations of a company performing previously locally, at the entrance into regional, national or global market. The expansion of the market scale, brings with it some uncertainties, which are intensified by operating in different countries, increasing the development of partnerships with local actors, spinning off parts of the complex managerial operations previously managed in-house.

Second, the complexity of the services to be produced, the uncertainties of the market in which they are inserted and the importance assumed by the speed in the interactions through the digital network, constitute new dynamics to which the companies specialized in services are dependent. These conditions lead these companies to be subject to agglomeration phenomena, realizing a return by clustering together, which is why they tend to concentrate in cities.

The third factor derives directly from the second character. More complex and non-standard functions, subject both to the uncertainty and changes in the market as the related increase in the speed of information exchange, are outsourced, more free are the headquarters to position themselves freely in the geographical space. This is because, according to Sassen, most of the activities related to agglomeration economies are done by new intermediate services instead of headquarters. Thus, the sector that distinguishes the competitive advantage of urban areas, in particular global cities, is the networked intermediate economy rather than corporate headquarters.

The advent of the digital network played a fundamental role in the organization and expansion of the phenomenon of servitization as in the significant change of leading economic activities in the urban realm. During the 80s, it was believed that such a technology would put an end to the benefits defined by the centrality and density of the city space. Expert declared that the city space would not have been more strategic for the advanced sectors but this did not come true completely.

«It is true that today's multinationals have expanded and have more than a million affiliates worldwide, but it was the routinized sectors that left cities while advanced sectors kept expanding their operations in more and more cities. As multinationals have decentralized their routinized sectors, they also have expanded their central headquarters functions and fed the growth of a separate, specialized services sector from which they are increasingly buying what they once produced in-house.» (Sassen, 2016, pp. 58)

The set of talents, information, skills but also universities, companies, research centres are the beating heart of cities knowledge production. In contrast to the simple collection and interpolation of data, the act of interpretation, evaluation, definition and judgment, require a continuous feedback loop with the environment in order to produce higher-order data. Today this information loop can not be completely replicated into the electronic space, defining the importance of intimate and personal relationships that can produce a higher order of information. Cities are an environment that helps to "find" the information you need, a critical factor for complex work. Standardized functions do not need them as they are not subject to uncertainty and nonstandardized forms of complexity.

The reflection of Sassen on the urban environment underlines two important components provided by the city: technological innovation and human competence. The first one refers to the presence of an economy which relates to non-standard dynamics, strengthening the transformation that is taking place in production systems that moves away from a matrix-based production towards customization without additional costs. An economy linked to the characteristics of a renewed Urban Manufacturing, defined as a link between advanced services and an informal creative economy.

The second one refers to the cultural changes that always accompany economic and spatial restructuring. In this case, it is important to underline how non-standard and advance service are developed in the city thanks to the social patters who live and merge in the dense urban space. For this purpose, it is essential to investigate the characteristics of these social groups and how these evolve from a legacy that has a fundamental role in the construction of such an environment.

1.2.4 A new industrial revolution

«[...] The Industrial Revolution accumulated machines very quickly, synchronized them with complex switching mechanisms, and so turned them into "apparatuses," and the apparatus quickly made it clear that machines would have to be rethought.» (Flusser, 2014, pp. 28)

During the nineteenth and twentieth centuries, we have witnessed the emergence and diffusion of different technologies that have radically transformed the productive structure and consequently, the social and spatial forms it assumed. The purpose of these reforms was to respond to technical requests, such as the optimization of industrial processes, more performing engines or new opportunities on the market, supported by an industrial sector always looking for innovation and competitive advantages.

Historically, these technological innovations achieved three industrial revolutions: the first characterized by the introduction of water and steam-powered mechanical manufacturing at the end of the 18th century, the second marked by Taylorism and the division of labour at the beginning of the 20th century and the third, in the glare of the digital age, with the introduction of programmable logic controllers (PLC) for automation purposes in manufacturing in the 1970s. These technological improvements were followed by several major shifts of the organizational structure of industrial production to face the changing nature of markets.

At the intersection of technological innovations and the consequent transformation of local and international markets, production has radically modified its spatial form and the relations with the territory on which it was located. Industrial production started with the transformation of the crafting system towards mass production with a rigid division of labour and a restrictive standardization. The consequent increase in production volumes has led to the disjunction between the space of manufacturing activities and the space of the city: craft activities that previously took place on the ground floor of the residential buildings, or inside courtyards, developing a thriving and intricate system of semi-private spaces, were replaced by increasingly stately buildings capable of hosting the complexes production processes and the sudden increase in volumes of products to be introduced in the market.

"[Urban transformation through the advent of the Industrial Revolution] This process with specific characteristics and specific system, despite some differences in time and space, tends to recompose social space and, at the same time, to separate the events of everyday life, especially with respect to the autonomy of those who are not directly involved in productive work" (Samuels et al., 2004, pp. 125)

In a seller's market where the major bottleneck was represented by production, the industrial structure focused its development on increasing output and productivity, ignoring customer needs and variations, in contrast to a pre-industrial culture technically based on the uniqueness of products. This condition revokes the famous quote by Henry Ford *«Any customer can have painted any colour that he wants so long as it is black»* (Ford, 2013, pp.13). In our culture, Ford's quote represented this standardized condition of industrial production. It is necessary to note that this phrase by Henry Ford was often interpreted as a question of "style" by the common belief as if Ford believed that the product he produced was good enough to enter the market without further improvement or modification. Instead, the motivation of Ford's position needs to be found again within the processes of technological innovation. It was not the taste but the cost-effectiveness of the process that interested him. In 1909, the year in which Ford expressed the famous quote, experiments were carried out on the assembly line inside his factories and the Japan black was the only paint colour able to dry quickly, keeping production speed high. Standardization became the critical element for reducing production costs.

As market saturation increases, it turns into a buyers market, forcing manufacturing companies in the direction of product differentiation. In order to raise the efficacy of product varieties, *Lean Production* became popular, allowing the removal of waste along the value chain. The spatial organization of the production apparatus reflects the transformation of the market, which takes on an increasingly global dimension, linked to international logistics networks and a continuous search for the optimization of production processes, easily accessible through the exploitation of manpower in developing countries. In this way, during the eighties of the twentieth century, the relocation of the productive assets of western countries towards developing economies began. This process was devastating for the western cities, especially for those that grew around a particular production or a single large industry. These company towns, of which there are innumerable cases within the European territory, have suffered an intense economic and social crisis from which not all have been able to recover.

The substitution of a manufacturing structure has led to the growth of service and knowledge economies within developed regions with a partial reuse of large industrial facilities abandoned by delocalisation. The increasing possibilities supported by the exponential growth of digital infrastructure and the larger integration of the *Internet of Everything* (IoE) into the industrial value chain has prepared the ground for the concept of a new industrial revolution, which is expanding under the name of the *fourth industrial revolution* or *Industry 4.0*. The upcoming revolution will be triggered by Internet, which allows communication between humans as well as with machines in a *Cyber-Physical-Systems* (CPS) through large networks.

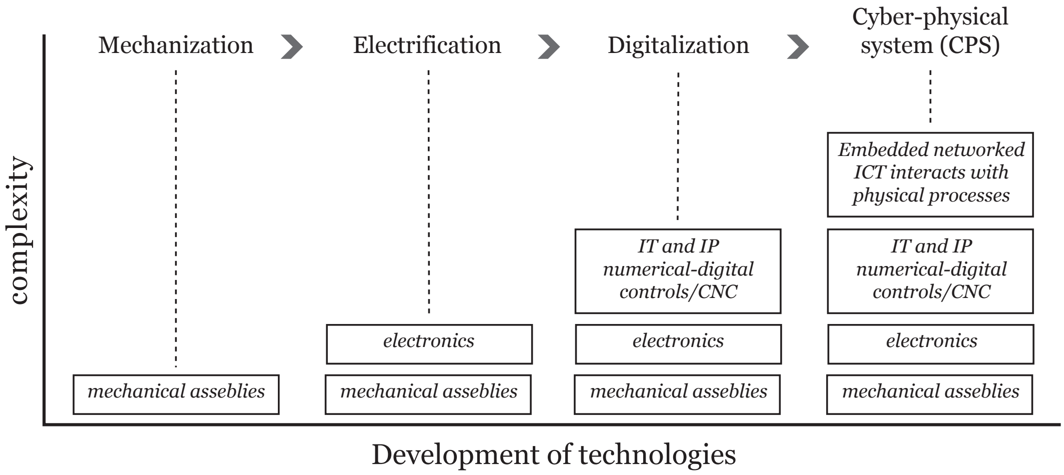


Figure 4: The image shows the key enabling technologies defining the different phases of the industrial revolution.

The term Industry 4.0 was presented for the first time to the public at the Hannover Fair in 2011. The following year, the German government established the Industrie 4.0 Working Group to investigate the potential of integration of digital technologies through production processes (Hermann et al., 2016). This new industrial revolution is emerging, for the first time, as an apriori revolution, not observed ex-post. An anomalous case that declines its uncertainties within its nature, identifying itself as a grouping of different fields of action, under a single "hat" of different names: *"Industrie 4.0"*, *"Advanced Manufacturing"*, *"Integrated Industry"*, *"Smart Industry"*, or *"Smart Manufacturing"*. (Drath & Horch, 2014)

The Boston Consulting Group has outlined the technologies that will enable this new wave of innovation in the industrial world has belonged to nine pillars: Big Data and Analytics, Autonomous Robots, Simulation, Horizontal and Vertical System Integration, The Industrial Internet of Things, Cybersecurity, The Cloud, Additive Manufacturing and Augmented Reality (Hermann et al., 2016), declaring an optimization of what is defined as an unbundled universe of industrial realities, towards an automated, optimized and integrated production process.

«[Industry 4.0]change traditional production relationships among suppliers, producers, and customers, as well as between human and machine» (Gerbert et al., 2015)

The combination of the digital and physical world is a great challenge that implies complex interoperability between sectors such as robotics, simulations, big data analytics, sustainability, and user experience. The scope of such excellent optimization is to obtain a strong integration in the value chain, constructing an Information Technology architecture to allow manufacturing elements to be autonomous and able to exchange information, control themselves and ultimately improve their efficiency and quality without human actions. This decentralization of procedural communication implies that machines have decision making power, reaching more flexibility and adaptability to respond to production requirements and to reach even more customized market demands.

The fundamentals of Industry 4.0 are: a) Interoperability, reached thanks to the communications capacity between people and machine using the Internet of Things (IoT) and Internet of People (IoE). b) Virtualization, Cyber-physical System and digital twin must create a virtual copy of the reality for real-time simulation. c) Decentralization, problem-solving and product customization happens without human interaction. d) Real-time capability, data are collected in real-time during the production process, and they are stored in Cloud to be analyzed. e) Modularity, production must be able to adapt itself to changes in market trends and customer's specifications.

All these characters create a continuous optimization of the production process with minimization of scraps, a reduction of downtime and adjusting time, and consequently in time to market. Communication between manufacturers and customers become easier, and thanks to customization, also the inclination to pay a higher price for the product increases. All these technologies shifts create the need for new research and high skilled labour to work with it. This change of paradigm within the production systems requires the training of a highly skilled workforce but also to find a solution to a generational change and the increase in unemployment due to the ineligibility of traditional employees for this new kind of job.

Through the technological and social spectrum that characterizes the wave of a new industrial revolution, it is possible to recognize decisive characters that could drive a transformation in the design of productive space, impacting in particular on the factory layout, both on a geographical and architectural scale. Likewise, influencing global supply chains and proximity dynamics. This transformation brings to the necessary rethinking of the factory system, even within a revolution deeply linked to digital infrastructure as a crucial enabling element. This contingency leads to review and investigate production not only as an element behind economic and social processes but also as a critical factor for the development of the contemporary city.

1.2.5 The fourth industrial revolution and the factory of the future

The factory is changing its nature again: from a human place to the realm of machines, it is now transforming its identity into a new interactive space, defining its role as a Platform, on which different actors, human and machine, as plug-ins, enter into a mutual relationship. Such technologies have essential implications in the design and layout organization of factory space. The spatial identity of the factory is at a crucial point, turning into an infrastructural unit, a plug and play platform, where users, machine and information grafted together to form networks.

The factory is reconfigured as a platform where machines, workers and raw materials change rapidly according to the needs of just-in-time production, increased market volatility and the deverticalization of firm structure. Modular production rises with the development and growth of network forms of production organization (Sturgeon, 2002, Kühnle & Bitsch, 2015), leading to the formulation of new productive spatial concepts such as the decentralized factory. The production of objects, thanks to new production technologies and digital infrastructure, can shift from a vertical model, where products are made in a single factory and then distributed globally, to a horizontal model, where a local factory, equipped to carry out very different outputs, produces only the local products demand. A first conceptual example of this possible future is presented by the *Productive Service Station* (PPS) developed in the analysis of the productive city of Rotterdam. (Francke et al., 2016, pp. 145)

.

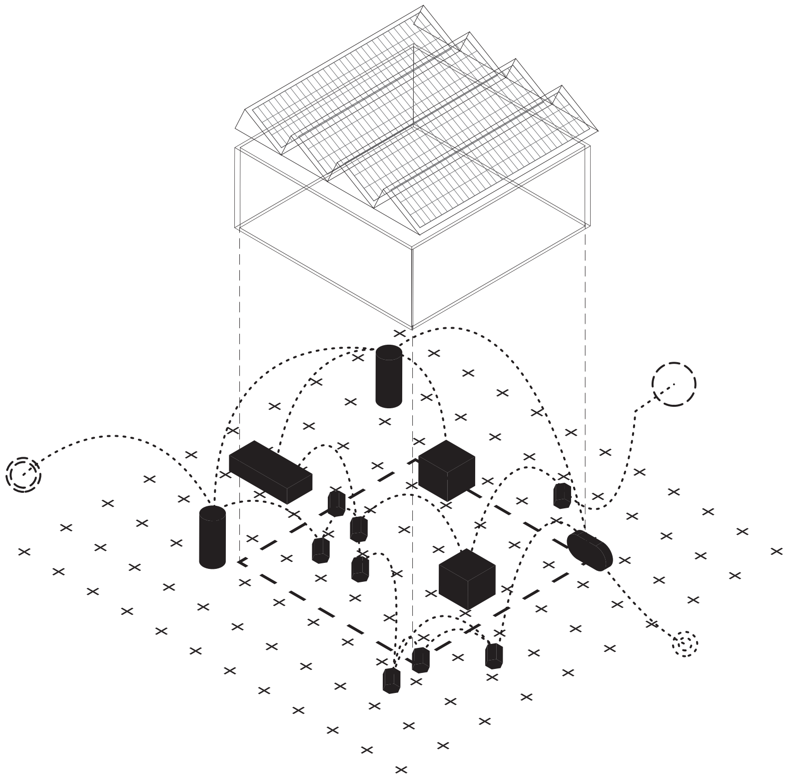


Figure 5. Industrial Platform: the spatial identity of the factory is at a crucial point, turning into an infrastructural unit, a plug and play platform, where users, machine and information grafted together to form networks.

The factory space breaks its extensive limits, the enclosure with which it recognizes itself and defines its presence within the urban fabric, subtracted from

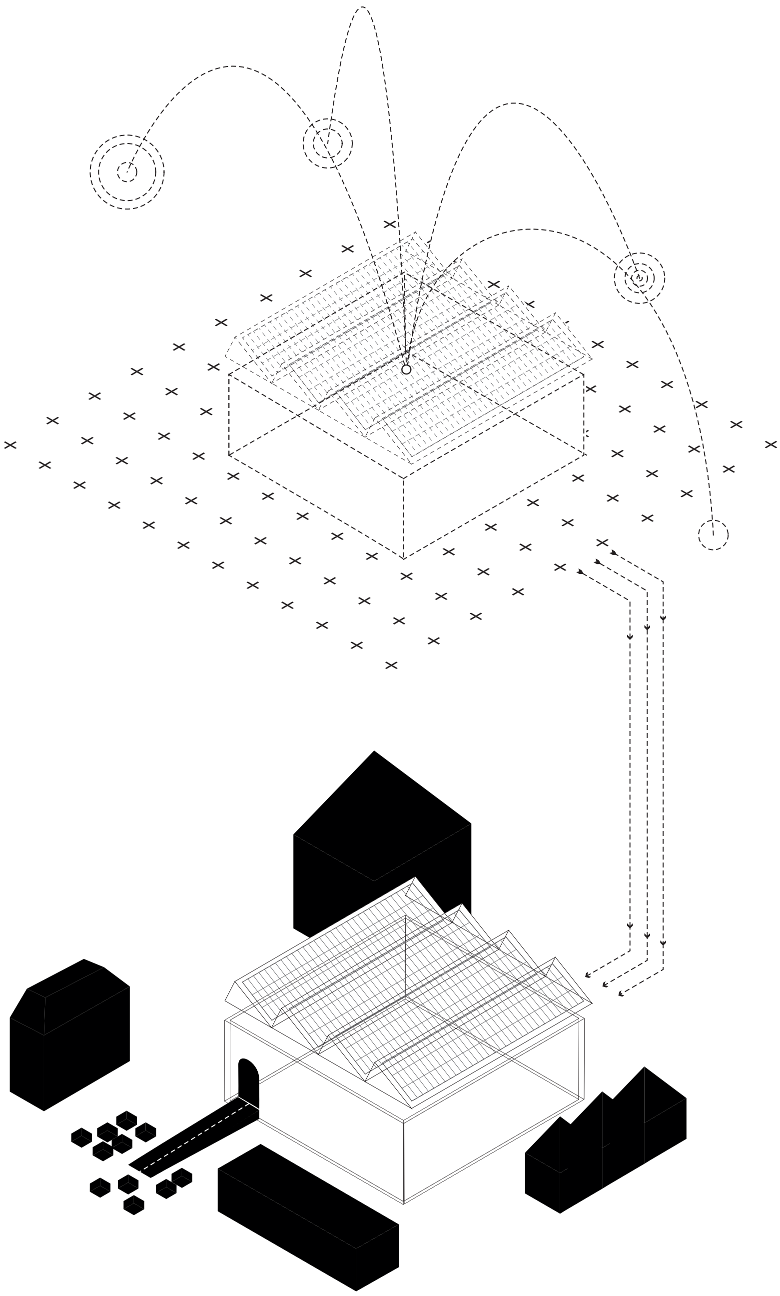


Figure 5. Real and Digital Industry. The factory takes on a double physiognomy, a real and digital nature, defining a new hierarchy in production processes. Smart factories are focused on optimizing all the phases of the production process, with virtual simulation they can easily manage a flexible production at higher quality with reduction in cost.

the formal and hierarchical regularity of the production flow for capillary flexibility. This interoperability of the parts takes place in the merging of physical with the digital structure where RFID, sensors, interfaces, smartphones become the nodes through which the two worlds come into connection. Keller Easterling (2016) analyzes how the infrastructure, considered to be a hidden substrate, assumes a position of power in the construction of urban space, interconnecting different activities of living and production instead, assuming itself the role of social space.

«far from hidden, infrastructure is now the point of contact and access between the rules of everyday life» (Easterling, 2016, pp. 11)

The digital infrastructure has given the opportunity to create a parallel world, where industrial processes are simulated and completed even before the industrial plant is built. This allows to simulate the various stages of production, check for any errors and correct them, allowing a significant saving of costs and times. As a consequence, the factory becomes a digital simulated space, where every action is calibrated and verified, even before this happens in the material reality. This concept is named Digital Twin, referring to the generation of an entirely digital product model or a part of it and its use for thinking on other occurrences of the same part or product, thus establishing a relation between multiple copies.

«[Digital Twin] a set of virtual information constructs that fully describes a potential or actual physical manufactured product from the micro atomic level to the macro geometrical level» (Grieves and Vickers, 2017, pp. 85)

The development of the digital twin allows the efficient prognostication of the effects of the product and process development as well as operating and servicing decisions without the need for high-priced and time-expensive physical mock-ups (Schleich et al., 2017). Such realistic digital models are essential for an immediate and effective evaluation of the consequences of design choices on the quality and function of mechanical products. Today many companies are using this concept to improve design and production, for example, Siemens aims for increased efficiency and quality in manufacturing by exploiting the possibilities of today's manufacturing digitalization in the context of Industry 4.0. Tesla aims at developing a digital twin for every built car, enabling simultaneous data transmission between the car and the factory. At the same time, other companies frequently use complex product models to support the immersion in virtual and augmented reality applications (Schleich et al., 2017).

«As the world of manufacturing changes, the way factories are planned, constructed and operated will also change. They will need to become more flexible and adaptable, achieve better integration between buildings and processes, and be more resilient to economic and environmental shifts» (Arup, 2015)

As analyzed in the report realized by Arup (2015), key enabling technologies of the "factory of the future" will pursue the competitive advantage of companies in relation to global and local markets. Harvard Business School professor, Michael Porter, has pointed out three possibilities to achieve a competitive advantage for a company aiming to be a cost leader. The first relates to the reduction of cost to offer the best price on the market. Another way is differentiation, providing products with unique characteristics that have some value for their customers beyond the simple offer of a low price. The third is the focus strategy, which can be cost-oriented, aiming to achieve a cost advantage limited to one or a few market segments, or oriented to differentiation, identifying a customer segment that is particularly sensitive to quality (Porter, 1998).

The most effective way to accomplish all the three typologies of competitive advantage described by Porter is to be pursued through adaptability. Market's demand changes continuously, and companies must achieve the flexibility to adapt their production to new variables. Adaptability could be pursued through the production of small-batch, a concept that disrupts the mass production system pushing clients to choose a product that they perceive as more personal and suitable for them. The new industrial revolution, which concentrates its characteristics around the optimization of communication and interaction between the parts of the production process, has as its primary objective these improvements, allowing companies to achieve greater flexibility through the digital structure.

As operational decision will be faced by decentralized systems able to handle with high complexity, distributing administrative process through different components, a starting point for the so-called cybernetic management, companies will be able to face the growing demand for customized products (Davis, 1989). A process, as recognized by Mario Carpo, Professor of Architectural History and Theory At University College in London, undermining the standardization and mechanical logic in the production system.

«Unlike mechanical making, digital making is rarely matrix-base, hence using file to factory digital technology it is theoretically possible to mass-produce variations, within limits, at no extra cost. [...] Digital file to factory technologies offer no economies of scale.» (Carpo, 2017)

Additive manufacturing and more affordable customization will be easier enable thanks to a 3D printing market which is scaling rapidly, increasing of 42% from 2012 with an investment of 412 million dollars in 2013, exceeded by a grew of a further 62% in 2014 (Netopia, 2013). *«Additive manufacturing also allows for manufacturing to take place in non-traditional spaces, such as a small office in a city centre. This will allow production to take place closer to the point of use, thereby lowering transport costs and associated emissions.» (Arup, 2015).* 3D printing techniques will give permission to manufacturing to be more mobile and dispersed. Consequently, factory locations are likely to become both mixed and closer to the end consumer. This improvement, together with the trends of "next-shoring" and "distributed manufacturing", developing products closer to where they will be sold, could result in smaller, more central urban factory locations.

Industrial productions, especially light manufacturing activities, are coming back to occupy urban places left empty by the relocation that has affected western cities since the late 1970s. These production activities, defined as Urban Manufacturing, are characterized by high technological components combined with craftsmanship production qualities and a digital infrastructure supporting production, logistic and customer relation. This phenomenon, which is becoming increasingly important in the debate on urban development, is leading to the emergence of new business models and cooperation between different companies working synergistically in a local area even though they are part of a global network.

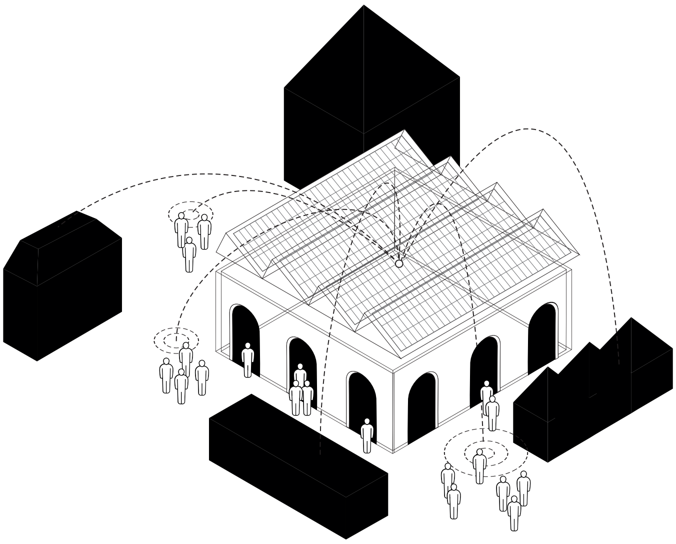


Figure 6. Urban Manufacturing. Production becomes a crossing space in which producers and consumers build the product value chain.

In the architectural field, this phenomenon led to the reappearance of spatial typologies that seemed to have disappeared under the push of mass production. A new domestic production, called neo-cottage (Rappaport, 2017), has taken on great importance in recent years thanks to platforms such as Etsy where small artisans can sell their products on the global market. No longer a singular domestic leisure activity, domestic crafts and DIY is redefining its image with a progressive agenda of individualization, emancipation, sub-cultural identification and anti-commercialism and especially as a multi-billion dollar industry (Luckman, 2013, pp. 127). The vertical factory (Rappaport, 2014) has also returned to being a competitive model within dense urban contexts, both as a vertical development of production flows, or as multi-tenants industrial buildings, where various manufacturing activities rent parts of a large building by sharing services and costs. Finally, architects and urban planners are experimenting with new hybrid buildings that seek to combine production spaces with other functions of city life in order to create a mixed-use district capable of supporting greater heterogeneity and resilience by combining workspaces, leisure activities and residential buildings.

1.3 Users.

1.3.1 Introduction: workers are changing habits

The human condition has always been influenced by the environment and by the human capacity to deal with the necessary resources through tools and machine to extract, farm, harvest and produce the necessary goods. This process is part of a dualism, a continuous influence between humanity and the environmental conditions around it. A position that has been heavily influenced by means of production. Technological transformations have occurred in parallel with social changes driving cultural attitudes and habits. Sigfried Giedion in *“Mechanization Takes Command”*, published in 1948, remains the most comprehensive survey on industrialization, describing how innovation and technical improvement has modified the way people dealt with different aspects of life from the domestic sphere to the urban environment. Today great transformations in the working system move in parallel with cultural and social changes which need to be taken into account to depict the phenomenon of new urban industrial production and to implement policies that are capable of responding not only to economic and industrial needs but also to social aspects.

The beginning of production plants relocation to developing countries was accompanied by the rise of cities as a place of consumption and the transmutation of most of the manufacturing jobs into services and knowledge economies. Cities are identified as generators of knowledge, both formal and informal, going beyond the sum of recognized knowledge actors, becoming an essential asset of today cities economies. An immaterial capital that has been a driver for urban development in recent decades, trying to create an inspiring and captivating space for knowledge and creative workers as a catalyst in a global competition for resources and economic assets (Sassen, 2009).

In recent years, thanks above all to the advancement of digital technologies, work activities escaped the limits defined by the spaces dedicated to work, occupying other places that were not designed for this purpose. Digital technology put the zoning, so dear to planners of post-war cities into crisis, highlighting a lack of flexibility in city planning and bringing out different practices in the urban space which, however, still lack a design capable of accommodating fast-changing temporary uses. The phenomenon of multi-local working or the explosion of the phenomenon of co-working and co-making spaces are two clear examples of a process that perceives the city as a fluid and constantly changing space. A transformation that is taking place at a faster rate than the previous decade, requiring new and flexible rules, a rapid capacity to react at user requests that have changed significantly since last century.

The creative community, Jacobs argued, required diversity, an appropriate physical environment, and a certain kind of person to generate ideas, spur innovation, and hardness human creativity. (Florida, 2012, pp. 28)

The digital infrastructure that colonized the office space first, then the domestic and public space now reached the workshop, the lair of "real stuff", and there it may have its most significant impact yet. (Anderson, 2012). The resurgence of the workshop system, powered by digital fabrication and a decentralized workforce, has led to a new focus on craft culture, linked both to the makers and DIY movement and to the learning process through making. The digital revolution is enabling a whole new generation of makers, a figure who is at the crossroads between the engineer, the craftsman and the artist. The laboratory space, as the Edison's "invention factory" in Menlo Park, relegated to the university and industrial world, takes on a community role within the urban context conveying different sub-cultures and creating a sense of belonging within creative social groups.

In the next paragraphs, the analysis of how the work system has been transformed will focus mainly on the effects of these changes on workers and users who live in the urban context. This analysis aims to highlight the characteristics and needs of workers, fundamental elements for the analysis of the phenomenon of urban manufacturing and the development of a methodology to analyze the case studies selected in the research.

1.3.2 Knowledge and Creative economy

In the last decades, cities in developed countries have witnessed a drastic decline of the share of manufacturing in contrast to an increase of the share of services (Figure 7).

Adam Smith and Karl Marx consider service as a non-productive activity, convinced that wealth could be created only by producing real things, using capital and labour as inputs (Winden et al., 2013). This consideration matched the widespread belief that service providers such as traders, bureaucrats and financial expert were parasites (Illeris,1996). Consequently, only the manufacturing of physical goods is the source of real wealth. Increments in productivity are high evaluable, despite in the service industries they are hardly observable, which has led to consider the exponential increase of the services sector as a consequence of the development of the manufacturing sector (Winden et al., 2011).

For a long time, manufacturing industries were considered the single driver for regional economic growth, creating a multiplier effect that enabled the expansion of the service sector in the region. This theory was criticized considering the inclination of services in fostering productivity improvements with the final aim of making the economic system more productive. The reflection becomes effective in the inquiry conducted by Illeris (1996) on the geographical and macroeconomic characteristics of services, their role in the overall economy and their increasing importance in regional development, as well as in international trades. As the importance of services growth, they started to be sold outside the region, even globally, creating value for the region. Moreover, basic services such as education or communication facilities, are considered fundamental non-manufacturing activities which are crucial for the functioning of primary industries. besides being an essential aspect for the quality of life, services determine the attractiveness of a place which had become increasingly important in the race to attract talent between regions (Florida, 2014). As the significant result of Illeris' analysis on the service sector underlies, the blurring border of the division between manufacturing and services, determines the necessary attention to how these sectors influence each other and what effects they produce on urban space.

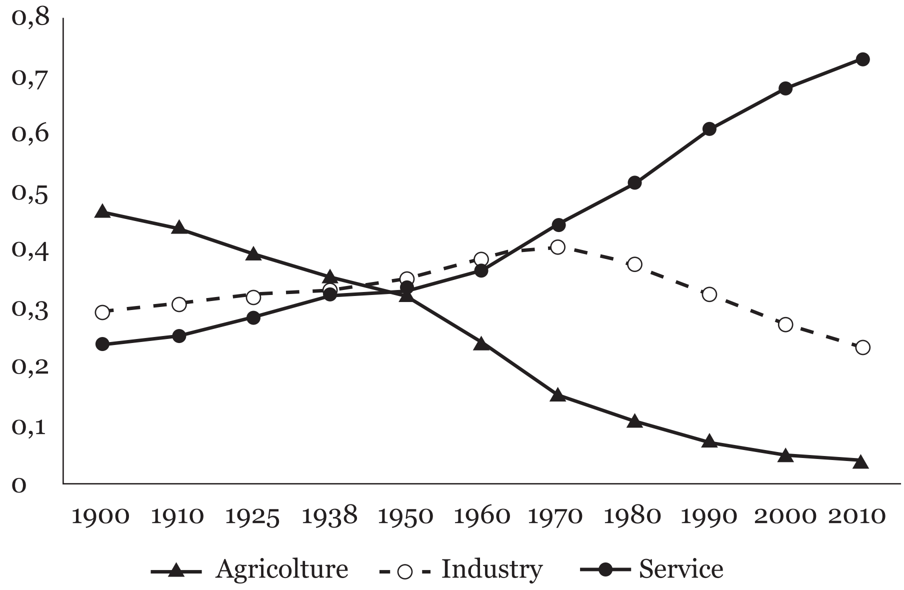


Figure 7. Sectoral Employment shares across 173 Europeans region 1900 - 2010. Adapted from Rosés & Wolf, 2018.

The process of deindustrialization taking place in the urban environment of advanced economies can be seen as part of the shift towards a "knowledge-based economy". The term was coined by the Princeton economist Fritz Machlup, in his book "Production and Distribution of Knowledge in the United States" in 1962. However, Peter Drucker popularized it in the fourth part of his work "The Age of Discontinuity" published for the first time in 1969. In the research published in the Annual Review of Sociology, Powell and Snellman define knowledge economy as

«Production and services based on knowledge-intensive activities that contribute to an accelerated pace of technological and scientific advance as well as equally rapid obsolescence. The key components of a knowledge economy include a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements in every stage of the production process, from the R&D lab to the factory floor to the interface with customers» (Snellman & Powell, 2004, pp. 119)

Druker depicts this phase of the economy as represented by the rise of a different type of workforce: after an age where the industrial system was looking to unskilled or semiskilled labourers to be inserted in a vertically structured work environment, the knowledge worker is characterized by a higher level of competence even if the typology of work did not change so radically as the level of education of new generations. The involvement of a new type of work organization depended on the complexity of a spreading global economic system facing the depletion of natural resources, the complexity of just in time production and its relative logistic infrastructure, energy costs and a global demand subjected to different local regulatory systems, which put in crisis the performances of companies.

This process is recognizable in the relevance assumed by competitive advantage concerning the comparative advantage described by Michael Porter. In an economic model, agents possess a comparative advantage over competitors if, in the process of producing a particular good, they are able to produce it at a lower marginal cost prior to the trade. As companies can mitigate input-cost disadvantages through global sourcing, the comparative advantage becomes less relevant compared to the necessity of continuous innovation for making more productive use of inputs characterizing competitive advantage (Porter,1998). Knowledge rises technical capacities and expertise needed for a trans-boundary, interdisciplinary global scale of action which define today's economic competition.

«What matters is that knowledge has become the central "factor of production" in an advanced, developed economy. Economists still tend to classify the "knowledge industries" as "services." As such, they contrast them with the "primary" industries: agriculture, mining, forestry, and fishing, which make available to man the products of nature and with the "secondary" industries that is, manufacturing. But knowledge has actually become the "primary" industry, the industry that supplies to the economy the essential and central resource of production. The economic history of the last hundred years in the advanced and developed countries could be called "from agriculture to knowledge." Where the farmer was the backbone of any economy a century or two ago, not only in numbers of people employed, but in the importance and value of what it produced, knowledge is now the main cost, the main investment, and the main product of the advanced economy and the livelihood of the largest group in the population.» (Drucker, 1992, p 224)

This transition means that regions or cities do not make income only by manufacturing real things, but also by creating value in the form of concepts, custom solutions for clients, technical assistance and other related activities. Solution and concept could be entirely virtual, from software to business service, or with a physical outline, like media contents, car sharing, and energy infrastructure. The formulation of ideas and concepts lean on knowledge, information, and culture, which define no fundamental difference in the final image of the product.

Indeed, the so-called "smile graph" shows how in thirty years of development European production has increased significantly the percentage of value-added created from R&D and service in material goods production, determining an increasing reliance of urban economic activities such as research centres, headquarters functions, business services, and information technology (Figure 8).

In 1990 Paul Romer published his analysis of the economic value of knowledge. In the essay, the author argued that unlike the classical factors of production, capital and labour, knowledge was a "non-rival goods" (Romer, 1990). His analysis continues underlining that, thanks to this structural character, knowledge could be shared infinitely, growing, unlike other resources, in per-capita terms. Knowledge is characterized by being an economy of abundance, instead of scarcity. Unlike most resources, like natural ones, which are consumed when used, knowledge can be shared and increase through utilization. Knowledge, as declared by Romer, could be shared infinitely, but did that mean it could go everywhere? This question arises in the analysis proposed by Adam Jaffe, Manuel Trajtenberg and Rebecca Henderson about the geographic diffusion of knowledge, resulting in difficulties for knowledge to move far away from the place of origin (Jaffe et al., 1993).

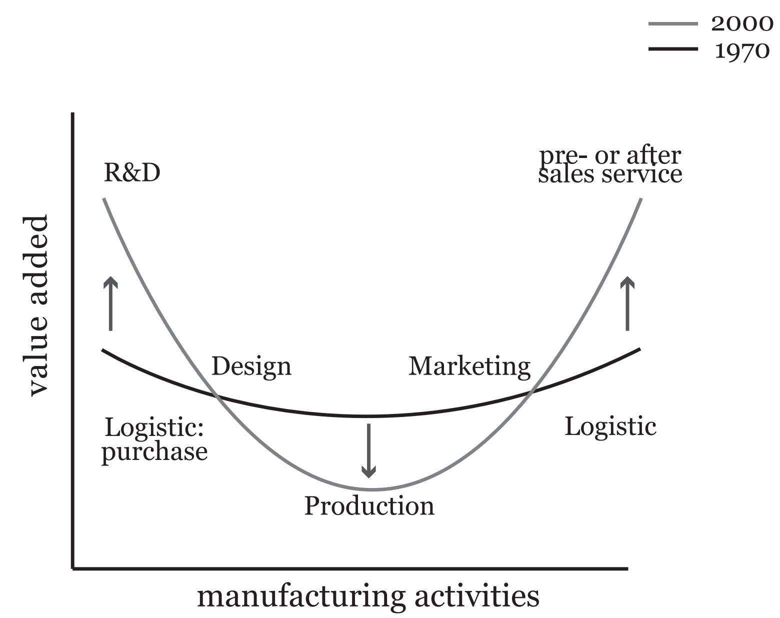


Figure 8. The Smile Graph. It underlines how in thirty years of development European production has increased significantly the percentage of value added from R&D and service in the production process of material goods. Adapted from Barbiero et al., 2013.

Scholars working on patens and co-authorship showed the importance of personal and collaborative relations over others geographical aspect in the diffusion of knowledge (Breschi & Lissoni, 2004), bringing to light the importance of networks in a knowledge economy, assigning importance to regional and urban policies for the enhancement of local collaboration between different sectors (Hidalgo et al., 2018). In the strengthening of innovation dynamic within the region, the concept of *"buzz"* and *"pipelines"* (Bathelt et al., 2004) has distinguished between a community-based learning processes enhanced by co-location and knowledge spillover called buzz by Storper and Venables (Storper & Venables, 2004) and knowledge acquired through external contacts spread worldwide named "global pipelines". The interaction between a virtuous local environment and the presence of global interplay provide regions and cluster with substantial benefit mixing two different knowledge and learning process, reinforcing the competitive advantage of the region.

As knowledge becomes one of the main economic drivers inside a region, the relationship between production and the city tends to dissociate itself from the spatial and organizational model developed in the twenty century, encouraging policies to foster innovation and creativity as the main driver for urban transformation. Historically, creativity has always been the lifeblood of cities, promoting their emergence as manufacturing, mercantile, and artistic centres but the idea of the *"Creative City"* become influential thanks to the work of David Yencken and his article "The creative city" (Yencken, 1988) published in the literary journal Meanjin in 1988, subsequently developed in a global movement of new planning paradigms.

The Creative City concept was developed earlier to what is called today the Creative Economy, which had a strong impetus in transforming the original concept described by Yencken. The elements that led to the recognition and subsequent promulgation of the Creative Economy must be sought in the concept developed by John Howkins (2001), where he defined a creative product an economic good, service or experience which result from creativity, characterized by an economic value based on creativity. Since creativity has always been embedded inside businesses as well as in everyday life, Howkins underline that the rise of its importance is to be sought in the changing nature of its relationship with the economy, in relation to the rise of higher education, market liberalization, higher average wages, new employment patterns and increasing urbanization.

The origin of today's Creative Economy is traced in the changing nature of work, primarily visible in the relation between individuals and their work. Two main themes can be identified at the origin of the concept: the first refers to industrial development and the rising importance of knowledge and data, studied by economist and management writers. The second originates from the recognition of art and culture as economic elements. During the 1970s, the introduction of the concept of cultural industries led the UNESCO and the Council of Europe promote research on their value and characteristics. Cultural Industries became Creative Industries in late 1997, when the England Labour authority incentivized the setup of a task force inside the Department for Culture, Media and Sport (DCMS), which results lead to the definition of 14 creative industries, later reduced to 12 (Landry, 2005).

In his work, Howkins defines what industries concur to what he described as Creative Economy, referring to a range of economic activities which are involved with the generation or exploitation of knowledge and information. They comprise architecture, craft, design, art, fashion, film, music and performing arts, toys and games, television and radio, advertising, research and development, software, toys and games, video games.

The rise of services and their increasing importance in all the stages development of products has led to a growing interest of scholars and companies in understanding which characters are essential to promote this sector.

The strategies adopted by enterprises and regional governments belong to the idea of innovation as the principal element to encourage the achievement of competitive advantage. They recognized in Knowledge and Creativity the leading characters to be pursued in order to enhance a virtuous process of innovation with the risk, as Charles Landry reported in his studies on the creative city, to be blind about the characteristics of this phenomenon. Laundry focuses his critics on how the creative city has now become a label that risks of losing its potential as the fundamental reasons why it emerged. The determinism derived from a stringent restriction of meaning assigned to arts and those professions considered part of the creative economy, risks to conduct to an urban development taking care only of some aspect of a community's creativity. Excessive use and the tendency of cities to adopt the concept, without an appropriate study of the state in which knowledge spillover and creativity occur on the territory can lead to the failure of such operations. In this way, the term risks of being emptied of its meaning, of its potential, "chewed and spit out", in Landry's words, outside the next slogan for a new society. (Landry, 2005)

1.3.3 Multi-locality, co-working and co-making

Contemporary cities are subject to the growing phenomenon of working in multiple places, including home, office, public place or shared working space through the use of ICT technology, which has enabled more flexible and mobile working habits. This phenomena reflects the analysis of Castells about digital network and how rapid information through the Internet has enabled the creation of a more flexible social, economic and cultural "architecture and geometry" in our cities (Castells, 2009). A change in the working environment is today a global fact, not only noticed by the private real estate sector, which is the largest actor in the development of this new working dynamics, but also investigated by public entities and research institute[5].

The dichotomy between work and living space, strictly present in the modern idea of the city through zoning practices and mono-functional urban planning, was firmly criticized by authors as Jane Jacobs, Patrick Geddes, and Lewis Mumford. They emphasized what could improve the everyday life experience over how the city might be shaped. A revision that, if it has not taken place through a growing awareness of planners concerning the limits that restricted zoning can cause, is being conveyed through a direct response by people to the new logic of digitalization and the limits that its advent has thrown down.

5 See for example Eurofound and the International Labour Office (2017), Working anytime, anywhere: The effects on the world of work, Publications Office of the European Union, Luxembourg, and the International Labour Office, Geneva. Eurofound (2019), The future of manufacturing in Europe, Publications Office of the European Union, Luxembourg.

Information and communication technologies opened the way to the superposition of function supported by a change in leisure and working experience of people occurring in diverse digital and physical places. While planners are still striving to describe new forms of multi-functionality, the closely related phenomenon of multi-local working has intercepted especially semi-private and public recreational space, as libraries, coffee shops or public squares, including also the time "in-between" while commuting to work (Hilti, 2009). As Di Marino and Lapintie argued in their several works on the topic, while *Multi-locality* has been mainly studied in the field of sociology, geography, organizational studies and anthropology, this theme has entered the architectural and urban planning debate only in recent times (Marino et al., 2018).

The complexity of the socio-spatial dynamics that Multi-locality calls to action is a challenging perspective, especially for architects and planners. Contemporary formal and informal practices are asking to change the design approach, passing from a rigid spatial and functional definition, regulated by precise and optimized standard rules, to a greater if not total space flexibility able to convey different use during time. As Multi-locality is a phenomenon primarily related to a part of the population that does not live in the place, moving daily-to-weekly to perform working tasks, Di Martino and Lapintie suggest that space organization should meet multi-local workers' habits and needs. A change of perspective from planning practice based on the number of permanent residents to multi-local communities, which consume a more extensive range of services out of a formal place of domicile (Knudsen, 2018).

In the working organization, the phenomenon of multi-locality is changing the social and spatial dynamics regulating office and factory space. As new types of employment contracts are becoming common, companies are proposing different office layout in order to accommodate the transition towards these new visions and work experience. The enclosed office workspace is substituted by not assigned desk in open space commonly organized around social areas, such as kitchens or small living and relax rooms, as a response to workers' needs (Florida, 2014). As indicated by van Meel and Vos, new working space no longer looks like cubicles, but are transparent, open, playful spaces with an identity (van Meel & Vos, 2001).

An example of this transition is described by the work of Clive Wilkinson Architects, who designed workplaces from Google, Microsoft, BMW, and Accenture among many others. In an interview with Claire Thomas for the online architectural magazine Dezeen, Wilkinson describes his interest for interior as a process addressing "psychological issues":

«One of the reasons I really like workplaces and interiors is that the impact on humanity is much more powerful than dealing with inert architectural shells, or the decorative outside dress of a building» (Howarth, 2014)

«Cubicles are the worst, like chicken farming. They are humiliating, disenfranchising and isolating» (Howarth, 2014)

«Workplace culture can be supported in a very sophisticated way by work tools, and work settings that are customised to different kinds of work - both individual and collaborative. That's the future.» (Howarth, 2014)

The changing nature of workspace design and the growing needs of multi-loThe changing nature of workspace design and the growing needs of multi-local workers are part of the rise of on-demand shared space in which flexible, collaborative and independent work has found a valuable resource to maintain social interaction and flexibility. Social cohesion and the search of more concentration or inspiration proved the lack of adaptability of working at home as in coffee shops or other public space, where social isolation or various distractions often become a disadvantage for flexible workers (Huwart et al. 2012; Olma & Sebastian, 2012, Spinuzzi & Clay, 2012)

These reasons have given strength to the birth and growth of co-working space, as a response to today's working needs in a knowledge-based economy, requiring competence such as critical thinking, communication, problem-solving and creativity in different fields of knowledge. Since such skill cannot be easily learned from publications, scholars have noticed that users choose co-working realities as places where these required competencies can be trained and improved (Bilandzic & Marcus, 2013; Lumley, 2013).

The "Global Coworking Survey 2018" provided by Deskmag, a platform entirely dedicated to co-working, indicates a 23% customer growth in individual spaces and the steady expansion of the most profitable co-working. Similarly, the survey shows that two out of three co-working are planning to expand their space by 70%, a third of them is planning to open another branch, increasing the number of 19,000 co-working companies already opened worldwide, which are hosting 1.7 million workers (Foertsch, 2018). These communities are not only attended by traditional categories described in the literature as freelancers, self-employed or creative people, but there is a growing participation of entrepreneurs and employed of private and public sectors. Co-working usually involves participatory activities that enhance collaboration, mutual support and the sharing of ideas among the co-working community. Some of them are designed around particular business communities. The spaces can also serve so-called "makers" by granting the access to shared cost facilities, including tools, optimized space and machine-shop equipment that empowers fabricating and prototyping (Kojo & Nenonen, 2017; Gratton & Johns, 2013)

Co-working places provide adaptability to their users, including economic efficiency and therefore, risk management in terms of flexible leasing policies. Self-employed people can benefit from utilizing and pay for a workspace only when space is needed. At the same time, the organization could deal with rapid exit and entry strategies when entering new market areas. Changes in work organization and workers habits are asking for a profound transformation of city space to accommodate a function remix and a higher level of flexibility, accommodating individual purposes as well as cultural group needs. The working space and its ongoing changes are the first visible and significant change of a process which is gaining importance in all spheres of city life and organization, including also the organization of political and social structure. The appearance of co-working and co-living space is an example of how different needs of a social group could find a specific output in the creation of community spaces, in a self-organized shared machine shop as well as public space occupation.

1.3.4 Community creation and enhancement

Collaboration space as coworking and shared machine shops are some of the key elements to create and grow the urban innovation ecosystem and experimental practice in cities. In recent times with the emergence of community forms of production the freedom of experiment has gained a major role. In contrast to the limitations embedded in hierarchies of formal organizations, co-making and co-working space provide settings where users are primarily intrinsically motivated and free to join and leave these communities, causing an increased freedom to experiment. (Dickel et al., 2014).

Co-working and co-making space are the manifestation of the so-called sharing economy business models, pooling resources to time-share costly equipment. Even if the last decade saw the rise of the “Maker Movement” and the worldwide spread of “Fablabs”, co-making spaces are currently playing a minor role in the production of knowledge, social organization and wealth (Troxler & Maxigas, 2014). Despite an intense hype around the shared idea of co-making, the last decades saw the birth and failure of places like Techshop, which were not able to create a strong local community to cover management costs. Although the appearance of places like shared machine shops is not a new phenomenon, contemporary examples show the presence of a resilient community organized around the production of physical goods. They are prominent laboratories in both their practices and products: as innovative forms of social organizations, space use and urban transformations and as developers of technological prototypes and craft objects proposing new ideas of the future.

The important role of these spaces within the urban context is supported by the studies carried out by Cohendet, Grandadam and Simon on the anatomy of the creative city. They developed a model made up of three different layers, the upperground, the middleground and the underground, to describe the essential components for the development of a creative process in an innovative local context. Each of these layers intervenes with specific characteristics within the creative process, allowing new ideas and products to pass from an informal micro level to a formal macro-level, enriched and transformed to come out on the market.

The upperground represent the layer of formal institutions and firms whose role is to bring creative ideas and develop products for the market. On the contrary, the underground is constituted by individuals as artists, makers, designers who are not directly connected to the commercial and industrial world.

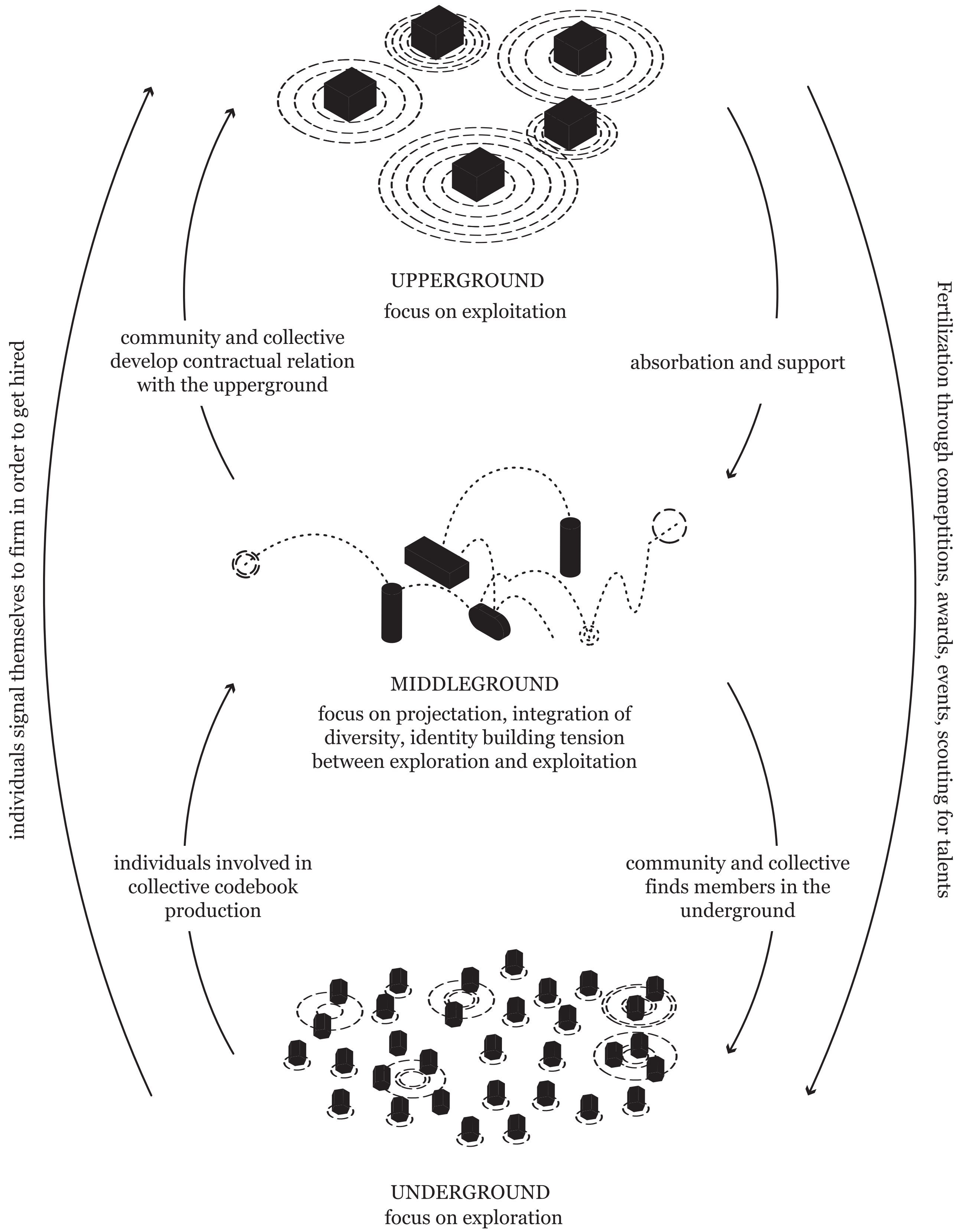


Figure 9. The Anatomy of the Creative city. It describe the relation between the underground, the middle-ground and the upper-ground Adapted from Cohendet et al., 2010.

In between the underground and the upperground, authors indicates the key role played by the middle ground, as an element of connection between the two worlds. *"The middleground is the essence of the creative city and the cornerstone to understanding how the creative, artistic and cultural industries on one side and the individuals who work in related occupations on the other side interact in creative processes."* (Cohendet et al., 2010: 92)

They describe the middleground as an intermediate structure liking the underground and the upperground, constantly moving between formal and informal relations and acting as a means to promote exploration and exploitation mechanism simultaneously (Cohendet et al., 2010: 97). The middleground appears structured as a community, a dynamic network where technical and artistic knowledge is interpreted, cultivated and used to support the creative ideas found within the local milieu. The middleground represents a network of connections, relationships, and interrelatedness between creative individuals which highlights the importance of collective forms in the process of creation (Fleming et al., 2016)

The rise of co-working and co-making space suggest the idea that today, particularly within urban contexts, there is a need for physical and material infrastructure, which offers space for experimentation through making, as well as a social and aggregation space. It supports communication and exchanges between individuals, today strongly intermediated by digital mediums.

The rise of the Internet made it possible to interact with people across the globe, but also share ideas, contents and information which might contribute to the emergence of innovation. This process raised the idea of "open innovation" (Chesbrough, 2011) and the possibility for users to scale their products thanks to a global community interested in participating in the optimization of a product (Anderson, 2012). With the current focus on the effect of networks and digital media, it is easy to overlook the relevance of physical spaces of innovation. However, especially when the result of a coordinated effort is not an immaterial good but something tangible, physical infrastructures and material resources beyond digital platforms are necessary. Co-making spaces are an excellent example of these new laboratory spaces.

With the maker economy projected to hit 8.41 billion dollar in 2020, it is worth asking whether we are witnessing the birth of a durable movement or another trendy notion about civic innovation[6]. The physical infrastructure of co-working and co-making spaces can only be efficiently exploited by actors located in a defined geographic radius. It required an expensive initial investment for equipment, training staff and space organization, as well as confront themselves with the real estate sector for the acquisition of a suitable space.

After the first investments, the most notable difficulties of these places turned

6 Bajarin, T. (2014, May 19). Why the Maker Movement Is Important to America's Future. Time. https://time.com/104210/maker-faire-maker-movement/

out to be the difficulties to scale the business and maintaining an active community. While most of co-working are for-profit spaces are subject to the payment of a fee for memberships, other structures as FabLabs, maker spaces or hackerspaces are usually organized as a no-profit business with the consequent increase in long-term economic difficulties.

In order to establish a sustainable platform, co-making spaces need to offer organizational and institutional stability while supporting local community programs, educational support and opportunity, and above all grassroots economic growth (Holman, 2015). While the role of co-making space in education and innovation is extensively discussed, the physical infrastructure they built is an example of how new business model for production could share a significant function in public and social life. They are identified with an additional role as social spaces, supporting wellbeing, by serving the needs of the communities, reaching subcultures and excluded groups.

1.3.5 Craft culture and education

A making renaissance is underway (Rossi, 2017). The craft revival we are witnessing does not only concern the attention of some segments of the global market to buying and selling handmade objects, but it also emerged as a critical review on the characters and value of craft culture and making culture. From the last decade, craft culture is experiencing a renovated importance as an economic, educational and cultural act analyzed and studied in different areas of social studies.

First of all, Craft culture gained importance as an enabler of meaningful relationship with the material world in contrast to today cultural homogenization and a poor quality both in terms of materials and value of the products on the market. As described by the sociologist Richard Sennet in *"The Craftsman" «craftsmanship names an enduring, basic human impulse, the desire to do a job well for its own sake»* (Sennet, 2008) Moreover, a renewed attention to material value guides to rediscovering the importance of personal relationships, of the story that exists behind each object, a value that goes far beyond the digital markets in which we buy most of the products we consume. The figure of the consumer-citizen arose more recognizably in the late twentieth century with more conscience of the risks, consequences and the planetary costs of consumption (Featherstone 2009, p. xvii; see also Soper 2004). Within a growing global market supported by digital infrastructure, many users begun paying attention to the quality of the items they purchased, also supported by an increasingly individualistic society where authenticity and uniqueness is a way of communicating what we are through what we buy.

It calls back the words of Walter Benjamin in *"The Work of Art in the Age of Mechanical Reproduction"*. The author reflected on the loss of the intrinsic symbolic value of the art piece, due to the advent of modern industry. Mass production annihilate under its weight the uniqueness of objects, flatting the profound symbolic meaning to a purely aesthetic, reproducible, market value. The uniqueness, described by Benjamin, has been translated in the idea of "limited edition" becoming part of the today marketing strategy adopted by companies for selling their products. In the same way, Manufacturing technologies and just-in-time production enable the development of "mass customization" where customers are part of the process of production of objects. This made it possible to develop a virtuous participatory process of customers, or increase the attention to product quality, or just be utilized as a marketing operation.

Uniqueness and quality favoured the comeback of craft culture, but the real engine of a new making renaissance was the spread of internet technologies that led to a global demand of handmade practice and goods in a way not seen since 1970, as Susan Luckman investigated in her book "*Craft and the Creative economy"*. Craft popularity and its potential market was always limited to local relationships, as happened for the Arts and Crafts Movement (Luckman 2012). However, today the intersection of local with global empowers the contemporary handmade economy thanks to international marketing and distribution making visible the importance of the by the *"long tail"* (Anderson, 2012), leading to the growth of online communities of making (Gauntlett, 2011) and the resurgence of the interest in small-scale localized production.

The interest in making is not only related to the economic aspect but also reflect a changing mentality in education and learning process. The anthropologist Tim Ingold has studied in detail the educational and learning value that occurs through the act of making. The author described it has a process of growth (Ingold, 2013, p 21) that start with an idea in mind, a flow of consciousness about what we want to achieve and through the processing of raw material we produce an artifact. The type of knowledge involved in the two steps, the generation of an idea and its materialization into an object, is different. The development of an idea into an object involved a deep knowledge of the material and its constraints, together with the mastery of the technique to be applied.

"Suffice it to say, at this point, that even if the maker has a form in mind, it is not this form that creates the work. It is the engagement with materials. And it is therefore to this engagement that we must attend if we are to understand how things are made" (Ingold, p. 22)

Today the value of knowledge produced experimenting with the material world is recognised by teaching organisations, both elementary and specialists. Schools are developing structures similar to maker spaces to support frontal lessons with the experimentation and construction of object. As the digitalisation of society evolves, education must provide all children with the opportunity to not only use digital technologies and computers program but also provide the knowledge to design and develop them. Without this competencies, it results hard to comprehend the nature of our digital society, and critical thinking on it will be even more critical in the future. (Eriksson et al., 2018). This deficit does not only concern the ability of the younger generations to understand digital technologies: scholars have also noted that the development of economies based on knowledge and services, has created a skills gap in the productive sectors.

The combination of frontal lessons with a practical approach is even more evident in technical schools and universities, as demonstrated by the ever more constant presence of research centres, accelerators, and incubators within these teaching structures. A compelling case is presented by the RDM Campus in Rotterdam, hosting an MBO (middle-level applied education) and HBO(university of applied sciences), a start-ups incubator and SMEs under the same roof. The structure is equipped with state-of-the-art laboratories, machine shops and rooms where students can practice and participate in real-life projects of companies. This makes RDM an interesting place for students and invites young people to opt for a technical study. Another example is the Manufacturing Technology Center (MTC) in Coventry, established in 2010 as an independent Research & Technology Organisation (RTO) with the objective of bridging the gap between academia and industry. It represents one of the most significant public sector investments in UK manufacturing for R&D but also Training, Advanced Manufacturing Management and Factory Design. The facility today is hosting more than 700 people between student and employs involved in industrial projects developed with more than one hundred affiliated companies.

In the architectural field, the merging characteristics of the school, as a learning space, and those of the factory, as a making space, leads to questioning what will be the characteristics of these places in the future. The philosopher Wilem Flusser, in his essay on the nature of the factory comes to the same conclusions: the factory and the school will tend to become the same place.

Bibliography

Aage, T. and Belussi, F. (2008) From fashion to design: creative networks in industrial districts, Industry and Innovation, 15(5), pp. 475–491.

Anderson, C. (2013). Makers. Il ritorno dei produttori. Per una nuova rivoluzione industriale. Rizzoli.

Aoyama, Y. and Izushi, H. (2003) Hardware gimmick or cultural innovation? Technological, cultural, and social foundations of the Japanese video game industry, Research Policy, 32(3), pp. 423–444.

Arup. (2015). Rethinking the factory.

Arvidsson, A. (2007) Creative class or administrative class? On advertising and the "underground", Ephemera, Theory and Politics in Organizations, 7(1), pp. 8–23.

Baines, T., Smart, P., & Lightfoot, H. (2013). The servitization of manufacturing: A systematic literature review of interdependent trends. International Journal of Operations & Production Management, 33(11/12), 1408–1434

Bajarin, T. (2014, May 19). Why the Maker Movement Is Important to America's Future. Time. https://time.com/104210/maker-faire-maker-movement/

Barbiero, F., Blanga-Gubbay, M., Cipollone, V., DeBacker, K., Miroudot, S., Ragoussis, A., Sapir, A., Veugelers, R., Vihriälä, E., B. Wolff, G., & Zachmann, G. (2013). Manufacturing Europe's future (R. Veugelers, Ed.). Bruegel.

Bathelt, H., Malmberg, A., & Maskell, P. (2004). Clusters and Knowledge: Local buzz, Global Pipelines and the Process of Knowledge Creation. Progress in Human Geography, 28(1), 31–56.

Benjamin, W. (1969). The Work of Art in the Age of Mechanical Reproduction (H. Zohn, Trans.). Schocken Books.

Bilandzic, M., & Marcus F. (2013). "Libraries As Coworking Spaces: Understanding User Motivations and Perceived Barriers to Social Learning." Library Hi Tech 31 (2): 254–273.

Botsman, R., & Rogers, R. (2010). What's Mine Is Yours: The Rise of Collaborative Consumption (International ed. edizione). Harperbusiness.

Branzi, A. (2006). Modernità debole e diffusa. Il mondo del progetto all'inizio del XXI secolo. Ediz. Illustrata. Skira.

Castells, M. (2009). The Rise of the Network Society, The Information Age: Economy, Society and Culture Vol. I (2nd ed.). Blackwell.

Caves, R. (2000) Creative Industries: Contracts between Art and Commerce, Cambridge, MA: Harvard University Press.

Cohendet, P., Grandadam, D., & Simon, L. (2010, February 24). The Anatomy of the Creative City. Industry and Innovation, 17(1), 91–111.

Collins, H. & Evans, R. (2002). The Third Wave of Science Studies: Studies of Expertise and Experience. In: Social Studies of Science 32 (2): 235–296.

Davis, S.M. (1989) From "Future Perfect": Mass Customization. Planning Review, 17, pp. 16-21.

Dickel, S., Ferdinand, J.-P., & Petschow, U. (2014, October). Shared Machine Shops as Real-life Laboratories » The Journal of Peer Production. The Journal of Peer Production, Shared Machine Shop(5). /issues/issue-5-shared-machine-shops/peer-reviewed-articles/shared-machine-shops-as-real-life-laboratories/

Drath, R., & Horch, A. (2014). Industrie 4.0: Hit or Hype? [Industry Forum]. IEEE Industrial Electronics Magazine, 8(2), 56–58.

Drazin, R., Glynn, M. A. and Kazanjian, R. K. (1999) Multilevel theorizing about creativity in organizations: a sensemaking perspective, Academy of Management Review, 24, pp. 286–307.

Drucker, P. F. (1992). The Age of Discontinuity: Guidelines to Our Changing Society (2 edition). Transaction Publishers.

Easterling, keller. (2016). Extrastatecraft. The Power of Infrastructure Space. Verso.

Eurofound (2019), The future of manufacturing in Europe, Publications Office of the European Union, Luxembourg.

Eurofound and the International Labour Office (2017), Working anytime, anywhere: The effects on the world of work, Publications Office of the European Union, Luxembourg, and the International Labour Office, Geneva.

Featherstone, Mike (2009) Consumer Culture and Postmodernism, 2nd ed. London:

Sage.

Fleming, L., Mingo, S. and Cheng, D. (2007) Collaborative brokerage, generative creativity and creative success, Administrative Science Quarterly, 52(3), pp. 443–475.

Florida, R. (2014). The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community, and Everyday Life. Basic Books.

Flusser, V. (2014). Gestures. University of Minnesota Press.

Foertsch, C. (2018, September 18). The 2018 State of Coworking Spaces. http://www.deskmag.com/en/the-state-of-coworking-spaces-in-2018-market-research-development-survey

Ford, H. (2013). My Life & Work—An Autobiography of Henry Ford. CreateSpace Independent Publishing Platform.

Francke, M., ten Kate, M., & Wessels, R. (2016). The Productive city. AIBR Rotterdam.

Gauntlett, D. (2011). Making is connecting: The social meaning of creativity from DIY and knitting to YouTube and Web 2.0. Polity Press.

Gerbert, P., Lorenz, M., Rüßmann, M., Waldner, M., Justus, J., Engel, P., & Harnisch, M. (2015, April 9). Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries. Https://Www.Bcg.Com. https://www.bcg.com/publications/2015/engineered_products_project_business_industry_4_future_productivity_growth_manufacturing_industries.aspx

Giedion, S. (1948). Mechanization Takes Command: A Contribution to Anonymous History. University of Minnesota Press.

Grabher, G., Ibert, O. & Flohr, S. 2008. The Neglected King: The Customer in the New Knowledge Ecology of Innovation. In: Economic Geography 84 (3): 253–80.

Gratton, L and Johns, T (2013) The third wave of virtual work. Harvard Business Review, 91 (1-2). pp. 66-73.

Grieves M, Vickers J (2017) Digital Twin: Mitigating Unpredictable, Undesirable Emergent Behavior in Complex Systems. In Kahlen F-J, Flumerfelt S, Alves A (eds.): Transdisciplinary Perspectives on Complex Systems: New Findings and Approaches, Springer International Publishing, 2017, 85-113.

Guangjie, R., & Gregory, M. (2007, July 12). Servitization in Manufacturing Companies: Forming an Academic Field with Meaning, Stocktaking and Coherent Inquiries. POMS College of Service Operations and EurOMA Conference, London Business School.

Hartley, J. (2005) Creative Industries, Malden, MA: Blackwell Publishing.

Helo, P., Gunasekaran, A., & Rymaszewska, A. (2017). Servitization: Service Infusion in Manufacturing. In Designing and Managing Industrial Product-Service System. Springer.

Hermann, M., Pentek, T., & Otto, B. (2016). Design Principles for Industrie 4.0 Scenarios. 49th Hawaii International Conference on System Sciences.

Hidalgo, C. A., Balland, P.-A., Boschma, R., Delgado, M., Feldman, M., Frenken, K., Glaeser, E., He, C., Kogler, D. F., Morrison, A., Neffke, F., Rigby, D., Stern, S., Zheng, S., & Zhu, S. (2018). The Principle of Relatedness. Papers in Evolutionary Economic Geography (PEEG), 1830.

Hilti, N. 2009. “Here, there and in-between: On the Interplay and Multilocal Living, Space and Inequality.” In Mobilities and Inequalities, edited by Timo Ohnmacht, Hanja Maksim, and Manfred M. Bergman, 145–163. Burlington: Ashgate.

Huwart, J., Giordano D., and Philippe V. (2012). Coworking: Collaborative Space for Microentrepreneurs (Technical Note #1). Brussels: European Business and Innovation Centre Network EBN;

Howarth, D. (2014, March 17). Clive Wilkinson interview about office design for Google. Dezeen. https://www.dezeen.com/2014/03/17/office-design-google-clive-wilkinson-interview/

Howkins, J. (2001). The Creative Economy: How People Make Money from Ideas. Penguin.

Illeris, S. (1996). The service economy: a geographical approach. Chichester: Wiley.

Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. The Quarterly Journal of Economics, 118, 577.

Knudsen, J. P. (2018). “Vicarious Habitation – Reinterpreting the Role of Peripheral Living in a Nordic Context.” European Planning Studies 26 (2): 279–296.

Kojo, I., & Nenonen, S. (2017). Evolution of co-working places: Drivers and possibilities. Intelligent Buildings International, 9(3), 164–175.

Kühnle, H., & Bitsch, G. (2015). Foundations & Principles of Distributed Manufacturing: Elements of Manufacturing Networks, Cyber-Physical Production Systems and Smart Automation. Springer International Publishing. https://doi.org/10.1007/978-3-319-18078-6

Landry, C. (2005). Lineages of the creative city. Creativity and the City: How the Creative Economy Changes the City, 42–54.

Liebowitz, S.; Margolis, S. (September 2000). Path Dependence. In Bouckaert, B.; De Geest, G., (eds.) "Encyclopedia of Law and Economics", Volume I. The History and Methodology of Law and Economics. Cheltenham: Edward Elgar. p. 981-998

Luckman, S. (2013). The aura of the analogue in a digital age: Women's crafts, creative markets and home-based labour after Etsy. Cultural Studies Review, 19(1), 249–270.

Lumley, R. (2013). "A Coworking Project in the Campus Library: Supporting and Modeling Entrepreneurial Activity in the Academic Library." New Review of Academic Librarianship.

Machlup, F. (1962). The Production and Distribution of Knowledge in the United States. Princeton University Press.

Marino, M. D., Lilius, J., & Lapintie, K. (2018). New forms of multi-local working: Identifying multi-locality in planning as well as public and private organizations' strategies in the Helsinki region. European Planning Studies, 26(10), 2015–2035.

Neely, A., Benedettini, O. and Visnjic, I. (2011) The Servitization of Manufacturing: Further Evidence. 18th European Operations Management Association Conference, Cambridge, 3-6 July 2011.

Netopia (2013). Forum for the Digital Society. 3D Printing: Technology and Beyond. http://www.netopia.eu/wp-content/uploads/2013/11/3D-Printing-Technology-and-Beyond.pdf

Olma, Sebastian. (2012). The Serendipity Machine: A Disruptive Business Mole for Society 3.0. Creative Commons;

Porter, M. E. (1998). Competitive Advantage: Creating and Sustaining Superior

Performance. Free Pr.

Porter, M. E. (1998, November 1). Clusters and the New Economics of Competition. Harvard Business Review, November-December 1998.

Rappaport, N. (2014). Vertical urban factory. Actar.

Ren, G., & Gregory, M. (2007). Servitization in manufacturing companies. 16th frontiers in service conference, San Francisco. CA.

Rifkin, J. (2013). The Third Industrial Revolution: How Lateral Power Is Transforming Energy, The Economy, and The World. Griffin.

Romer, P. M. (1990). Endogenous Technological Change. Journal of Political Economy, 98(5, Part 2), S71–S102. https://doi.org/10.1086/261725

Rosés, J. R., & Wolf, N. (2018). Regional Economic Development In Europe, 1900-2010:A Description Of The Patterns (No. 278; Economic History Working Papers). London School of Economics and Political Science.

Rossi, C. (2017, February 7). Craft contains the critical thinking that could unpack the current state of architecture. The Architectural Review. https://www.architectural-review.com/essays/craft-contains-the-critical-thinking-that-could-unpack-the-current-state-of-architecture/10016445.article

Samuels, I., Panerai, P., Castex, J., & Depaule, J. C. (2004). Urban Forms. The death and life of the urban block (1 edition). Architectural Press.

Sassen, S. (2009, November). Cities Today: A New Frontier for Major Developments. ANNALS, AAPSS, 626, 53–71.

Sassen, S. (1991). The Global City: New York, London, Tokyo. Princeton University Press.

Saval, N. (2014). Cubed. A Secret History of the Workplace. Doubleday.

Schleich, B., Anwer, N., Mathieu, L., & Wartzack, S. (2017). Shaping the digital twin for design and production engineering. CIRP Annals, 66(1), 141–144.

Sennett, R. (2013). L'uomo artigiano (A. Bottini, Trans.). Feltrinelli.

Snellman, K., & Powell, W. (2004). The Knowledge Economy. Annual Review of Sociology, 30, 199–220.

Soper, Kate (2004) ‘Rethinking the “Good Life”: The Consumer as Citizen’, Capitalism, Nature, Socialism, 15(3): 111–16.

Spinuzzi, Clay. (2012). “Working Alone Together: Coworking as Emergent Collaborative Activity.” Journal of Business and Technical Communication 26 (4): 399–441.

Storper, M., & Venables, A. J. (2004, August). Buzz: Face-to-face contact and the urban economy. Journal of Economic Geography, 4(4), 351–370.

Sturgeon, T. J. (2002). Modular Production Networks: A New American model of Industrial Organization (MIT Working Paper IPC-02-003). Industrial Performance Center.

Sullivan, L. H. (1896 march) The tall office building artistically considered. in Lippincott’s Magazine. pp. 403-409

Troxler, P., & Maxigas (Universitat Oberta de Catalunya). (2014, October). Editorial note: We now have the means of production, but where is my revolution? » The Journal of Peer Production. The Journal of Peer Production, Shared Machine Shop(5). /issues/issue-5-shared-machine-shops/editorial-section/editorial-note-we-now-have-the-means-of-production-but-where-is-my-revolution/

Tschumi, B. (1994). Architecture and Dysfunction. MIT Press.

van Meel, J., & Vos, P. (2001). Funky offices: Reflections on office design in the ‘new economy’. Journal of Corporate Real Estate, 3(4), 322–334. https://doi.org/10.1108/14630010110811661

Ward, Y., & Graves, P. A. (2007). Through-life Management: The Provision of Integrated Customer Solutions By Aerospace Manufacturers. International Journal of Services Technology and Management (IJSTM), 8(6), 455–477.

Winden, W. van, Carvalho, L., van Tuijl, E., & van den Berg, L. (2011, January 25). What role for manufacturing industries in the urban knowledge economy? Production - People - Region, Dortmund, Germany.

Winden, W. van, Berg, L. van den, Carvalho, L., & Tuijl, E. van. (2013). Manufacturing in the New Urban Economy (1 edition). Routledge.

Yencken, D. (1988). The Creative City. Meanjin, 47(4), 597.

Chapter 2

Evolutionary spatial practice of making: from Proto-industry to the Incubators Model

2.1 Introduction

2.1.1 Spatial organization of production, the rise of the Factory

Architectural research on the themes of work and industrial production, their spatial configuration over time and the current transformations of the relationship between work and living activities must deal with the technical characters and cultural meaning of the building typology of the *Factory*, the production space par excellence of our time.

Dealing with the factory space raises the necessity to investigate what characters and parameters are needed to define a building as a factory and how this space has changed over the last century to accommodate a continuous transformation of our way of producing objects. These arguments raise the question of what is a factory today, and what are the fundamental components to define it.

Factory definition states "*A structure in which work is organized to meet the need for production on a large scale usually with power-driven machinery*". Alternatively, "*A building or set of buildings where large amounts of goods are* *made using machines*"[1]. Through the analysis of these definitions, it appears that to mark off a building as a factory; the following conditions must be present: a large-scale production must take place inside the building, and this production has to be achieved through the use of machines. It turns out that the elements that define a building as a factory are the objects that are contained within it, namely industrial machines.

However, what happens when production stops in the Factory? When there are no more machines inside? Can we still call these spaces as factories or should we give a new name to these places? Furthermore, if these places are no longer Factory, what are they? Today the definition of the Factory is still determined by what has been the modern Factory, a space developed from the technical improvements introduced with the industrial revolution, characteristics that today may have undergone significant changes. These questions lead to a mandatory investigation of the characteristics of the factory building, retracing its origins and its evolution by identifying constants and agents of change that can be tools to decode the complex definition of the Factory.

2.1.2 Human relation with production

"Studying factories so as to identify the human being"

Vilém Flusser

The Factory, as we know it, is the result of a process of transformation of the means of production, whose origins date back to the early years of the seventeenth century, but whose common image is rooted in the literature that described its functioning and its social implications at the end of the nineteenth century, through the works of authors such as Charles Dickens, Émile Zola, David S. Landes or Friedrich Engels[2]. A cruel image, describing the problematic and coercive conditions of the workforce, the inequalities produced by the industrial system and the tiring rhythms of the assembly line.

Factories were born from the introduction of mechanization into the processes of simple craft production, such as spinning, weaving, flour milling or steel production, changing the spatial and social dynamics that had characterized craft since ancient times. This transformation of the means of production announced a change in the space and dynamics of the city: on a large scale, with the enlargement and modernization of European cities, due to the necessity for a transport infrastructure capable of satisfying the demand for raw materials and the volume

1 The first factory definition refers to the description on the Encyclopædia Britannica, the second is the definition given by Cambridge Advanced Learner's Dictionary & Thesaurus

2 An interesting description of the condition of labour worker is depicted by Simone Weil in the book, La condition ouvrière. A collection of notes, letters and essays by the French philosopher composed between 1933-34 and 1942 working eight months in large French industries to gain a direct experience of working-class life. (Weil, 1951)

of goods in constant growth. On a small scale, going to weaken and eliminate the small production that was part of everyday life, organized around courtyards and commercial streets characterizing the informal city. Since the city is composed primarily of its inhabitants who live inside its boundaries and direct the complex hierarchy of interactions, flows, infrastructures, commercial relations, as cultural and social occurrence, the change resulted from mechanized production methods and the space used for their purpose, the factory, has consequently produced a transformation of the social context and man's habits.

The idea that man and his nature are intrinsically linked to the modes of production and consequently to space where these processes take shape is the incipit of the text written by Vilém Flusser about the Factory and its identity. In 1999, in his book "*A philosophy of Design*", Flusser dedicates a short chapter to the Factory, organizing his essay on the idea of Homo Faber, a term used to describe the human capacity of producing artefacts with the surrounding nature, turning them to his own advantage in the fight for survival. The term is chosen by the author in contraposition to the zoological term Homo Sapiens Sapiens, declaring the capacity to making as the relevant characteristic of our species.

Flusser looks at the factory with an anthropological attitude, manifested in the incipit of the chapter where the author indicates the motivations that make the factory a place that needs to be studied and analyzed in detail. As making is an essential act of relation to the natural world, the analysis of factory organization in different historical periods allows the interpretation of changes inside social and cultural groups.

"So anybody who wants to know about our past should concentrate on excavating the ruins of factories. Anybody who wants to know about our present should concentrate on examining present-day factories critically. And anybody who addresses the issue of our future should raise the question of the factory of the future" (Flusser, 1999: 44)

Flusser intends the factory as a physical space, a generic working-floor, where Nature, the physical matter is transformed into artefacts by man. A change in the relation between man and Nature is supported by a radical change in factory space, reflecting a cultural transformation of the society. Initially accomplished by hands, whose natural essence is performing transformative acts, men were in direct relation to the natural world. This relation changed rapidly with the introduction of tools and the learning process, taking the place of inherited knowledge and the instinct of primitive hominids. More acquired, learned information is introduced, the more each working space becomes a place where human beings become less natural and more artificial. In the act of making, the artisan is not only producing artifacts but is also making an artisan out of himself. The act of making is a form of knowledge and culture creation. Taking back the incipit of this introduction, factories, are places in which Nature and the characteristics of human beings are always in transformation.

With the introduction of tools, men and Nature are not anymore in direct contact.

Flusser describes this passage as a new form of human existence: man is not any more comfortable in the environment as the primitive man. Estranged from it, he is both protected and imprisoned by culture. Tools act as intermediaries objects between human being, at the centre of a hypothetical universal relational system. Nature stays at his surrounding. The main character of this system of relations is the interchangeable essence of tools: the artisan is seated in the middle of the workshop, and when a tool breaks, he replaces it with a new one.

This type of relationship remains stable from ancient times until the middle of the eighteenth century when the introduction of machines is accompanied by a broad change in the hierarchy of relations. The workspace changes its spatial characters to accommodate a new entity that differs significantly from the essence of elementary tools. Machines are designed to be more efficient, precise and quicker to use, but they are also bigger and expensive, and they required a precise designed space and technology to work. The Second Industrial revolution changed the existence of man again, conveying him out of his culture as the first one, the introduction of tools, has moved him out of Nature. Machines are more valuable, durable and precise in the manufacturing process that human beings, which become subordinate to their process. The machine took the place of man in the middle of the production space, and when a human being becomes old or ill, he is replaced with another one. The machine becomes the constant and human being the variable. Today these established relational forces are questioned by the advent of robots and the essence of their relationship with humans. How will be the Factory of the future? How will these new relationships shape the workspace? These are crucial questions to be answered. Flusser describes the relationship between man and robot as reversible, in continuous change, because robots can be applied for different uses and they are smaller and cheaper than machines.

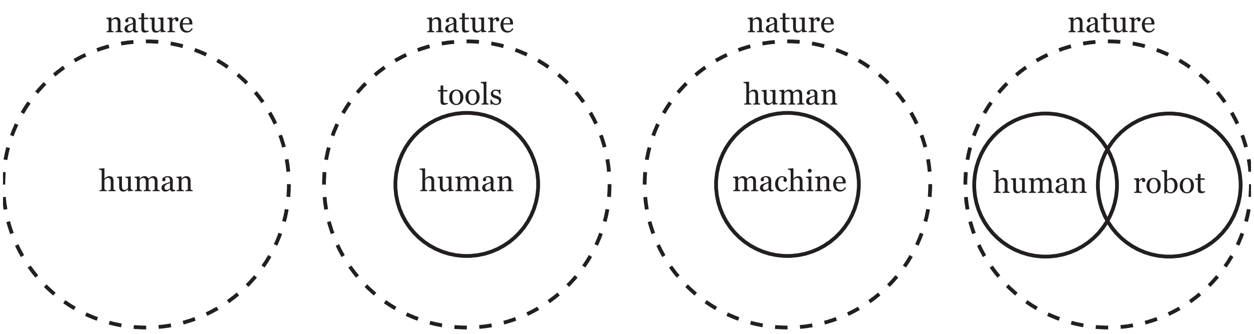


Figure 1: Description of the relation between Man, Nature and Machine based on the text written by Vilem Flusser *"The Shape of Things: A Philosophy of Design"*

Robots need to be in constant relation with human activities, moving forward from the univocal relationship between man and machines, from mechanical interaction to neurophysiological. They can only do what human beings want, but at the same time, human beings can only want what the robot can do. In this relation we could look at the space of the Factory as we were looking at the space of the original working-floor: the symbiosis man-robot results in direct contact with nature, and production could take place everywhere and nowhere. What has radically changed from the pre-tools phase of manufacturing is the type of knowledge employed in this relationship and consequently, since producing is a process of knowledge and transformation of man, the nature of human beings is radically different.

It turned out to be decisive the type of knowledge employed in the different system of production. While primitive production worked on inherited information and the use of available things to be turned to our advantage, tolls asked to acquire information empirically in the act of "learning by doing", making mistakes and refining techniques. Instead, machine functioning started to required not just empirical but theoretical and scientific knowledge, and today robots are calling for a more abstract learning process and the development of interdisciplinary knowledge.

While the rise of machines explains the development of universal education, elementary school for learning how to use machines, secondary schools for learning how to maintain machine and university to learn how to build machine, the passage into robot-human relations ask for a continuous learning process between the two. The human being needs to learn how robots are functioning to permit robots to alleviate him from the task of turning nature into culture. The factory of the future will be a space where humanity will learn how to do this with, by and from robots.

This image of the future Factory depicted by Flusser recalls more the space of laboratory, of the library, of the learning centre where the new entity represented by the man-robot is more similar to the figure of the researcher rather than the artisan or the blue-collar of the early twentieth century. Something appears on the horizon, wondering how the Factory of the future will look like. As the act of turning is today a continuous flow of communication and development of knowledge, the space of the Factory become more similar to the space of the school. In contrast with the classical opinion, which always considered these two places as opposed one to the other, the school representing the place of contemplation and leisure and the Factory denoting the place of making and acting, now these two spaces are taking the same path. When robots start to replace machines in the Factory seems more clear that this new Factory is nothing but an applied school and the school is nothing but a factory for the acquisition of information.

Homo faber becomes homo sapiens sapiens because he has realized that manufacturing means the same thing as learning, i.e. acquiring, producing and passing on information. (Flusser, 1999: 50)

The physical and conceptual transformation of the factory space materializes in the role assumed by research and production centres, where the barriers between product development and making are eliminated in a spatial continuum between ideation and production. This relationship is also visible in the spaces dedicated to education, in the pilot projects intropducing FabLabs into primary and secondary schools or the creation of hybrid spaces in technical institutes where theoretical studies are supported by a learning process based on the concept of "learning by doing", supported by training with local companies. However, this relationship is particularly decisive in university institutes, where applied research is fundamental. Even more than before, manufacturing centres, incubators and interdisciplinary laboratories collect significant investments, playing a vital role for university centres. In these places, international industries and local companies carry out their activities alongside universities, developing joint projects and new technologies.

In the contemporary world, the transformation of the work system through a new human-robot interdependence and the introduction of a renewed relationship between theoretical and practical knowledge is enhanced by the digital infrastructure which has made it possible to fluidify parts of the production process by removing the spatial limit in which these could take place. More and more work functions can be reproduced in environments that have not been designed for this purpose, by reducing the size of the necessary machines and the type of infrastructure required. The digital factory allows the simulation of the processes that only after a complete optimization will actually be carried out in the material space. The human-robot relationship has transformed production models and their impact into our life.

2.2 Craft Production and the development of modern industry

Craft production techniques characterized the creation of objects until the advent of industrialization and the development of standards related to interchangeable parts.

The term *"craft"* derives from the Anglo-Saxon *crseft*, meaning "strength, skill, or cunning," in contrast to "art," which usually implies the intention of producing beauty or pleasure. The two terms are often associated by contemporary scholars as *"Arts and Craft"* due to the difficulties in many societies of differentiating the aesthetic from the strictly utilitarian. In opposition to a conflictual perception between Craft and Industrial production, anthropologists prefer to use the term "technology", referring to the processes of manufacture and the "material culture" embedded in artefacts themselves in an evolutionary trajectory. Since crafts include all activities that produce or modify objects by manual means, with or without the use of mechanical aids, the range of study is vast, as extended is the range of social forms within which the craftsmen operate.

The term *"Craft"* remains today a contested term within arts, crafts, and design circles assuming specific meaning depending on context and historical moments. Usually, it denotes a skill, involving a high degree of "hands-on" craftsmanship rather than just skills with machines.

In pre-modern times, craft production was usually supervised by the guild system. They were professional associations of artisans and merchants who oversaw the practice of their craft and trade in a particular area. The control of guilds over craft production extended on the whole process, from the coaching and training of new apprentices to quality control over the sold product. Their power, usually assigned by the city government, gave them the authority for regulating the maximum and minimum price of goods, the hours of apprenticeship and the number of trainees, as well as reducing free competition while maintaining a high quality of the finished product. However, this control was subject to limits: the boundaries of the city.

Historians disagree about the role that guilds have played within the urban economy. On the one hand, they created a social capital of shared norms, common information and mutual help (Epstein, 2008), but also a collective political action that has a recognized connection with the early form of socialism (Farr, 2000). A structure that benefited guilds members even if arguably could damage outsiders. On the other side, Ogilvie has argued that they regulated trade for their benefit, with restricted entrance into the guild, creating monopolies and distorted markets, reducing the rate of innovation and made society poorer (Ogilvie, 2008; Ogilvie, 2011). Craft production and the guilds govern system had a persuasive influence on the socio-technical system in which they were inserted. The development of industrialization and the consequent falling of the crafting system had a slow but impactful result on the whole society: from the spatial form of production to social relations.

The description of this evolutionary path can be depicted through the analysis of three main elements characterizing craft production: Skills and knowledge, the uniqueness of the objects produced and the relation between craft economy and places, portrayed by material culture and technical traditions. The analysis of these three elements is a guideline thought the complex reality of craft society.

Skills and knowledge sustained the authority of masters craftsmen and Guilds, the system of government and production management in almost all European cities. Guilds system was organized vertically, with a precise division of labour between apprentices, journeymen, and masters. Apprentices were young students who came into the workshop to learn a profession, they were rarely paid, made except for food and lodging, and they had to undergo several years of practice before they could be considered skilled workers. Reached that moment, many of them became journeymen, which allowed them to work as paid employees but not as self-employed master craftsmen. Becoming a master was a much more difficult path, not only did one need to possess higher skills in the processing of materials and technical knowledge above his counterparts but very often this position was accessible only to masters' sons or close people. Moreover, this procedure had to be validated by the guild itself, through an examination that consisted of the realization of a masterpiece, a *"chef d'œuvre"*. The execution of the apprentice's work was based on imitation: one learned the profession by copying (Sennett, 2008: 64). This system has remained almost the same over time, both at the organizational and spatial level.

Skill and Knowledge were the political elements supporting the whole system. In these qualities, resided masters' authority on a strictly vertical working structure

(Sennett, 2008: 66). In turn, the authority of masters and therefore of guilds were empowered and made vulnerable to political authority that ensured their power: the sovereign, the state or the city government. Questioning the validity and values that defined authority was the breaking point of the guild system that disappeared progressively in consequence of changes in social structure and political power which embraced the vision of liberalism.

"Where corporatism embraced the principles of paternalism, hierarchy, and disciplines in the social and political realm, and the economic principle of containing competition and channelling production and distribution toward what was perceived as the public good, liberalism championed the principles of an unregulated or "free" economy based on what was thought to be the "natural" market exchange, individual self-determination, and absolute private property" (Farr, 2000: 277)

As for corporatism, liberalism was strictly related to social taxonomy and the exercise of power, in this case, related to the rise of a new social class, the bourgeois and industrial capitalists. The status associated with the possession of skills and knowledge was being increasingly contested. For masters, the ownership of skills was the frontier to be defended against the unskilled, the number of whom was rising with the burgeoning population of the 19th century. Undermining the status of the artisans was not only the advance of a new social class but also a different model of knowledge of the physical world linked to science and engineering which brought inexorably to a change in the organization of production systems. Mass production and standardization, even more, fragmented the artisanal knowledge. As a consequence of guilds decline, numerous handicraft workers were forced to find employment in the emerging manufacturing industries, using not the traditional guilds techniques but standardized methods controlled by industrialists (Braudel, 1993).

In response, the artisan class, deprived of their status by law, reacted with a continuation of collectivism expression, forced to envision a new paradigm of distinction, founded into independence. Authomomy was pursued by being emancipated from impoverishment and proletarianization, perpetuating a lifestyle that has characterized them and their profession; at the same time maintaining the high quality and uniqueness in their work, making even more evident the differences between those who had access to technique and knowledge and those who were destined to be part of the mass of unskilled workers. This search for independence and uniqueness, in contrast to a growing standardized organization of production, became a sign of distinction, an element of distance to the nascent industrial system. On the other side, the continuous growth of population and the following rise of unskilled labour was the element that fueled the rapid ascension of the industrial system. Capital and technological advancement based their advantage on the ample supply of labour force present in the market.

At the same time, craft production involved a high connection between tradespeople, reflected in the development of a tight connection between communities and places. Craft production requires the development of intimate knowledge of methods of production that happens through the coaching of an experienced worker: a full-time specialization of a skill-set through constant hands-on training in workshops, as well as social engagement. The verbal interaction between teacher and student encourages strong social bonds, which ultimately leads to cohesive cultural groups, typical of modern-day craft communities. The development of craft specialization is also highly related to place: goods are integral to the social relations of a community, linking groups of people together through the creation of tangible items.

Craft production has always been part of the formal and informal economies in many cities. Often consisting of craft neighbourhoods, were craft specialization took the shape of a networked production system (Artigues i Vidal & Mas i Palahí, 2019; Griffiths, 2017). It consisted of subdividing the whole process into different phases and distributing them between different areas, encharging every component of the community of a single step of the complex production process.

This urban structure of production has a vast influence on social organizations, producing phenomenons of clusterization of similar activities in specific areas of the city. An aspect still traceable today thought urban morphology and building typologies as well as in toponymy, even if production ceased from decades. As production activities took place in inner courts and courtyards of medieval blocks, community relations and public life were strongly affected by working organization rhythms. A modern example of a networked production system has been investigated and reconstructed by the research team headed by Bernardo Secchi in the study of the new city plan of Prato[3]. Craft activities are part of the material culture of a defined society, and a change in crafts economies has often coincided with spatial and cultural transformation.

Skill and Knowledge, besides essential qualities for the realization of artefacts, assumed a political and social meaning giving authority to the vertical organization of the guild system. Uniqueness and quality were a technical condition of craft production and elements of contraposition to the rising industrial model which embraced mass production and economy of scale. The industrial system will tend to distance itself from the spatial and cultural context on which the crafting system constitutes itself by proposing new rules of social interaction and space organization. What has resulted drastically changed by the introduction of the modern industrial system was the cohesion of cultural groups and their relation to the belonging place.

3 During the studies for the construction of the urban plan of the city of Prato between 1993 and 1999, the research group led by Bernando Secchi analyzes the industrial production structure of the city. The city of Prato, famous for its textile industry, is represented through the use of different thematic maps, including the phases and the urban structure of the yarn production system. The analysis shows how the production structure, in particular inside the Macrolotto 0, has been divided into the different courtyards forming the urban structure and every courtyard is individually specialized in a particular phase of the process. The maps show the essential collaboration between the various actors in the production chain and highlight how the urban structure is influenced by the technical aspects of production. (Laboratorio Prato PRG, 1996)

“A technical form is indifferent to the social context it finds”
(Braudel, 1993: 323)

2.2.1 Proto-industrialization and the decline of the guilds system

The transition from a craft-based economy thought an industrial model was the sum of different phenomena which occur during an extended period, between the 17th and 18th centuries, influenced by a social factor as purely economic ones. The reformulation of the role of the state in economic activities, the impact of capital accumulation and distribution thought credit, handicraft and provisioning trades undercapitalized and disintegrated facing emergent capital-intensive economies of scale, and the reorganization of labour force assume increasing importance for contemporary historians, taking the same position of factors such as technological innovation, mechanization and factory production, undisputedly recognized as agents of the so-called Industrial revolution (Farr, 2000: 291).

These factors of change in the social and productive organizations of western Europe were at the base of the fiercer struggles between conservative guilds and the merchant class, which increasingly gain capital and control over the means of production. The growing capitals of the merchant class could be utilized to expand production that was already beginning to make use of new mechanized tools. This process happened in the countryside, where guilds’ control over production did not operate. Here entrepreneurs had the freedom to organize a putting-out system, a network of the labour force, in part related to a rural economy, working in their property, workshops or domestic environment, the raw materials provided by the entrepreneur who took a share of the profit. This network system could not be easily monitored, especially for those raw materials that had a vast offer on the market, such as wool.

This long phase of transition into modern industrialization was subject of study by Franklin Mendels in 1972, concerning the rural linen industry in 18th-century Flanders, subsequently expanded by other economic historians in the 1970s and 1980s. Mendels coined the term Proto-industrialization, referring to the intensification of rural manufacturing that occurred in various parts of Europe after 1650, above all in the textile industry for national and international markets. Economic historians further believe that proto-industrialization and the commerce that supplied and sustained it, best explains the early accumulation of capital and the birth of a capitalist economy.

Proto-industrialization was organized into cottage workshops, and the primary production unity was the household. Raw materials were distributed by merchants to farmers and collected after being spun to be again distributed to weavers working looms in their cottage to produce cloth. Merchants would then distribute the clothes to other cottage workers for bleaching and dyeing, and finally collected and sold the material to a wholesaler in a near or distant city. Peasants engaged cottage manufacturing to supplement their income from their farming activities but when textile demand grew after 1650 and especially in the 18th century, proto-industrialization achieve unprecedented scale, even dominating particular region in the Netherlands, northern France, the German Rhineland, Belgium, and above all England (Farr, 2000). As the volume of textiles multiplied, proto-industrialization strengthened marketing networks and contributed to the accumulation of capital to entrepreneurial merchants who in turn sought further sector for investment. Furthermore, because peasant workers were paid cash for their products, they become increasingly integrated into a cash and wage base manufacturing economy. Each of these factors further prepared Europe to make the leap into industrialization.

The putting-out system constituted an example of proto-industrialization, a first stage in the introduction of factory and mechanized manufacturing techniques, causing problems for entrepreneurs. Supervising the production was challenging as managing the final quality of the product or accurately record activities and their cost. Manufacturers resolved this need for control over the entire production process by moving the work into more extensive workshops or factories. By the later nineteenth century, most remaining rural outwork was in marginal trades and was conducted by low-income families.

Proto-industrialization was a significant historical phenomenon because it represented a massive and marked change into the organization and volume of production of goods from the medieval period to the early modern era. Towns and cities were already economically active locations, representing both a concentrated demand and concentrate production.

The putting-out system and urban production are the two faces of the same process of transformation not only related to the productive and economic processes but also for the spatial forms in which these processes took place. The accumulation of capital and the need for strict control to ensure uniformity and quality over all the production phases gave birth to hybrid, and experimental forms of concentration of the rising productive forces resulted in the creation of the first factories.

2.2.2 Relations between the countryside and the city

Proto-industrialization describes the historical phenomenon of the organization of a networked production system in the countryside of many European regions in contrast with the rigid guilds system governing urban regions. The term also refers to the theory of economic development advanced by Mendels in 1972, arguing that proto-industrialization had a direct and causal relationship with the emergence of factory production, assumed to be the fundamental characteristic of the industrial revolution. The textile industry, in particular the cotton manufacturing, was the leader of factory-based industrial development and empirical studies confirmed the theory proposed by Meldels, asserting that the development of the first factories took place in the countryside, in an attempt to concentrate the decentralized cottage production in a single building. It is easy to conclude that the cottage industry, both in its archaic forms of small domestic productions and in its more articulated structure of the putting-out system, has been suddenly replaced by the introduction of factories and the industrial production system during the eighteen century.

More recently, scholar adopted a more evolutionary than a revolutionary approach to the study of industrial development (Farr, 2000), demonstrating that industrialization was a slow and protracted process, occurring not so rapidly and not exclusively in the countryside. City and town were not only centres of trade and finance, but they were also characterized by being vital manufacturing centres, where artisans engaged in multiple industrial activities, improving their manual skills with mechanized tools and new sources of power. In addition to a strong bond that combines city and countryside as elements of the same economic system, in which the campaign supports the urban economy, and conversely, it takes advantage of the city character of being a node of transregional commercial networks, industrialization process produced different experiment in the spatial organization both in the countryside than in the city space. These experiments, rather than arising from a conflict between city and countryside, were the result of different subtended relations and specific territorial organization characterizing European regions.

The relations and conflicts between the two systems must be taken into consideration in the analysis of the spatial transition from a craft productive model into an industrial one. The introduction of mechanized processes did not suddenly destroy craft and small-scale production. On the contrary, this phenomenon created a whole set of possibilities for small commodity procedures. In the mid-nineteenth century in England, industrial production as ironmaking, steelmaking, and sawmilling provided an increase in work for small workshops. The steam-driven factory turned out semi-finished material that still had to be crafted and designed by furniture makers, carpenters, ironmasters in their shops, traditionally organized. Only at the end of the century and even later in parts of Europe, master's workshops were overwhelmed by mechanized factory production in a transition into industrial capitalism. In this transitional phase, those who saw their professional figure radically changed were workers and journeymen, whose contracts in master's workshops were subject to the trend of industrial outputs and market demands.

This transitional phase saw the rise of a different spatial organization of production. In essence, the introduction of small scale industrial machinery into shops, as in the case of Paris, called the city of the "small workshop par excellence", in which an increasing demand was managed by enlarging the division of labour as would be faced by traditional craft economy. The rise of collective production space, as common loom shop in the attics of English weaver's cottages, allowing several looms to be worked at the same time, increasing the profits of the working class or the weaving sheds, a horizontally extended loom shop, where entrepreneurs made available means of production and raw materials for a rental fee. Later examples were the vertical multiple workplace or loft buildings, which had a more visible spreading in the United States but also adopted European territory in smaller numbers. Finally, the rise of the modern factory where architects and engineers spent much of their effort in designing structures, flows and new imaginary through its facade composition.

2.2.3 Pre-modern industrial organizational models

The phase of transition from craft production into the modern industry has been characterized by the development of different systems of production and different spatial organization. Braudel in *Civilisation matérielle, économie et capitalisme* recalls the categorization of pre-modern industrial organization models made by Hubert Bourgin to describe industrial life between the fifteenth and seventeenth centuries. The work of Bourgin, still relevant today, described industrial production as necessarily belonging to one of the following four categories: *manufacturing nebula, scattered factories, the agglomerated factory and factories equipped with machines*. These four categories described the different production model peculiarity as their social and territorial characters.

The first model, the *Manufacturing Nebula*, is described as a set of innumerable, tiny family workshops, formed by a master and two or three workers and apprentices or by two or single family. In each of these elementary units, tasks were unceasing and undifferentiated without a clear and distinct division of work. In this category fall a lot of artisanal activities as the nailer, the knifemaker, or the cobbler and the goldsmith or other non-sectoral activities like bakers, distillers or cheesemakers and butchers. The essential character of this artisanal pre-industry is its ability to resist the capitalist impulses that easily affect more specialized professions, more easily mechanizable. A long list of traditional crafts and craftsmen will remain in business often until the 19th century or even until the 20th century, representing a large part of the whole manufacturing economy. For example, in France, the craft industry will rank in second place compared to modern industry only after 1860 (Braudel, 1993).

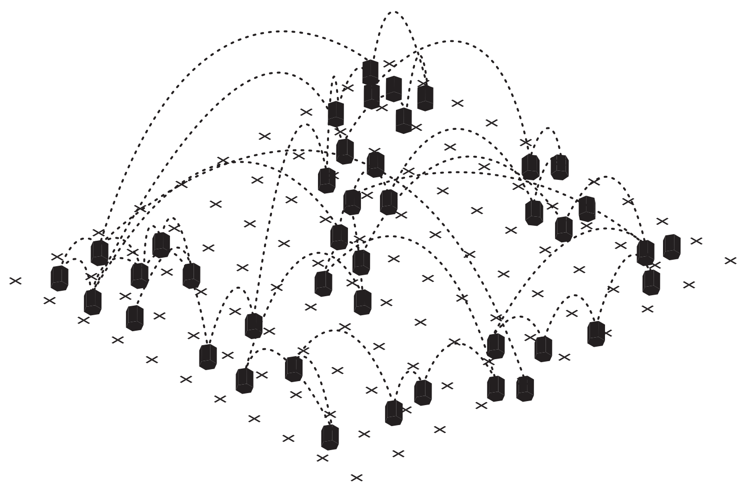


Figure 2 *Manufacturing nebula.* Small craft or family workshops scattered throughout the area.

Small manufacturers did not die out with industrialization; they just took new forms. Although production shrank, countryside families continued to produce food, clothing and other goods for their use or sale. Urban household production also grew. Clothing manufacturers provided sewing and tailoring to home seamstresses, and the mid-nineteenth century development of the sewing machine fostered the expansion of production, particularly among more impoverished and immigrant populations of large cities. Indeed, although its relative economic diminished contribution, household manufacture remained a significant activity throughout all the 20th century.

The second category, the *Disseminated Factories*, represents those realities in which laboratories are dispersed but connected to each other. These are the type of productions that follow the nature of the putting-out system, as subcontracting work. The putting-out system is part of what is called cottage industry which was very common in time where a large part of the population was engaged in agriculture, sustaining the traditional farming with other incomes, especially in the wintertime where there was little work in the fields. It existed as early as the 15th century, but it has increased during the 17th and 18th centuries, becoming a popular system for cloth production but also for the manufacture of wrought iron objects as pins, pots, nails, and pans.

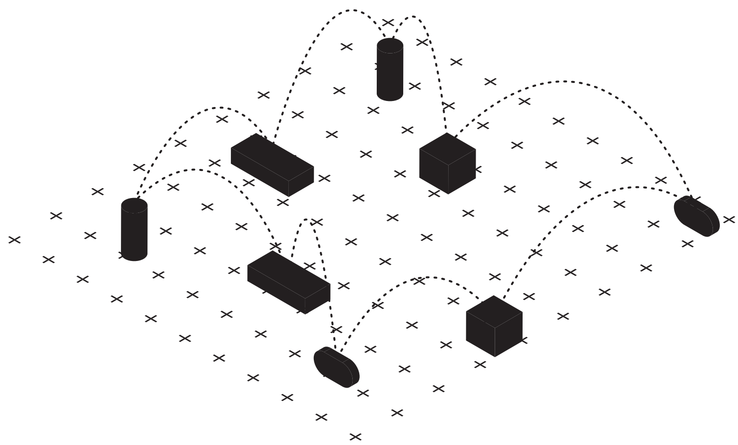


Figure 3 *Disseminated Factories.* Laboratories are dispersed but connected to each other.

The cottage industries had some advantages for workers compared to the industrial systems that were developed later: workers could work in the domestic environment at their speed and children involved in the production were better treated than they would have been in the factory system, even if the toxins from raw material could contaminate houses. The key to its operation was the entrepreneur, who purchased the raw materials, distributed them among the working families, passed the semi-finished products from one artisan to another, and marketed the finished products. Typically, the small artisan would not know about distant markets or of the preferences of distant purchasers and rarely had the money to purchase needed raw materials. The size of the trading networks and the volume of merchandise moving within them made the services of the entrepreneur indispensable and subordinated the workers to his authority.

The third category is represented by the *Agglomerated Factory*. This category was constituted later than the previous ones and characterized the factories in which various operations are brought together in one place. Their characteristic is the concentration in more or less vast buildings, of the workforce, consenting a specific division of labour, and increased productivity and quality control. In this category, Bourgin introduces breweries, tanneries, glassworks or state-owned factories or textile factories developed in the eighteenth century.

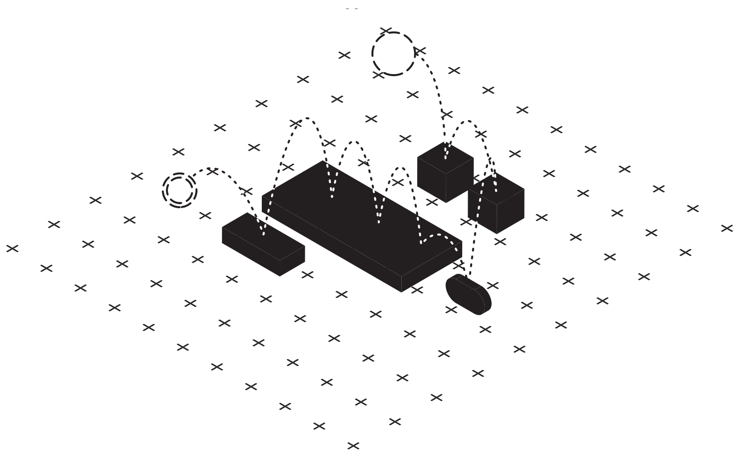


Figure 4 *Agglomerated factories.* Various operations are brought together in one place

The agglomerated factory was the natural evolution of the putting-out system. The entrepreneur who entrusted the raw materials to the processing of the individual families within the putting-out system could not have total control over the quality of the finished product due to the different skills of the artisans and the different processing phases. This problem could be solved by agglomerating some phases of production in large buildings that could contain the machines and workers, thus guaranteeing a constant control over the quality of the product.

Finally, the fourth category includes factories equipped with machines, which exploit the motive power of water or steam. Early factories that contained small amounts of machinery, such as one or two spinning machines and fewer than a dozen workers have been called “glorified workshops” (Landes, 1997). This category will be the one that will give rise to the modern factory through the increasingly extensive use of machines and unskilled labour force.

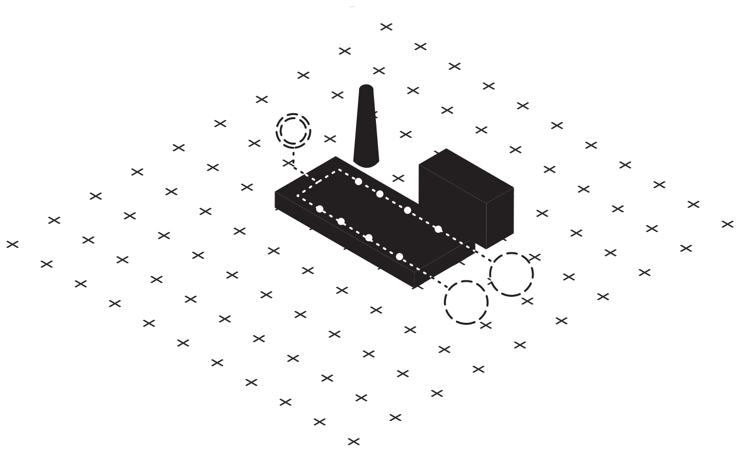


Figure 5 *Mechanized factory.* Factories equipped with machines, which exploit the motive power of water or steam.

2.2.4 The space of production: relation between dwelling and production

Despite differences between European regions, pre-modern production models were characterised by a close relationship with the domestic environment: a relationship of contiguity, in which domestic and productive functions share the same space in a temporal alternation marked by daily functions.

Before the industrial revolution most of the population, both rural and urban, inhabited what Frances Holliss defined as "workhome", a building where dwelling coexisted with working activities[4]. From ancient times the space of the house has always been a working space without barriers to domestic life. Brunskill in his essay on the vernacular architecture described the longhouse, a medieval ordinary single-storey rectangular building, where most of the activities of everyday life took place in a central open space, the living room, enlarged to accommodate simple machinery near the heat and winter light of the fireplace and a long mullioned window to provide natural light during daytime working hours (Brunskill, 1970: 161). Most of the time, the advent of industry and machinery created the necessity for the realisation of a partitioned room for craft activities, usually positioned on the ground floor or in the attics of a two-story house, a "top-shop", as happened in the later cottage industry in England (Brunskill, 1970: 163). These cottage houses where the place of work of watchmakers, silk-weavers or loom-workers, evolved

4 Home-based work was almost universal before the industrial revolution and as a result the majority of pre-industrial buildings combined dwelling and workplace in some way. In medieval times, most people were members of self-sufficient and self-reproducing communities, their lives involving a combination of productive and domestic work, undifferentiated and indistinguishable (Holliss, 2012)

into the cottage factory, consisting of a terrace of top-shops with a steam engine at one end and a single driveshaft linking power-looms in the individual weaving lofts.

Interaction between work and living activities does not only happen within the private domestic space. Craft-workers and merchants had the storefront facing the main street and the workshop in the back, thus allowing the display of products for sale. Sometimes the front space functioned also as a workspace, but most of the time manufacturing activities required the use of a secondary room or building and external space to carry out specific processing. This often happened within the inner courtyards of urban blocks where working activities intertwined with domestic life in a spatial continuum. This proximity interaction was possible thanks to the complex and organic morphology of medieval urban blocks, where a succession of courtyards and buildings created a semi-public space where public and private life blend.

The architectural models combining work and domestic activities, as the shop-house, the weaver's cottage or the workshop, along with their work dynamics, technical knowledge, and social relations, were progressively replaced by new production models raised during the so-called Industrial Revolution. The analysis of the transformations that took place from pre-modern models, based on craftsmanship to the first proto-industrial experiments, for finally reaching complete mechanisation, makes possible to identify permanence and evolution of patterns that today are effective in the identification of characters and spatial forms that a renewed relationship between city and production brings into play.

At the turn of the twenty century, however, social reformers decided that home-based work was undesirable. In some cases, this was true: working and living in the same place could lead to unhealthy situations and severe illnesses and consequently to death. However, in most cases, work had no injurious effects on the home apart from increasing an existing problem of overcrowding, producing instead had a beneficial effect on neighbourhood public life. However, the great urban transformations of the end of the century with the destruction of working-class blocks and courtyards to improve the health conditions of the great European cities, produced the realisation of housing models which not included the possibility of homework, neither in the organisation of the spaces nor in the lease agreements. Concurrently, Ebenezer Howard introduced the idea of the Garden City, proposing the division of the city by functional zoning, adopted with zeal in the newly formulated system for planning and organising the built environment.

The case of Paris, described as the most significant industrial city in the world between 1835 and 1848 (Bouvier, 1972), is an interesting example of a strong commitment between working and living activities, progressively interrupted by the urban transformation and the rationalisation of the block proposed by Haussmann. Haussmann's intervention produced the rationalisation of urban blocks with consequent densification to maximise profitability. In this organisation, the internal courts were often associated with different housing units: they no longer coincided with the single plot, not even to the whole block. On the ground floor, a wall continued to separate the buildings, but at the upper level, the volume of the courtyard was common, overlooked by other with whom it had no direct relationship because they had no access to this side, creating an indirect strategy of control and separation.

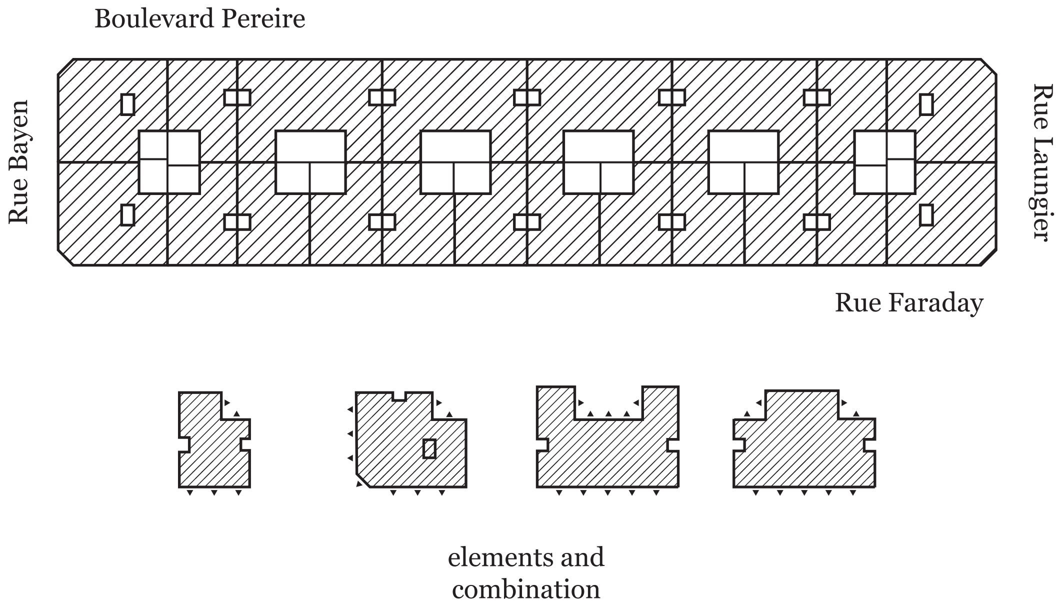


Figure 6. The figure visualized the Haussmann's intervention and the regularization of the urban block with the construction of shared internal courtyards between different buildings block. Adapted from Panerai, 2004.

The pre-haussmann block was instead defined by a dual system composed by the edges and the interior. Edges were directly connected with the street, a place of exchange and presentation, controlled by rules. The interior, on the contrary, was a zone at a distance from the street, cut off from it, a space that was not necessarily seen, without functions of public representation. A malleable, transformable place not subject to the strict rules of the public front, offered to private appropriation, as depicted by Zola in his description of public life and trade in the peripheral neighbourhoods of Paris[5].

The different roles assumed by edges and interior permitted the organisation of complex tissue, making it possible to distribute multiple functions on the block. Usually, the edge, connected to the street, was more rigidly subdivided to permit densification, allowing the interior of the block instead to be used for more extensive land uses and less tight plot subdivision. This space, the interior, was usually the

5 In the book "L'assommoir" Zola describes the peripheral working neighborhood of la Goutte d'Or, a typical working Parisian class neighborhood. Within the description of the neighborhood practices and activities, appears that the center of the block integrated different activities.

space for heavy workshop or industrial establishment, garages, sheds or depots, gardens or public facilities. This duality made it possible to find mixed functions as housing, exchange and workplace or collective facilities in the same block organised by a horizontal hierarchy of courtyards. The Haussmannien block has lost most of its multifunctional qualities. The rigid organisation of the block does not permit the accommodation of spatial changes and diversification. The Haussmann city did not support multifunctionality, altered by social convention so that industry is brought closer to commerce and immediately diverted towards the sphere of the luxurious (Panerai, 2004). The Haussmann city rejected the workplace from the private residential block, substituted by a functionally and rigid organisation losing the richness of its possible articulation.

The case of Paris and Haussmann's urban transformation is a famous example of a diffuse phenomenon in European cities. During the twentieth-century new housing and residential complex were built segregated from both commercial and industrial zone following and interpreting CIAM prescription about the functional city[6]. The critique on zoning practice that followed this process culminated in Jane Jacobs's "*The Death and Life of Great American Cities"* in 1961, followed by an ongoing discussion on the values and qualities of urban planning that integrates more functions and different users by developing mixed-use neighbourhoods.

The interrupted relation between production activities and the city space has produced two critical effects. On one side, the implementation of zoning plans and the construction of strictly single-functional building typologies has created a low flexible buildings stock, today not readily adaptable for the re-introduction of work-related housing, commercial or social-spatial models. On the other side, the abandonment of the relationship with the domestic space and the rise of economies of scale led to the creation of experimental solutions and new spatial model to host production and manufacturing activities.

Since proto-industrialisation, we can see a transformation of the production space that has led to the creation of the modern factory. The different spatial forms that production assumes from a proto-industrialisation transition originates from the cross-cultural space of the medieval workshop, developing a different organisational model in turn subject to territorial authority regulation. The next paragraph depicts different spatial models that production has taken on with particular attention to the functions hosted and their interaction. The models described do not cover the total of all production buildings and all their characteristics as these are the result of different peculiar factors. The description depicts cross-cultural and inter-regional models, recognisable in different cultures and countries representing different relation strategies of production with other functions and with the urban space.

6 The theme of the Functional City and land planning based upon function-based zones was analyzed during the CIAM 4 in 1933.

2.2.5 Architecture of production: from the workshop to the factory

From the common and ordinary space of the workshop, the transition from craft production into the industry has experimented with different layouts and management strategies. The development of machinery and mechanisation has led to a phenomenon of agglomeration of small artisan and family productions with the consequent development of architectural forms capable of responding to new needs both from a dimensional and technological point of view. As spatial and technical request changed, also social relations in the workplace changed to accommodate a vertical reorganisation of the entire production system and the introduction of the scientific management of work. From the intimate space of the house and the cohesive interaction of the workshop, the advent of the modern factory required a higher rigidity and a new building structure.

To retracing the variety of spatial and managerial models of this phenomenon, it is necessary to describe the most critical aspects that characterised the cross-cultural space of the medieval workshop and how these characters subsequently gave rise to different spatial typologies linked to production.

The workshop for the craftsman is his home. (Sennett, 2008: 59) It could be a room or a building which provide both space and the tools for making or repairing manufactured goods. Workshop spatial characters and internal disposition are designed to accommodate production requirements and workers activities. In his description of the workshop, Sennet emphasises social characters as the characterising value of defining a workshop. He said: "*The workshop is a production space where problems relating to authority are handled by participants in face-to-face relationships" (Sennett, 2008)*

The themes of authority and autonomy, as for depicting the guilds' organisational system[7], are useful to describe the workplace and its characters. Sennet's definition highlights the horizontal organisation of the workshop and the type of relationship existing between those who command and those who obey. The authority of the master derives from his accurate technical knowledge of the profession and from the social role attributed to him by society as teachers to new generations, to his apprentices. The research of autonomy reflect the transformation of the craftsman's workshop into the artist atelier. It is customary to believe that the artist's studio was a place of solitude, where the artist could work expressively on his own, but this idea was often wrong. This concept of the autonomy of the artist in the making is more linked to the ideal space of the *"Studiolo"*: a site of refinement learned better suited to silent contemplation than to dust and hammering (Wilkinson, n.d.). Artists used to work in workshops, also called *Bottega*, crowded with assistants and apprentices. Only successful artist could afford both a Bottega and a Studiolo, thus spatially separating the functions of production from research and development. A spatial division which anticipated the division of labour developed with capitalism.

7 See the previous paragraph 2.2

What makes the difference between the craftsman and the artist was the value assigned to the originality of the works that came out of the workshop. The concept of autonomy proposed by Sennet refers to the willingness of masters to start their own business as independent entrepreneurs, paying the workers without the obligation to teach them a profession. This happened through the construction of a recognizability of their works, thus going against the guild principles that tended to even individual differences between workshops. Guild goal was to protect the place where the object was manufactured, the city as territory, not the individual craftsman. Inquiring the value assumed by the manufactured objects, a difference stands out between the artisan workshop and the artist's atelier: in art, the agent is the individual, the artist and its recognizability, while in crafts the agent is collective: all contribute to the production and value of the object.

An indispensable character of the workshop is outlined: its role as a social space, a space for interaction and teaching, where bonds are created between people through the transmission of knowledge, from simple advice in the workplace to a paternal role in medieval times, through a face-to-face sharing. (Sennett, 2008: 77)

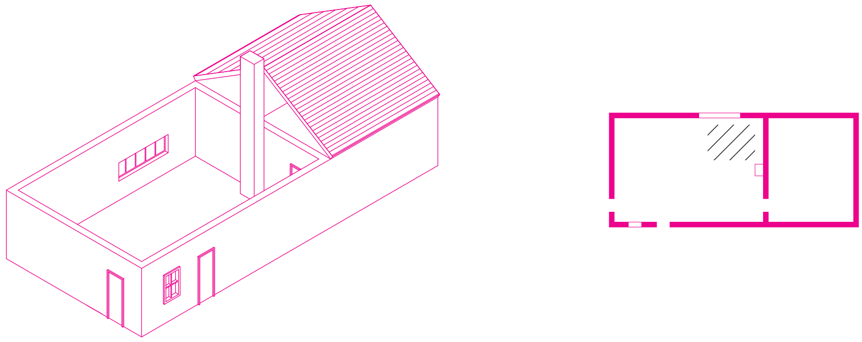
Different types of the spatial and social organisation of the workshop were developed in response to the technical and social changes imported since the advent of industrialisation. The collective production process of objects will be replaced by the assembly line and the division of labour, expanding the spectrum of managerial and spatial alternatives linked to production. These places will not completely lose their social role, but it will take place outside the factory, in spaces dedicated to workers' associations. The laboratory space and the revival of the artistic ateliers through the reuse of light industrial buildings are giving new impetus to the tradition of the workspace as a space for experimentation, teaching, and social relationships.

The following architectural typologies highlight the evolution of the workspace and its relationship with other functions.

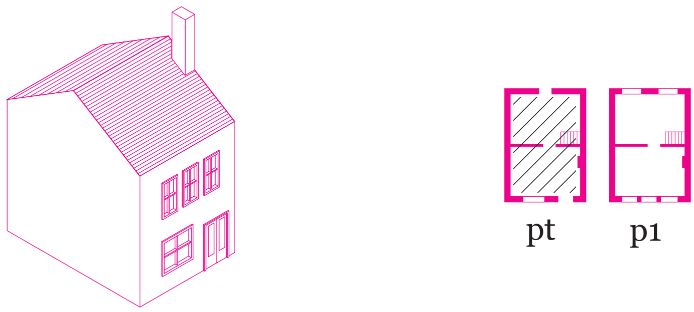
Working and living

Work-home. The first workspace has been a domestic space. The space of the house has always been associated with the workspace, in a continuous alternation between different activities. With the rise of non-agrarian society, domestic manufacture become familiar. The introduction of machinery into the domestic space required either the living room to be enlarged or transformed to accommodate the work area. In other cases separate room was added, organized for the purpose. The living room was enlarged so the weaver could benefit from the heat of a single hearth, and enough light from a long window on the wall. Alternatively, an extra storey could be added so that the manufacture could be separated from family life. Requirements were similar for any domestic manufacturing craft industry. Following Frances Holliss's research on the topic, the work-home can be characterized by a predominance of the domestic function over the working function or vice versa, which determines the size and type of spaces dedicated to production.

Her identification of the dominant function is, in turn, related to the analysis of the level of separation between domestic and working activities according to these categories: *live-with*, *live-adjacent*, and *live-nearby*[8].



The Long-house. The long-house is a type of long, proportionately narrow, single-room building. Like other European house building typologies, this building often hosted manufacturing and domestic activities in the same room. The working space was commonly positioned near the fireplace to take advantage of the heat and light of the fire during the winter and provided with a large window for daytime work.

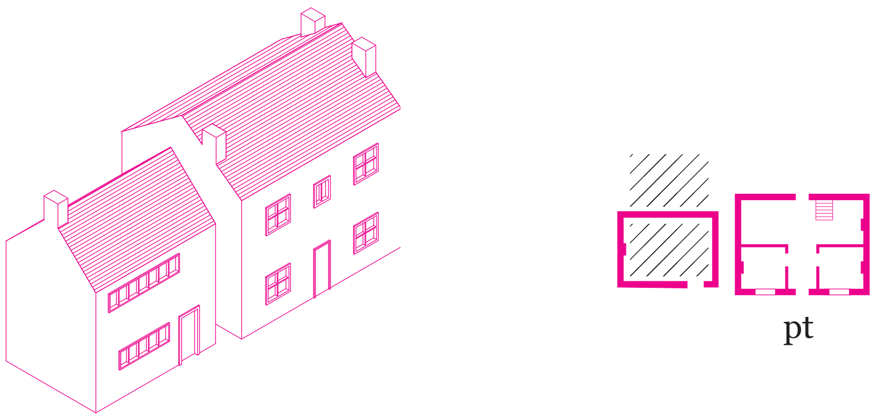


The shop-house. The shop-house is a building type serving both as a residence and a commercial business. This typology, recognized as a worldwide spread

8 Live-with typology is the most common and involves partial or no spatial separation between the two functions. The dwelling and the workspace are contained in a single building accessible from the main street. Life-adjacent implicated a higher degree of separation between functions. This typology is characterized by two compartments , one for the dwelling and the other for production. The access from the main street is separated. The most common model have the living accommodation above the workplace. Live-nearby represent the greatest situation of spatial separation between the two functions. The buildings hosting the dwelling and the workshops are different buildings (Holliss, 2012).

ordinary building, is characterized by a shop, opened to the street also used as the owner's residence. A cross-cultural typology which took different forms as the Asian shophouse, or the Italian palazzo and the merchant's house of northern Europe[9]. Sometimes the production space could be superimposed on the sales space or located in an adjacent room prepared for this task.

Weaver cottage. A weaver cottage was a housing typology used by weavers for cloth production inside the putting-out system. Weaver's cottage was common especially in Britain, organized with the domestic spaces on the lower floors and a loom-shop on the top floor, recognizable by a long row of windows which provides maximum light possible for working. Cellar loom shops on the ground floor or in the basement were found where weavers used to work woven, as the material needs more humidity to be efficiently worked. It was usual for a loom shop to contain three or four looms which were worked by members of the family. A typical two-up or two-down cottage presented the loom shop on the second floor, two bedrooms on the first and a kitchen and a living room on the ground floor.



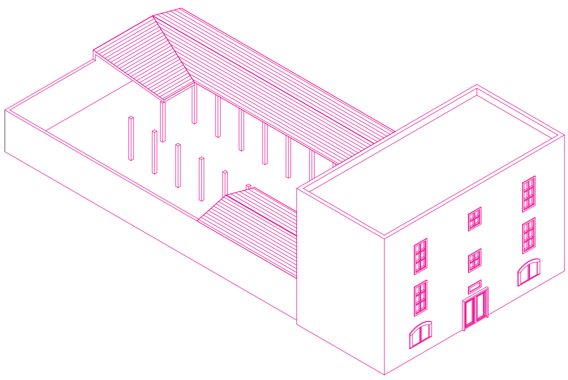
9 Within the book "Living over the store", Howard Davis carries out comprehensive and accurate research on shop-houses and on the characteristics that this type of housing assumes in different parts of the world. Davis defines the shop-house as a cross-cultural phenomenon with a fundamental role in city life.

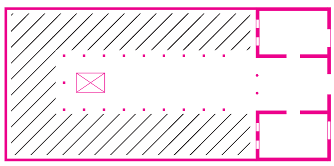
The workshop. The workshop may be composed of a room, a series of connected rooms or a building which provides both the area and tools (or machinery) that may be required for the manufacture or repair of manufactured goods. Workshops were the commonplaces of production until the advent of industrialization and the development of larger factories. The workshop is not characterized by specific and recognizable architectural features. The spatial characteristics were defined at best by the activities that were carried out inside or otherwise, by the construction characteristics of the building. This second option was the most common as different activities replaced one another without interruption. What strongly characterizes the workshop as an architectural space does not concern the specific activity within it but how this space relates to other living activities.

Proto-factories

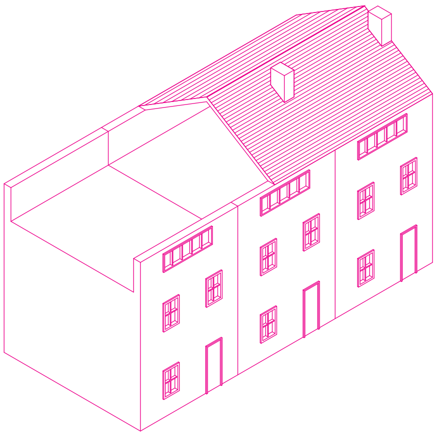
The introduction of machines and a better organisation of work helped the upscaling of the workshop which could employ more than sixty journeymen in the production, a large number for pre-industrial standards. This was possible thanks to a more structured production by phases which could be handled in different buildings or even in different locations in the city. The scale assumed by these activities hardly remembers the limited space of the workshop.

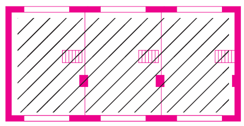
It is clear that at first the manufactures used existing buildings for their installation. Proto-industrialization developed itself from already known forms and structures, in particular those that governed the world of agricultural labour and convents. The square courtyard, the French *cour carré*, around which the buildings were organised, was a symbol of the unity of the task imposed on all those who participated in the work. The spatial configuration of proto-industry was an evolution of the consolidated space of the workshops and an anticipation of the subsequent developments of the modern factory.





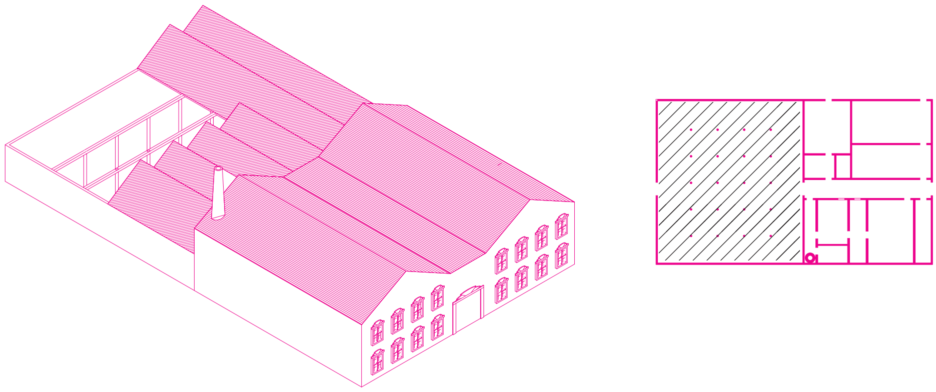
Casa-Fabrica: Minimum production unit. The formulation of a new architectural typology called *"Casa-fabrica"* was initially determined by the convergence of the two forms of occupation of the space: the residence of the owners, and the space dedicated to production. The concept of the *"Factory-house"*, from the Spanish *"Casa-Fabbrica"*, is productive typology which brings together the manufacturing production of the early nineteenth century with the home of the industrialist, servants' quarters, the specialised workforce and machine technicians. The building was organised around a central courtyard where the engine was installed, with structural dimensions of 5 meters, so that it was possible to use traditional construction technology without central pillars and the production was organised vertically. The building used as the residence of the patron and the directors of the factory was located on the main road, closing the space of the internal courtyard.





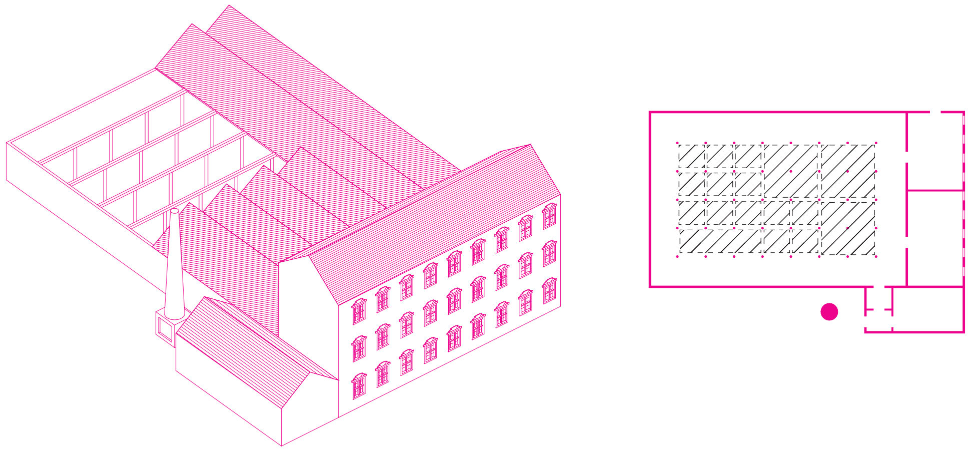
p2

Common loom shop. The introduction of new looms and spinning machines led to the evolution of domestic production linked to the putting-out system. The realisation of a common loom-shop in the attics of a row a weavers cottages made it possible to work several looms at the same time and expand their number. It was believed that artisan weavers wove cloth during poor weather or in time break from agricultural work to supplement their primary income. Historians proved that more likely the labour force employed into putting-out systems worked full-time at the loom, breaking off to help their neighbours during the harvest. Full-time weavers tended to cluster in rows of cottages forming a hamlet. During the urbanisation of the eighteenth and nineteenth centuries, the construction of peripheral areas used massively the typology of weavers cottage, built-in line attached to one another. This spatial typology allowed the workers to realise the first examples of shared manufacturing. The perimeter walls that divided the attics between the different dwellings were demolished, allowing the resulting space to be used to place a higher number of looms and increase production. Thus a smaller number of workers could control more machine by increasing the profits of the community as well as of the single family.



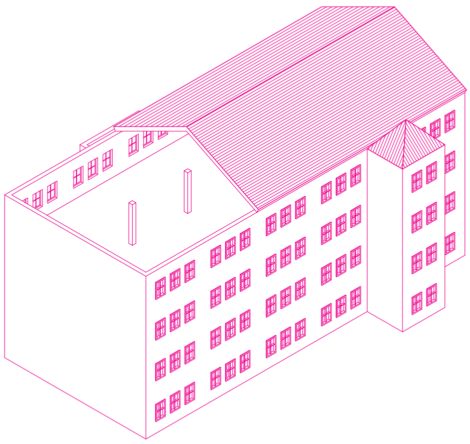
Weaving shed. The loom shop was adequate until a more powerful steam engine was developed introducing the weaving shed, whose first examples were nothing more than extended loom shops. A weaving shed is a distinctive type of single-storey mill developed in the early years of the eighteen century to accommodate the new power looms for weaving. The horizontal spread of the weaving shed related to the severe vibration produced by power looms, requiring them to be positioned on a solid ground floor. A weaving shed can be a stand-alone mill or a component of a combined mill. Maximum daylight is achieved by the introduction of saw-tooth north-facing roof lights.

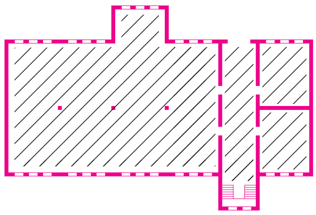
The purpose of a weaving shed was to provide spaces for rows of identical looms. A standard shed would house 1200 looms, and it was common to think in multiples of 400 looms. The looms were powered by leather belts from overhead cross-shafts, on bevel gears from the line shaft that ran the length of the shed. A typical mill attached to the weaving shed hosted the boiler room, an engine room housing the steam engine and two or three-storey building where the preparatory process was carried out, below and above would be a warehouse, hosting also the offices. They initially adjoined existing mills, subsequently standalone mills were built by speculating investors or by industrial co-operatives of former handloom weavers. The weaving shed was a simple industrial buildings.



Room and Power mill. The weaving shed was born from the need to concentrate all the machines, materials and workers in the same place and have much control the production phases. These buildings were built by investors who owned both the building and the machinery used, paying individual workers for the quantity of material produced. The risk of sustaining both the production with relatives market changes and the building maintenance led to the development of the *"Room and Power"* model. It consists in renting a plot or even a number of looms, to smaller businesses paying the owner for space and for the power, generated by a mill engine or a waterwheel. Space was rented to other companies who could specialise in weaving without the skills needed to finance, build and maintain a building.

The room and power system is an interesting case where space management and production are developed separately, developing a competitive strategy for the development of small businesses and the presence of different manufacturing activities in the same building. The case of the *Queen Street Mill* a steam powered weaving shed located in the village of Harle Syke above the town of Burnley, Lancashire is a fundamental example of the development of a Room and Power mill not by speculating investors but by an industrial co-operative of former hand-loom weavers and the only remaining example of a functioning nineteenth-century steam powered textile factory in the world.

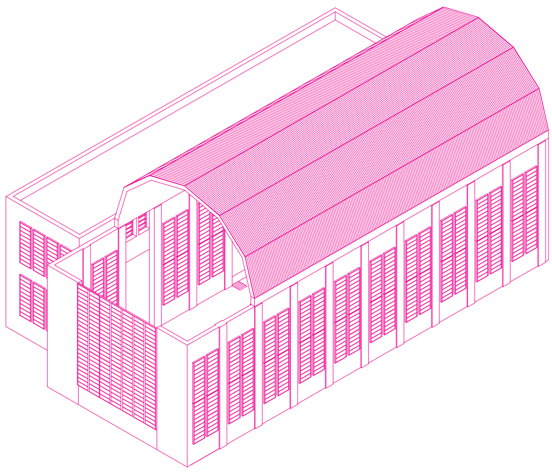


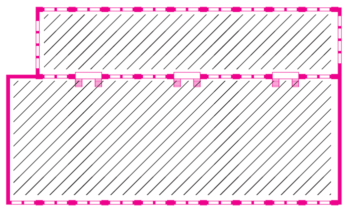


Multiple workshops or loft building. In large industrial centres a number of workplaces were located in the so-called multiple workshop buildings. These workshops consist of separate floors or part of floors, located in buildings which contain a number of workshops. Sometimes the building in which these workshops were located was formerly used before as a tenement or dwelling, and which has become too dilapidated for living purposes, and has been converted then by breaking up the partition and altering the construction into a workshop building. More frequently these shops were located in buildings specially constructed for this purpose, which are known as *loft buildings*. This construction is often the result of the congestion of a large number of people in a small area. In New York alone, between 1901 and 1910, on Manhattan Island not less than 800 loft buildings were erected from eight to twenty stories in height[10]. Fire dangers and the lack of fire protection in the loft buildings were the main reasons for opposition to the construction of multiple shops.

The Modern Factory

The evolution of a production system based on human ability and the use of tools towards the predominance of the machine produced a necessary transformation in the design of production spaces. At first small productions, not requiring a large work area, shared spaces and sources of energy, has happened with the "casa-fabrica", the power and loom mill or the loft building. When the capital and space requirements became too high for cottage industry or workshops, and consequently to an increase of more specialised and massive production, a new building typology was developed.





The special factory. From the he advent of the twentieth century, most industrial and production activities are carried out in the modern factory. The term modern factory means "a building or a complex of several buildings, where workers manufacture goods or use machines that transform one product into another". It is not possible to identify any universal characteristics of the modern factory since these buildings are designed taking into account the wide diversity of the specific processes that each industrial sector requires, plus the cultural and technical diversity present in every city, every country or place.

10 The industrial panorama of New York has been depicted by Price in his book about *"The modern factory. Safety, sanitation and welfare"* edited in 1914

2.3 The characters of modern factory

The notion of the words "*Factory*" and "*Workshop*" has changed from the meaning generally given to them at the introduction of the modern factory system. The English word factory comes from Latin *facio* (I do, make) through Latin *factor* (one who or which does or makes something) and Middle French *factorie* and it was used to indicate a trading establishment in a distant country. A change of its meaning appeared in the eighteen century. Carroll D. Wright's definition is often quoted as a classic:

"*A Factory is an establishment where several workmen are collected for the purpose of obtaining a greater and cheaper conveniences for labor that they could procure individually at their homes, for producing results by their combined efforts which they could not accomplish separately, and for preventing the loss occasioned by carrying articles from place to place during the several processes to complete their manufacture*" (Wright, 1884)

The first Factory Act in England used the words "*mill and factory*" without defining the characteristics of these places, while in the Act of 1844 the two words were defined as

"*all buildings and premises situated within any part of the United Kingdom of Great Britain and Ireland, wherein or within the close or courtyard of which, steam, water or any other machinery is employed in preparing, manufacturing or finishing, or in any process incident to the manufacture of cotton, wool, silk, flax or jute, either separately or mixed with any other material or any fabric made thereof, were used* " (Cooke-Taylor, 1886)

At this time the expression "factory" did not mean any place devoted to spinning and weaving using motive power. In the Act of 1864 the term "*factory*" not only defined places wherein power other than manual force was used in any process connected with the production but also "*any premises, whether adjoining or separate, in the same occupation, situated in the same city, town, parish or place and constituting one trade establishment in, on or within the precincts of which fifty or more persons are employed in any manufacturing process*" basing the distinction between a workshop and a factory on the number of employees. Also other countries attempted to define the factory following this criterion: The French Law of 1841, the Austrian code of 1859, the Italian Code of 1886 regarded a workshop as a place with more than ten workers therein (Price, 1914). A more scientific definition appeared in the Act of 1878, which gived a distinction between a factory and a workshop based upon the fact that in the former, machinery worked by steam, water or other mechanical power is used, while the workshop is a place where work is done without the help of motive power.

In the architectural discourse, a building intended for manufacturing had the first generic formulations in the eighteenth-century French essays. Augustin-Charles d'Aviler in his *Dictionary of Architecture* published in 1755, defined the term "*manufacture*" as: "*...un grand corps de bâtiment, composé de plusiers logements, salles, laboratoires, galeries, magasins, etc., ou sont logés et entretenús des ouvriers qui travaillent, par le moyen de métiers...*" (d'Aviler, 1755). D'Avilier was followed by Jacques François Blondel and the italian Francesco Milizia, who in addition to being favorable to the introduction of housing for workers, managers, and inspectors responsible for the economy and the process of production, was also the first giving indications about the formal characteristics of the architecture of these buildings. In his publication "*Principj di Architettura Civile*", Milizia wrote, "*...l'ordinanza della loro architettura deve essere semplice, e annunciare la solidità della loro costruzione, senza però presentare un carattere fiero, e marziale..."* (Milizia, 1781). The factory had to be characterized by its functionality, solidity, and sobriety. Antonio Carbonel in his essay published in 1794, defined the term factory as: *"...taller inmenso, donde las màquinas por mayor las mueve el agua; una fuerza grande, una fragua de áncoras, una ferreteria, el conjunto de martinetes..."* (Artigues i Vidal & Mas i Palahí, 2019). For Carbonel the essential characteristic of a "*factory*" was the presence of mechanical tools.

Despite these first indications regarding the architectural and spatial characteristics, the construction of the first buildings labeled as factories took place under the pressure of two main factors, determined by the social and technological changes of the nineteenth century: the first concerns the separation between living and producing, while the second arose from the need to create *"container"* buildings that could host various activities during time without altered their structural characteristics.

In the innovative panorama of the nineteenth century, the formulation of the typology of the *"Casa-fabrica"* still meant the permanence of a constant of old origin: the residence of the producers connected to the working space. The spatial organization of this typology imposed to locate the residential building on the main road, while the buildings dedicated to production were organized in the internal part of the plot. The modern factory separated these two functions, as a consequence of the urban transformations of the nineteenth century and the common relocation of production facilities in the outskirts where the presence of large plots made it possible to expand the plants and respond to a growth in production. The appearance of the production "block", as an autonomous building, facing the main road, will offer the first opportunity to construct a building designed for industry clearly differentiated from the residence, signaling a substantial change in the formalization of industrial buildings. From this moment, production buildings will tend to be separated from the residential buildings, differing from them by composition, tending towards a more formal autonomy. The modern factory will be the first building not realized to meet the demands of human life but to meet the requirements of mechanized production. A space designed for the machine.

This autonomy of the modern factory will also have an influence on the urban development system. Domestic production and proto-industrial experiments often occupied existing buildings or parts of them, modifying their internal space to new uses. Instead, the introduction of the modern factory required a spatial dimension that could not suit the medieval parcel organization characterized by small and irregular plots. The development of the modern factory affected the morphology of the city to accommodate its spatial organization as well as its logistics requirements modifying the regulation of plot dimensions.

Linked to economic and commercial aspects, the second factor was one of the greatest contributions of modernization, introducing the idea of fabricating a building that would allow its use by various activities without altering the general composition of the building. In an era when the mobility of activities was on the agenda, the creation of "*container*" buildings was an appropriate commercial attitude. This widespread mentality of the nineteenth century was directly incorporated into the construction of the factory (Marullo, 2013).

Structural dimension and flexibility were the key elements to foster the development of the modern factory. Mass production required the development of a generic building layout which had to be able to rapidly change depending on the needs of the production process and possible future expansions of the plant. The various experiments that followed one another in the construction of the modern factory, in particular, the use of reinforced concrete which possessed a high fire resistance, and structural patents which increased the size between the spans allowing more flexibility, led to the definition of a *model factory* able to meet the needs of different industrialist and productions. In architectural theory, this process gave rise to what is termed as a typical plan.

The term "*Typical Plan*" was first introduced by Rem Koolhaas in his analysis on the repetitive homogeneity of the twentieth-century manhattan's office plants, whose layouts were designed using an elementary architectural frame, composed of standard elements.

The core, columns and external facades are juxtaposed to realize an architecture that becomes progressively rarefied, assuming an indeterminateness, that leaves no room for peculiar characters, sufficiently vague to shelter any program. The architecture of Manhattan's skyscrapers described by Koolhaas originates their ideal composition from the nature of the modern factory and its practical development. The office space, as the modern factory machine shop, rejects any fixed organization or conventional composition, dismounting the idea of fixed equilibrium between parts, between interior and exterior, between form and function in favour of an ideal of permanent variation.

"A typical plan is an American invention. It is zero-degree architecture, architecture stripped of all traces of uniqueness and specificity. It belongs to the New World" (Koolhaas & Mau, 2002)

Through the industrialization and serialization of building techniques, the modern factory established a new meaning of the idea of typicality, from the richness described by Peter Carl[11], to indicate the logical reproduction of the identical. (Marullo, 2013). The typical plan described by Koolhaas is not a typology and not even a model but represents a diagram applicable to whatever content and able to work in any context. It is a plan that coincides with what it contains and what actions, movements, are accomplished inside, reflecting a maximum indeterminacy within the specificity of an enclosure. The modern factory was reduced to a limited set of typical plans and relatives standards to perform a rapid layout organization that could meet multiple industrial needs. As Marullo examined in his essay, the typical plan can be considered as an algorithm for creating space according to configurable parameters that could be shaped, stressed, reduced or specialized depending on the circumstance.

Its generic, standardized characters and the ability to adapt to different contexts have allowed the typology of the modern factory to expand all over the world, becoming the space and symbol par excellence of production activities. The modern factory has been the subject of projects carried out by architects and engineers, recognized as masterpieces for the excellence of the projects, influencing architectural style and composition from the modern movement until today. These projects have been the subject of study, research, and essays that have described their construction process, their operation, the buildinging technologies used as well as the innovative formal choices. But it is in the forms assumed by minor architecture that the factory has had its widest use and expansion, with the construction of anonymous buildings that have colonized the suburbs of cities around the world.

2.4 From the modern factory to the rise of the incubator model

2.4.1 Introduction

Since its initial development, the modern factory has become the industrial space par excellence, innovating rapidly the spatial and technical solution adopted. At the same time, it constituted a system of relations that extend far beyond the limits of any walls containing machines and tools for creating a product. The ideals of the modern factory are intertwined with the economic and social forms of modern society having deep role in its development and organization.

One of the significant issues of modern industries concerned its buildings stock which was not always suitable for the requested technologies and the development of new industrial processes. In the second half of the twentieth century, major

11 The concept of “Typicality” introduced by Peter Carl refers to a “convention”, a “framework of understanding” based on everyday situations and typical elements. In Peter Carl’s idea of “Typicality”, the “Type” is a subset. It is a formal variation; it is an isolated fragment of the more profound and richer structure of “Typicalities”. The main difference between typology and typicality is that the first focuses on (architectural) objects, the second on situations. (Carl, 2011)

industrial cities were full of empty industrial buildings, and most of them were too large for the type of tenants attracted in the inner city. This high rate of vacancy is the most visible sign of the changes that have occurred in the economies of western inner cities areas. London alone, during the 1970s, had over 2.2 million m^2 of vacant industrial space, forty per cent of which was in buildings over the 5,500 m^2 (Gripaiors, 1997).

These phenomenon can be partially related to a change in planning management in the post-war reconstruction phase, but discarded industrial buildings were mainly due to a structural changes in manufacturing and in their preferred location. The decline of urban areas was caused by a change in the manufacturing base of western countries, demanding new location and process. The large multi-plan firms closed down their older inner-city plants and transferred production to more efficient greenfield sites with the access to lower-cost premises, room for expansion, more accessible communication routes and a skilled workforce, leaving behind the less-skilled workers in areas with declining economies and vacant, vandalised buildings. The high cost of the labour force and general overheads led to a decline of manufacturing and an increase of distribution and assembly functions. Hierarchical firms adopted more flexible organizations decentralizing function to rapidly adapting to new technologies and markets, which required a change in the workforce, from skilled labour in the heavy manufacturing to light industry and assembly. Parallels to the decline of manufacturing, the 1960s saw the rise of modern warehousing facilities due to the increase in imports, and the expansion of the service industry reclaiming central city office space.

The widespread phenomenon, diversified case by case in its peculiarities, saw the appearance of a new spatial model of production to foster the development of local industry, experimenting new strategies to reuse the large stock of disused industrial buildings. This model set significant attention to the role played by small and medium enterprise, experimenting strategies to foster the development of new local companies as an effective instrument of local development.

The introduction of the book "*Industrial Rehabilitation. The use of redundant buildings for small enterprises.*" written by Peter Eley and John Worthington in 1984, with extensive involvement of the Urban and Economic Development Group (URBED), begin with these words:

"Reusing industrial building is more than just a romantic idea. Old buildings are a potential resource, which if rehabilitated, can often provide cheaper a more appropriate premise for new and growing firms. By finding fresh uses, decay can be halted and whole neighbourhoods rejuvenated while ad the same time maintaining a sense of time and place" (Eley & Worthington, 1984: 3)

The phenomenon is vast and varied, and it led to the development of different categories and nomenclatures such as *working community*, *vertical industrial park*, *multi-tenant building*, *shared machine shop*, with peculiar characteristics based on social, spatial or managerial aspects. At the same time, every single case of this broad spectrum shares some fundamental common characteristics that allow to observe the phenomenon from a general point of view. We will refer to this phenomenon as the *Incubator Model*.

The term incubator is a general term for workspace developments which aim to provide a supportive environment for small businesses. On the whole these are managed workspace developments which operate at the bottom end of the market, offering small, unpretentious space to small and very small firms. The principal characteristic of these developments is an active management. This can vary from a caretaker/handyman up to business and technical support for tenants. (Morley, 1989: 88)

The incubator model appears to be based on pre-modern spatial production typologies such as the laboratory, the workshop or the Casa-Bottega, extracting its functional and organizational aspects for the elaboration of a new form and a managerial model to governs it. The first modern incubator is claimed to be the *Batavia Industrial Centre* in Batavia, New York State, developed by the Mancuso Family in 1959, and still operating today. The facility is characterized by hosting different activities, from arts and craft to productive enterprises. The Mancuso Family purchased an old closed industrial facility, abandoned after the relocation of production activities, which result in an intense crisis for the small city. To compensate the widespread unemployment and bring back productive companies connected to the territory, the Mancuso family began to fill the large industrial spaces with small businesses, encouraged to locate their business in Batavia thanks to the flexible and low cost rents. (Kilcrease, 2012). Another pioneering project has been the Stanford Research Park, realized in 1951. The university facility was realized to host laboratories and researches spin-off, becaming subsequently an important example in the management and development of new business and research enterpises.

Referring precisely to modern scientific laboratories, Sennet describes them as structured mostly according to the model of the artisan workshop (Sennett, 2008: 59), declaring that the social history of technical work is largely the history of concrete attempts by the laboratories to tackle or avoid the problems of autonomy and authority. (Sennett, 2008: 60) Sennet's consideration of the nature of modern laboratories recalls the struggle between authority and autonomy experienced by the master craftsmen and the guild system during the industrial revolution of the mid-nineteenth century, described in the prevoius paragraphs (Paragraph 2.2).

Today situations comparable to those of the laboratory are sometimes cut into gigantic complexes: modern car factories, in addition to the enormous spaces of the assembly line, also include spaces reserved for small teams of skilled workers, *the factory has become an archipelago of laboratories*. (Sennett, 2008: 60; Eley & Worthington, 1984: 5)

Business incubation diffused slowly during the 1960s and 1970s (Hackett & Dilts, 2004). The success of the first experiments produced greater knowledge of the phenomenon, and from the 1980s, the incubator model assumed international importance.

Today incubators are an integral part of the modern entrepreneurial ecosystems, evolving from the initial idea developed between the years 1960 and 1970 to concentrate on digital innovation, startups and disruptive technologies[12]. Famous Silicon Valley startup incubators, like *Techstars*, *Y combinator* or *AngelPad broadcast are* a very different idea from the original incubator model. These places encourage companies to seek and destroy inefficient local and regional businesses in their pursuit of innovation; to move fast to change the world and become historically rich in the process. Their business model considers more evaluable one glorious startup, like Uber or Airbnb, over the thousand serviceable smaller companies. For Justin Peters, the message is clear: new incubators disrupt places like Batavia (Peters, 2017).

2.4.2 The shared machine shop: a precursor of the modern incubator

The incubator model cannot be defined as a spatial practice conceived in the panorama of the second half of the twentieth century. The history of production and its spatial organization is studded with singular examples where artisans, industrialists, inventors or researchers decided to share their workspace[13].

Practical examples are challenging to find, often passed unnoticed by historians, perhaps because of their being conventional realities, part of the common daily life. These places, during the advance of mass culture and the modern factory, economies of scale and internationalization, were often subjugated by bigger businesses, silently disappearing or continuing to operate locally without taking a leading role in the innovation of industrial and technological culture of the time. Some examples, the most virtuous or the most fortunate, were registered in local annals, leaving a trace that today, with some difficulty and a bit of fortune, can be

12 The concept of "disruptive technology" and then of "disruptive innovation" was first introduced by an article by Christensen et al., Published in Harvard Business Review, in 1995. As they reiterated in 2015, according to the authors this concept is refers to a limited area compared to the extension implemented over time by other authors, researchers, consultants. According to the authors, "" disruption "describes a process whereby a smaller and less resourceful company is able to successfully challenge the dominant companies in a certain sector. Dominant companies in focusing on how to improve their products and services for the most demanding and profitable customers, exceed the needs of some segments and ignore the needs of others. New entrants, with "disruptive" intent, successfully begin to satisfy those neglected segments and carve out a position by providing the features required by the segments ignored by the dominants, often at a lower price. (Bower & Christensen, 1995)

13 Examples of shared production spaces can be traced in the organization of the activities of the medieval monasteries, in the first factory houses that were developed on the Catalan territory where the factory owner rented the adjacent spaces to exploit the power of the steam produced and obtain revenue from renting part of the factory, in the common loom shops built in the attics of the British weaver's cottages, in the Room and Power mills where workers rented both space and the machines for the realization of their products, or Carpentry workshops such as Russell & Sons Company where several craftsmen worked side by side in the production of furniture and furnishings.

found, adding knowledge to this vast field of research, still little explored in its spatial and social components. An example of such circumstances is C. E. Lipe Machine Shop.

The building, also knew as Straight Line Engine shop, was established in Syracuse, New York in 1880 by Charles E. Lipe, a mechanical engineer. While Lipe worked on his own ideas, he rented the space to other artisan and mechanical engineers. The shop was organized in the Lynch Building, a two-storied brick building with a usable surface of 1900 m^2 (Hardin, 1993).

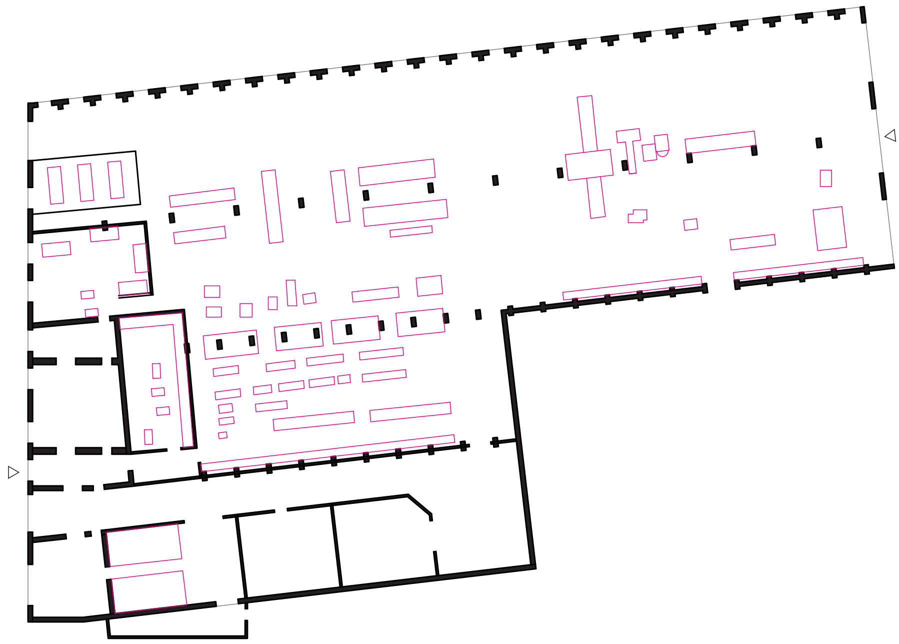


Figure 6 Straight Line Engine Shops, Interior, Syracuse, New York, 1896. Source. Horace, 1896.

The name of the building deviates from its first owner, Patrick Lynch, a salt manufacturer, who build the venue as a machine shop for the salt industry, which relied on machinery made in the Syracuse area, famous at the time for its mechanical production. The building had several owners after Lynch and was used for the manufacture of farm implements and lawnmowers, followed by other business in the mechanical sector. By 1879, the Lynch Building was put up for sale (Horace, 1896).

The building became an earlier industrial incubator when Charles E. Lipe, a young engineer who graduated from Cornell University, bought the building to open his machine shop. Lipe's idea was very simple and resulting from practical problems. While doing his independent work, Lipe allowed other inventors to use the building and some engineers moved into the building to work independently but also to collaborate in the creation of new products and machines to solve industrial problems of the time. (Chase, 1924). The Lipe shop soon became an important place for inventors and an incubator for new industrial companies, thanks to the large number of patents and inventions realized inside. Lipe himself was a prolific inventor, moving from a cigar-rolling machine to motion picture equipment, time recorders and much more (Industrial Age Fed Syracuse Boom, n.d.).

Figure 7 Straight Line Engine Shops, Interior, Syracuse, New York, 1896. Source. Horace, 1896.

The workshop was described as *"the best equipped machine shop in Central New York, having machinery and tools adapted to the widest range of work"* by The Post-Standard newspaper in 1898. After the death of Charles E. Lipe in 1895, a large portion of the building was maintained by C.E. Lipe Estate managed by his brother, for the production of special machinery.

The example of the C. E. Lipe Machine Shop makes explicit how the incubator model constitutes an evolution of a spatial organization of production already present in pre-modern times. A model that, unlike the factory, remain in continuity with a way of producing that characterized human history; linked to a small scale of production with attention to each step of production, from conception to the final product; a reality still related to an artisanal way of producing, in contrast to mass production and a tighten division of labour. At the same time, C.E. Lipe Machine Shop represents only an unconscious antecedent of what will be conceived and investigated, in the second half of the twentieth century, as the model of the modern incubator, which after the first phase of experimentation by single actors and groups of entrepreneurs, will gain on a new intensity, becoming a component of the industrial landscape, institutionalized by local and national governments.

2.4.3 The development of the business incubator model

The reuse of the industrial plant of the Batavia Industrial Center, together with the Stanford Research Park realised in 1951 are two pioneering programs which started the Technological Business (TBI) Incubator movement (Lewis, 2001; Campbell & Allen, 1987). Technological Business incubators diffused slowly during 1960s and 1970s, and their conceptualisation can be traced back to Western industrialised countries in the late 1970s and early 1980s. This first wave of incubators programs focused on job creation and economic restructuring, providing affordable spaces and shared services (Mian et al., 2016).

Facing a rapid rise in unemployment resulting from the collapse of traditional industries, both European and American governments recognised that new strategies were needed to help regenerate sectors, regions, and communities in crisis. During the 1980s the strategies pursued were broadly marked by a switch from a "top-down" approach, based on exogenous factors and involving public intervention to convey surplus mobile capital and jobs from advanced to underdeveloped or declining regions, to a "bottom-up" approach, to promote economic development by maximising the indigenous potential. In the same period, business incubators began to be applied as instruments to promote innovation and technology transfer (Allen & McCluskey, 1986).

The infrastructure that incubators typically offer to their tenants includes office space (Bergek & Norrman, 2008), production facilities (Grimaldi & Grandi, 2005), meeting and conference rooms, reception and office services (McAdam & McAdam, 2008). The incubator panorama evolved in the last fifty years from just real estate project or university spin-off facilities to more complex, business development-support organisations with a broad spectrum of different business models.

In the last decade, the business incubation industry assisted to a notable increment in the number of corporate incubators and accelerators. In 2016, Hochberg reported that from the first accelerator in 2005, the Y combinator, the number of accellerator raised from a dozen in 2008 to more than 180 in 2013 only in the United States, while word-wide the estimated number was closely to 3000 units (Hochberg, 2016).

The common idea of an incubator as a building, a section of a building, or adjacent building providing space and assisting new and small firms was not new. However, between the 70s and 80s, incubator advancement has been formalised and institutionalised. The growth of business incubator revealed a convergence of a number of previously existing forces: the growing small business sector, shared office service organisations and professional business management with a technical assistance network, multi-tenant real estate operations, new capitalisation mechanism in the early stages and an increase in the entrepreneurial initiative. As an indigenous economic development strategy, the incubator movement responded to local needs as a resource for local development, investment and the growth of business services environments.

The first major study of business incubators in the United States, "*Business incubator Profiles: a National Survey*" at the Humbert H. Humphrey Institute of Public Affairs at the University of Minnesota, published a survey on the active incubator panorama in 1984. Almost all had been developed in vacant or abandoned buildings, receiving some form of public grand or tax incentive in order to acquire or rehabilitate the property.

The incubator address the problem of new firm undercapitalization with the provision of rents below market standards and affordable services. In addition to shared services, business financing and assistance, and affordable working space, a fifth element has been described as characterizing numerous incubators: a congenial supportive environment. As a result, many tenants and companies established profitable trading and relationship selling and buying services and goods or developing cooperative projects with other firms in the incubator. Flexibility, in terms of space and management, has been described as a crucial aspect for the success of an incubator. Buildings are designed to allow firms to move within them as they expanded while short term leases and deferred rental payments allowed companies to cope with market changes efficiently. The majority of tenants firms were light manufacturing followed by office uses, research and development firms.

2.4.4 History of Businnes Incubator

The origin of the Incubator model can be traced within the American and British context of the second half of the twentieth century.

In the United States, the development of business incubator has three historical roots. The first originated by the efforts to redevelop inner-city ruined areas, subsequently focusing also on the more peripheral areas in difficulty across all the Midwest and Northeast of the country. The second reason is related to an experiment founded by the National Science Foundation to promote innovation and entrepreneurship in the university ecosystem, following the example of the Stanford Research Park. The third component is instead related to the private initiatives of numerous successful individual or groups of entrepreneurs who attempted to transfer their own experience to start-up companies thought the realization of a favourable environment to promote technological innovation and commercialization.

One of the earliest incubators in the United States was constructed in 1968 when the University City Science Center (UCSC) decided to start the redevelopment of an inner-city cleared area near the major university of Philadelphia. Although the project was not explicitly set up to assist the development of new enterprises, UCSC recognized the demand for smaller, flexible space required by new companies, providing their excess capacity, in terms of equipment and space, to external start-up companies. Over the years, the redeveloped area and its business population grew by over 6000 people working in large and small companies in what was once a run-down inner-city neighbourhood. An example of how business incubator becomes part of the strategies for renovating inner-city areas in crisis (Bradford, 1982).

Parallel to the experimental strategies for the recovery of brownfield sites within the urban context, the incubator model has been strongly connected to strategies to increase innovation and entrepreneurship in university research contexts. The most notable example was the construction in 1951 of the Stanford Industrial Park, renamed in 1970s, Stanford Research Park, to highlight "the focus of cooperation between the university and the tech companies" (Palo Alto History, n.d.). The Stanford Research Park was born from the joint initiative of the city of Palo Alto and Stanford University, which was facing financial difficulties after the end of the Second World War (Chu, 2010). Taking advantage of the extensive landed properties of the university, the Dean of Engineering and Stanford University Rector, Frederick Terman, proposed the creation of a business park focused on university-affiliated R&D that could generate income for the university in crisis, and at the same time tax revenues for the community of Palo Alto. The initiative was appreciated by the municipality which became a structural partner of the project. In 1951, 84 hectares were destined for the construction of the centre, and in 1953 the first tenants began to occupy the venue (Palo Alto History, n.d.). In the early period of activity, Stanford University examined its development meticulously, subjecting possible tenants to rigorous controls, to make sure they were in line with the university's general principles. Only in 1991 the Stanford Management Company was established to administer the university's financial and real estate assets, including the SRP. The centre has been described as "*an engine for Silicon Valley*" (Stanford University Investment Report, 2016: 10) hosting important companies such as Hewlett-Packard which has been in the park since 1956, NeXT Computer, Xerox, Facebook and also Tesla Motors. This first example was followed by the establishment of other university incubators, supported by grants from the National Science Foundation with the development in 1973 of an experimental national program, created to improve entrepreneurship education, fostering the promotion of new technologies in existing firms and sustain new businesses.

The third precursor that led to the development of the incubator model concerns the private sector, through the figure of the successful entrepreneur as an incubator for new businesses. The most notable example concerns the Batavia Industrial Center and the figure of Joseph Mancuso described in the following paragraph (Paragraph 2.4.5). However, there will be other actors within this process such as Loren Schultz, President of the Technology Center International (TCI), who in 1976 opened its first Technology Enterprise Center in the suburbs of Philadelphia hosting companies involved in high-tech business and in the realization of technological products. As described by Campbell, Schultz previous experience in technology-oriented enterprises provided him with crucial know-how regarding the development of new products to be placed on the market. This experience permitted him to open several centres in the 1980s and expand on the national market, attracting communities of companies interested in spaces, services and advice in a supportive environment. During the 1980s, more conventional private venture capitalists founded new incubators to host their portfolio of start-up companies in a similar controlled and supportive context (Campbell & Allen, 1987).

While in the American context, incubators emerged from the private sector, where shared space, services and management were common circumstances in the real estate market, as the informal incubation of new businesses by existing ones, scholars point out that the modern form of incubator appeared in the United Kingdom.

They were generated by two movements that developed simultaneously. On the one hand, they are rooted in the redevelopment and reuse of historic buildings in order to create workshops for craftspersons and artisan, arranged and managed collectively to create an optimal working environment space optimal for these businesses. One of the most prominent examples has been the industrial rehabilitation realized in Rotherhithe by Nicholas Falk, who has been one of the pioneers in this field carrying out several local development projects together with the Urban and Economic Development Group (URBED). On the other hand, modern incubators raised from the subdivision of old vacant buildings by architects for the construction of what were called *"working communities"* of design-related firms with shared accommodations, services and management. The first example of these a working community has been the project realized at number 5 on Dryden Street in Covent Garden, designed by David Rock.

After these first projects strongly linked to community action, precursors of a model that was widely used on the national territory, the second wave of incubator development was a response to the closure of the large industrial plants that hit the nation in the 1970s. In 1975 the British Steel Corporation created an agency entirely dedicated to the construction of new industrial buildings for supporting local businesses, companies transfert and financing expanding local businesses, in order to help create jobs in areas where the closure of steel production plants had left thousands of workers out of work. In parallel, the BSC realized several "*community workshops*" where businesses could start and grow. The first small company workshop was carried out in April 1979 at Clyde Ironworks near Glasgow. This was accompanied by other workshops for a total of ten, located in areas affected by the closure of the steel production plants, called "*areas of opportunity*". Over the years, a number of private companies followed the example of the British Steel Corporation, but above all the local, regional and national bodies, universities and community organizations sponsored the realization of business incubators throughout the United Kingdom and also in the rest of Europe West. In 1987 Cambell's analysis estimated the number of business centers "(shared office incubators) and" managed workspace "or" workshops "(industrial incubators) in the UK around 200-500 units.

The high number of incubators present on British territory is partly linked to the implementation of a nationwide program, called "*The Small Workshop Scheme*", in force from 1980 to 1985, which provided for state funding to industrial buildings giving an impetus private sector developers of small workshops. This program was the result of a series of studies drawn up between the 1970s and the first half of the 1980s that had highlighted the shortage of small industrial premises throughout the national territory. These results brought to light how the conditions for the development of small and medium-sized local businesses were strongly influenced by the economic and spatial resources present at the local scale and how the creation of a space favourable to this type of activity could be an adequate answer in the long term. Even if, as expected, the size, location, type of services and local conditions are necessarily different from place to place, leading to necessary tailored actions based on the reference context.

2.4.5 The Batavia Industrial Center and the birth of the business incubator model

The history of the first incubator is inextricably linked to the history of the Mancuso family who at the end of the nineteenth century emigrated from Sicily to the United States of America in search of better living conditions. After a few years in New Orleans, the Mancuso family moves to Batavia, a small city located halfway between Buffalo and Rochester in the state of New York. At the beginning of the twentieth century more than twenty manufacturers were located in the city producing a variety of products, however the largest company was the Johnston Harvester Company with more than 9 million square meter building and two and a half acres of land in the downtown district. The Johnston Harvester company was sold to the Massey Harris Company in 1910. (Kilcrease, 2012)

Charles Mancuso found a job in the company in 1907, while his sons managed to start their own business in other sectors. The success of the Mancuso brothers paralleled that of the Massey Harris Company, supported by the state orders during the Second World War and by the Marshall Plan in the first post-war period. Unfortunately, the era of prosperity for the Massey Harris Company was coming to an end and the factory was relocated to Racine in Wisconsin after a series of cuts in wages and in the number of workers. In September 1958 production stopped definitively leaving the plant empty. The closure of the most important factory in the city together with the recession that the whole territory of the United States of America was experiencing led to an increase in unemployment. Batavia, as most company tows, had become too dependent on a single manufacturer and was struggling to find solutions to the deep economic crisis.

The response of the municipality to the crisis that affected the city after the closure of the Massey Harris Company factory focused on a strategic urban renewal to attract service activities with the introduction of commercial spaces in the abandoned areas of downtown. (Kilcrease, 2012) It is interesting to analyze how service-oriented strategies to foster economic development are still prevalent today, making it challenging to develop future industrial areas in the urban context.

However, a good city needs industries for local development and jobs creation and the Mancuso family was aware of this problem. The family decided to buy the abandoned factory of the Massey Harris, planning an economic return from renting the plant to a large company. This strategy was not new, but even in the most virtuous cases, the companies that settled in existing buildings, taking advantage of incentives and tax exemptions, moved to another location when these benefits ended.

Joseph Mancuso was charged to find a company that could be interested in locating in the disused building without succeeding; the operating cost and the out-dated plant did not attract interest from large local companies. Joseph decided to adopt a new strategy that would not have required significant structural improvement and renovation of the building. He parcelled the whole plant into smaller spaces easier to maintain and administer attracting smaller firms looking for a space to start their own business. It was not enough to beat the competition from other cities or other industrial plants looking for new tenants. He decided to use his know-how about business management to offer more than an empty space, helping small businesses to survive in the long-term. A virtuous process to increased their occupancy length and perhaps leading these companies to leave the building, contributing to the growth of the local economy.

The Batavia Industrial centre offered management related services as order taking, customer service support, budget and account training, legal advice but it also offered services related to manufacturing as paint-spray booths, trucks for rent, a variety of cranes and shared machinery, all priced at cost (Democrat and Chronicle, 1983). From the first year, the Batavia Industrial Center (BIC) began to have its first tenants, and in four years more than 500 people worked in the thirty-five business housed in the building. (Kilcrease 2012). The success of BIC was also due to the clustering of small businesses around one or two anchor tenants. In the same way, as the community of activities located in BIC grew, various activities began to collaborate exchanging services, thus creating a process of growth for companies and the whole community. It was in this period that for the first time, the word *Incubator* was associated with this type of space. During an interview, Joseph Mancuso was showing the chicken farm housed in part of the building, and he realized that as the breeder was incubating chickens, his job was to incubate businesses (Peters, 2017).

The Batavia Industrial Center is still in operation today, although several periods of crisis have forced the Mancuso family to find new strategies to avoid closing the BIC. In particular, problems originated from the obsolescence of the building, forcing the Mancuso family to make large investments to improve the heating, electrical and plumbing system and also make large revisions of the roof structure and the interiors of the various buildings. In 1994 the buildings were 98% occupancy with 106 business and most of them were manufacturers. In the first thirty years of its existence, BIC hosted over 1.000 tenants. Those that had left BIC to have their own place had employed over 2.000 people, including a shoe manufacturer with 300 workers, printers with 100 and a box manufacturer that employed 150 people.

In the 2000s, the addition of new buildings to those of Massey Harris made the Batavia Industrial Center one of the first business incubators where individuals can work and live under the same roof. (Kilcrease, 2012)

2.4.6 David Rock and Nicholas Falk, the British side of the incubator movement initiators

Within the English panorama, two figures have contributed mostly to the birth and development of the modern incubator. This model emerged at the conjunction of two different perspectives, having different points in common, although they developed following distinct trajectories. The first point concerns the high demand for accessible workspaces by small businesses, both industrial and designed related. The second concerned the reuse of the redundant industrial stock characterizing peripheral areas as well as the inner-city. Instead, the third common point concerns the attitude to bottom-up community real estate operations to activate cooperative processes in the development of private businesses. The two figures in question are David Rock, architect and graphic designer, and Nicholas Falk, economist and founder of the Urban and Economic Development Group (URBED).

David Rock, born in Sunderland in 1929, studied architecture at Durham University, joining Grenfell Baines & Hargreaves in 1959, followed by 12 years with Building Design Partnership. Since 1971 he has been in partnership with John Townsend, an expert office designer, founding the Rock Townsend based in London. In 1972 they opened their studio at 5 Dryden Street, an experimental project of "*working community*", which contributed to the development of their approach to design, developing the idea of a multidisciplinary approach to architectural projects and new urban strategies to provide office space for small design businesses (Rock, 1986). He has been RIBA vice-president twice, in 1986-87 and 1995-97, and RIBA president from 1997 to 1999.

In 1971 the two architects were looking for a space in central London for their small but growing architectural practice, deciding to take over a derelict printing works of 2000 m^2 at 5 Dryden Street in Covent Garden, which they converted for multiple uses for their practice and several other small firms with the idea they could collaborate on longer projects (Marsh et al., 2003: 78, Stratton, 2000: 97). From this proposal stemmed the concept of "*working community*", the first in the United Kingdom. The building hosted sixty-five firms in it, combining big firms such as Building Design Partnership and small firms, with a central service. The idea that led to the realization of the project was that the small firms could get on with their work and the centralized services, like in a big company, could do everything else (Eley & Worthington, 1984: 9). Central services took care of space organization as the reception area, conference rooms, the exhibition area, the technical library and people, from the receptionist to the manager, who looked after the running of the building, electrics, cleaning, bills and so on. The building also hosted what are called service firms,who were commercially available such as a secretarial firm, a printing firm, accountants and tax firms. The building hosted all sorts of designers and other building design professions (Rock, 1986). All this infrastructure permitted the small firms, on average made up of three people, to get on with their work. The Rock Townsend organized all as a collective, a cooperative of groups. The participating firms took joint responsibility for the scope and quality of the scheme. They had voting shares in the company, as tenants and landlords at the same time, arranging the finance, the management and the design of the place. (Eley & Worthington, 1984: 10)

The success of the 5 Dryden Street project allowed David Rock and his partner John Townsend to create a second project, The Barley Mow workspace, formerly a wallpaper factory in Chiswick, realized in 1976 (Eley & Worthington, 1984). The building of the Barley Mow Center played a key role in the local industry across Chiswick for many generations. The building date back to the late nineteenth century, Arthur Sanderson & Son's opened their wallpaper factory. It was constructed in Barley Mow Passage to establish the production of the family company, which was established in 1860 importing luxurious and expensive French wallpapers. After a fire in 1928, the production moved in a new location in Perivale, and the building was sold in 1931. Only in the 1960s, the building reopened as light engineering work, but it became vacant again in 1971, acquired and renovated after five years by Cornhill Insurance Co (The story of more than a century of industry at Chiswick's Barley Mow, n.d.). The new concept for the building attracted different types of entrepreneurs and professionals, ranging from architects, jewellers, violin craftsmen, forniture designer and artisan. When opened the building hosted one hundred and forty-five firms, approximately three hundred and fifty people in about four thousand square meters of space. The venue was divided for two-thirds in studio space and one-third as workshops (Rock, 1986). The internal organization reflected the same idea of 5 Dryden Street, with centralized services, plus other small activities as a restaurant. In 1993, the Barley Mow Workspace was acquired by Workspace plc, still in use today as a business incubator.

The two projects, the working community at 5 Dryden Street and the Barley Mow Center shared the same concept but with a single significant difference in their development. Meanwhile, the project of 5 Dryden Street has been conceived as a cooperative place where tenants were also owners of the building, sharing common services and vision, the Barley Mow Center represented the first step into a commercial attitude of the newborn incubator model. The project was realized as a commercial operation, and for this purpose, the Rock Townsend assumed the role of developer, obtaining special clearance from the professional institution, since at that time professional firms in the United Kingdom were not allowed to perform the role of developer. As for the working community model, Rock Townsend has been the first professional firms to cover that role in the United Kingdom (Rock, 1986).

The second actor who played a crucial role in the birth of the modern incubator in the United Kingdom is Nicholas Falk (Campbell & Allen, 1987). He graduated in Philosophy, Politics, and Economics (PPE) at Oxford University, followed by an MBA at the Stanford School of Business. In this period he worked with the Ford Motor Companies, followed by three years with McKinsey management consultants.

During his period at Stanford, he signed up for a course on urban regeneration organized by the Free University of the West. It was through this experience that Falk developed an active political interest in urban renegotiation. During a trip to San Francisco, he noticed how community action could help to transform the degraded inner city, being impressed by the transformation of Ghirardelli Square, where the abandoned Ghirardelli chocolate factory was located. One of the earliest notable adaptive re-use projects in the United States that instead of replacing the historic brick structures with apartment buildings, was transformed to host an integrated restaurant and retail complex. The complex opened in 1964 (The history of Ghirardelli Square, n.d.). Returned to London Falk obtained a Research Fellowship in the Social Administration Department of the London School of Economics and he began a research project on the Rotherhithe area in London's Docklands, which will become the central element of his doctoral thesis in 1982. In 1975 he joined the Fabian Society, reciving a three years grant from David Sainsbury from Gatsby Foundation (Ferry, 2017). With this grant, he founded the Urban and Economic Development Group (URBED) in 1976, a non-profit-making firm of development consultant specializing in the regeneration of run-down areas and the creation of work (Falk, 1984).

Nicholas Falk's commitment to developing the incubator model is more difficult to trace back to individual projects. His engagement in this field started from some experimental projects such as the development of the Rotherhithe area to expand in the field of research, writing, patronage, including reports for governments, think tanks and inhouse publications. The experimental project in Rotherhithe, a historic but run-down corner of the Surrey Docks was the project that allowed Fank and URBED to create a step-by-step development model for the reactivation of redundant industrial areas, subsequently applied to many projects throughout the national territory (Falk, 2000: 97-108). On the Rotherhithe site, Falk's first action was the recover of the Brunel's derelict Engine House, which held the steam power pumps for building the Thames tunnel. The building was renovated and now houses the Brunel Museum. Through the creation of a development trusts, the third in the history of the London area, Fank continued the recovery of the area by converting the neighbouring warehouses, the Hope Sufferance Wharf. Together with the developer, the Industrial Building Preservation Trust, and the London Borough of Southwark, the large warehouse, dated from the eighteenth century, was renovated into several warehouses to workshop use (Marsh et al., 2003: 78, Falk, 1984).

The building was built in 1831 and was classified as a listed building. The adjoining warehouses were built later, and at the time all the complex was empty from twelve years. During the nineteen century it was used as a coal wharf and depot, to becoming a sufferance wharf for the handling of foodstuffs, flour and metals during the twenty century until the 1960s. In 1974 part of it was acquired by the Industrial Buildings Preservation Trust and converted by Duffy Lange Giffone Worthington, coordinated by a management council which consisted of professional and artisans who were to be eventual tenants. Initially, the project aimed to collect most of the funding needed for the conversion of the building through long-term commercial loans at favorable rates. The project instead collides with a public and private reality, slow or disinterested in financing this type of real estate transformation operations. The fund had to find an alternative solution to local government financial support due to cuts in spending and to financial institutions, which were no interested in investing in a redevelopment project of old building for a mixed-use. Grants from charitable foundations were the primary source for reaching the initial capital needed for the conversion (Eley & Worthington, 1984: 147-148). The high costs of the conversion led however to the accrual of debt, and in 1977 the building passed to the Southwark Council. It closed a few years, to be converted into apartments some years later (Byrnes, 2015). In the following years, Falk worked on many projects developing a strategic step-by-step urban regeneration model capable of self-sustainable and flexible. In late 1980 he was also a key player in the renewal of another abandoned London waterway complex: Merton Abbey Mills. It was an arts and craft village in the eighteenth century and the main silk-printing works of Liberties, fully restored with the realization fo a theatre, artisan and art workspaces, cafes and temporary activities in the internal public space (Harkness Report, 2014).

2.4.7 The second wave: the evolution of the incubator model

Unusual experiments and a slow diffusion marked the first period of development of the modern incubator model. After this first season, Business Incubators were recognised as long-term strategies of economic development with a variable prospect for employment (Campbell & Allen, 1987: 187) and multiplier effects on the local economy (Eley & Worthington, 1984: 19). The first wave of incubator programs until the 1980s, aimed at economic restructuring and job creation (Mian et al., 2016), essentially offering affordable space and shared facilities with an emphasis on small businesses (Lalkaka, 2001).

In this perspective, the incubator model was institutionalised and implemented by local and national governments. A key example of this historical moment is the British national program, in force from 1980 to 1985, "*The Small Workshop Scheme*", providing state funding to the private sector for the realisation of small workshops and the renovation of the industrial building stock (Campbell & Allen, 1987).The second wave of incubation programs in the 1980s, following the success of early models, especially in the United States, became a ordinary model within the private real estate market. Venture capitals extensive invested worldwide in establishing and managing technology business incubator. In this period, for-profit incubator offered a more extensive set of services, compared to low-cost industrial space and shared primary services conceived in the initial concept (Dichter et al., 2010).

In the 1990s, the recognised need to provide a strategic support to tenants and outsider affiliates as well as stimulating a collaborative environment led to a complete organisation of value-adding services. Counselling, skills enhancement, networking services, access to professional support and seed capital became strategic services for the development of companies and the consequent success of the incubator (Dichter et al., 2010). This transformation led to the second generation of incubators, although many of the developing regions today still refer to the original model.

In the late 1990s, due to the advent of the digital revolution and the rise of internet technologies, a new incubation model emerged, the Internet-based virtual incubation model, supporting new venture growth, particularly in specialised ventures such as Information Communications Technology (ICT) start-ups (Mian, 2014). The appeal of these for-profit Internet-based models proliferated but faded within months of the April 2000 NASDAQ technology stock crash (Mian, 2014). In parallel, the digital economy has given rise to a new form of Technological Business Incubator mechanism: the accelerator. The business accelerator model has been developed focusing mainly on the service added enhanced by digital technologies, developing consultancy programs designed to accelerate the development of start-ups and their activities, sometimes providing funds or grants under certain conditions. The average duration of an acceleration program ranges from six to twelve months. In this period, strategic, operational and organisational difficulties are addressed with a consultancy company support, to develop a know-how and operate efficiently in the market. The late 1990s constitutes a breaking moment for the incubator model that from light industry and local development will deviate to focum mainly on internet and ICT technologies with disruptive capacity and a short time to market, in the aim of creating growth-potential, tech-based ventures (Lalkaka, 2001).

In 2002, the European Commission started an incubator monitoring program to analyze success and defects of the incubator model (Centre for Strategy & Evaluation, 2002). With a renewed attention to the characteristics of the vast galaxy of incubators, a question about how to define and classify the different model arose. Despite alternative classification as technology centres, science park incubators, business and innovation centres there still a debate between researchers and scientists regarding the categorisation of incubators, because despite different names, their basic functions are often very similar. A better way to differentiate between organisations that share the basic incubator characteristics was found n the differentiation between no-profit and for-profit programs.

Today incubators are an integral part of the modern entrepreneurial ecosystem supporting the growth of new ventures. In 2015, there were globally 7,000 incubator programs, one-third of which were technology-oriented (InBIA, 2015). A significant percentage of the business incubators are not subject to particular sectoral orientation and are essentially mixed-use facilities (Centre for Strategy & Evaluation, 2002).

2.4. 8 Describing the incubator: a problem of definition

During fifty years of development of the phenomenon, considering the 1980s as the reference period of the first generation of business incubators, concepts and definitions changed consistently. The analysis on scholars definition published by Hausberg and Korreck on the Journal of Technology Transfer in 2018 pointed out how scholars conceptualization about the incubator show proximity and overlapping, increasing confusion in delineating a single and unique definition of the phenomenon (Hausberg & Korreck, 2018).

The large number of researches developed between the 1970s and 1980s focused on studying their characteristics from the point of view of economic development, job creation or real estate management. At the same time, while there have been numerous case studies of this type, Campbell stresses the lack of effort in recognizing the characteristics of the population of these places. Already in 1987, Kuratko and LaFollette stressed the problem of definition which accompanies the growth of the incubator phenomenon. "*The task of defining what is meant by an incubator has become difficult since the original concept is being adapted to fit the needs of the economic areas*" (Kuratko & LaFollette, 1987: 49)

The rise of internet technologies and the role assumed by ICT companies, together with the emergence of service and knowledge economy, has been a breaking point in the evolution and conception of the incubator. ICT technologies and the development service sector change the perspective in the definition of the incubator from physical characters, as in the 1980s and 1990s, to an explicit focus on services provided to tenants. They became the parameters to investigate which entities could be qualified as incubators and which cannot be.

"While for a long time the physical collocation of incubatees has constituted a central defining characteristic of business incubators, this feature is lacking in some more recent definitions due to the increasing focus on counselling and support services and the advent of virtual business incubators. On a most fundamental level, definitions of incubators refer to these as projects, tools, facilities, buildings, enterprises, organizations or most broadly institutions" (Hausberg & Korreck, 2018: 162)

The decline of the importance of the physical space within the various fields of study of Incubators is in line with the crisis of architecture in actively taking part in the development of this phenomenon, both in practice than in research. The task of the architect and design choices had difficulties in evolving from the established practice of developing, opened or closed, cubicle office environments. Moreover, few studies proposed a deep inquiry on the relationship between incubator activity population and the spatial solution applied to hosts them. Only in the last decade, this relationship has taken on new strength, often driven by the real estate market and by purely commercial purposes that, even if representing a captivating imaginary, resulted in layout choices with a low degree of experimentation and spatial quality. A question emerges about which spatial forms or arrangements can unleash the potential for better communication, exchange, optimization, of human and technical activities that these places host. The question is if the incubator model can exceed the mere rigorous office layout we experience from fifty years and if its form and order, its general characters, possess the right characteristics to be a catalyst for the development and growth of today SME's, characterized by a service-oriented high-tech light manufacturing and professions taking part in creative economy.

The debate over the definition of incubator remains open (Latouche, 2019). In their literary review, Hausberg and Korreck indicated two definitions of incubators. In essence, a broader one focused on the entity and the aim of the organization managing the incubator, and a narrower one, defined by the tangible and intangible support elements which constitute an incubator. These definitions are only a milestone in the incubator analysis. If architecture may not be one of the key areas for a narrow definition of the incubator, with a broader point of view, architectural studies are called as a fundamental discipline to expand this field of analysis.

"*Business" incubating-organizations are those that support the foundation and/or growth of new businesses as a central element of their organizational goal."*

"Business Incubators are business-incubating organizations that support the establishment and growth of new businesses with tangible (e.g. space, shared equipment and administrative services) and intangible (e.g. knowledge, network access) resources during a flexible period and are funded by a sponsor (e.g. government or corporation) and/or fund themselves taking rent (or less frequently equity) from incubatees." (Hausberg & Korreck, 2018: 161)

2.4.9 Definition related to space

Since the research denote that the definitions of the incubator concept are widespread and diversified, the following definitions refer to the incubator defining its spatial characteristics.

"A facility which promotes the early-stage development of a for-profit enterprise within the confines of a building (...)" (Plosila & Allen, 1985)

"Real estate projects with shared space and administrative arrangements [and] organize the business development process." (Campbell et al., 1985)

"A facility with adaptable space which small businesses can lease on flexible terms and reduced rents [where] Support services are available and shared" (Kuratko & LaFollette, 1987)

"Large buildings operated to nurture young companies by providing low-rent space, shared office services and management advice."(Lumpkin & Ireland, 1988)

"Centralized physical facilities that 'incubate' new and small ventures by providing them with varying support services and other assistance."(Udell, 1990)

"Are multi-tenant buildings providing affordable, flexible space, and a variety of office and support services which share a common purpose: to nurture small

fledgeling firms into healthy businesses."(Weinberg et al., 1991)

2.4.10 Difficulties in collecting and compare data

In the field of research, the complex nature of incubator, its being subject to the spatial and digital domain, formed by multi-scale networks of interaction where social, economic and managerial elements influence each other in a chain of events determining the success or fail of the project, is challenging reality to be investigated in its ensemble. The studies in this field are very heterogeneous, addressed through different points of view and with different objectives. The economic field and performance studies are the domain in which more research has been done. Already in 1987, Campbell pointed out the large number of researches achieved on incubator developments in contrast to a limited interest in the analysis of their population and characters. As describing the elements that characterize an incubator produced dissent between scholars with a different point of view, manifested in different definitions with conflicting and overlapping elements, even the attempts to investigates their performance methodologically have often generated analysis barely comparable.

As the local context in which business incubators operate vary from one location to another, there are limits on the extent to which comparison can be made. The analysis of the incubators then collides with another difficulty which is the collection of data to carry out surveys and comparisons. Although the use of digital tools and the extensive databases that the advent of the internet has made available, the analysis of the reality of incubators deals with congenital problems due to its nature.

Businesses hosted in an incubator are often small companies that appear for the first time on the market, in this phase companies face problems often informally, within market niches that are not always traceable or, on the opposite, totally digital, as in the case of crafts sold on Etsy. Taking, for example, this type of platform, analyzed by Luckman's inspiring work "Craft and the Creative Economy", the economy of Etsy and the type of information collected are based on a scale that can hardly contain accurate spatial data, intersecting the discussion on the role of the incubator in these economies. The analysis must be approached in a bottom-up perspective, starting from the fundamental element: the place where these companies carry out design and production operations, to subsequently widen the field of analysis to the broader scales of the phenomenon. In an attempt to investigate job creation performed by incubators, Udell brings attention to the criticality that systematic research in this field must face: the problem of obtaining good and reliable data. This problem, which also occurred in the fieldwork of this research, relates on entrepreneurs often reluctant or too busy to share information, which does not keep good records or feel themself engage in self-aggrandizement when providing information (Udell, 1990).

Bibliography

An empty building became the first Business Incubator" Democrat and Chronicle Aug, 23 1983, 4.

d'Aviler, A.-C. (1755). Manufacture. In Dictionnaire d'architecture civile et hydraulique et des arts qui en dépendent. Charles-Antoine Jombert.

Allen, D. N., & McCluskey, R. (1986). Structure, Policy, Services, and Performance in the Business Incubator Industry. Entrepreneurship, Theory and Practice, 15(2), 61–77.

Artigues i Vidal, J., & Mas i Palahí, F. (2019). casa-fàbrica als inicis de la industrialització. Registre de fàbriques de Ciutat Vella de Barcelona 1738-1807 / 1808-1856. Ajuntament de Barcelona.

Bergek, A., & Norrman, C. (2008). Incubator best practice: A framework. Technovation, 28(1), 20–28.

Berger, R. A. (1984). The small business incubator: Lessons learned from Europe. Office of Private Sector Initiatives, Small Business Administration.

Byrnes, A. (2015, February 3). A Rotherhithe Blog: Hope Sufferance Wharf and Granary, Rotherhithe village, 1850 - 2014. A Rotherhithe Blog. http://russiadock.blogspot.com/2015/02/hope-sufferance-wharf-and-granary.html

Bouvier, J. (1972). Rondo Cameron, La France et le développement économique de l'Europe, 1800-1914. Annales, 27(1), 90–93.

Bower, J. L., & Christensen, C. M. (1995, January 1). Disruptive Technologies: Catching the Wave. Harvard Business Review, January–February 1995. https://hbr.org/1995/01/disruptive-technologies-catching-the-wave

Bradford, C. (1982). The politics of private sector initiatives: The case of City Venture Corporation. Institute of Public Affairs.

Braudel, F. (1993). Civilisation, économie et capitalisme: XVe-XVIIIe siècle: Vol. 2: Les jeux de l'échange. Armand Colin Livre de poche.

Campbell, C., & Allen, D. N. (1987). The Small Business Incubator Industry: Micro-Level Economic Development: Economic Development Quarterly.

Campbell, C., Kendrick, R. C., & Samuelson, D. S. (1985). Stalking the latent entrepreneur: Business incubators and economic development. Economic Development Review, 3(2), 43–48.

Carl, P. (2011). Type, Field, Culture, Praxis. Architectural Design, 81(1), 38–45.

Centre for Strategy & Evaluation. (2002). Benchmarking of business incubator. European Commission Enterprise Directorate- General.

Chu, J. (2010, October 1). Stanford University's Unique Economic Engine. Fast Company. https://www.fastcompany.com/1686634/stanford-universitys-unique-economic-engine

Chase, F. H. (1924). Syracuse and its environs; a history,. Lewis historical Pub. Co.

Cooke-Taylor, R. W. (1886). Introduction to a history of the factory system. London R. Bentley.

David Rock. (1979). Built Environment (1978-), 5(3), 195–196.

Dichter, G., Reis, G., & Marchand, N. (2010). The Smart Guide to Innovation-Based Incubators (IBI) (P. Vanrie, Ed.). Europea Union - Regional Policy.

Ebenezer, H. (1985). Garden cities of tomorrow. Attic Books.

Eley, P., & Worthington, J. (1984). Industrial rehabilitation: The use of redundant buildings for small enterprises. Architectural Press.

Epstein, S. R. (2008). Guilds, innovation, and the European economy, 1400—1800. Cambridge Univ. Press. http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10221547

Factory. (n.d.). Encyclopedia Britannica. Retrieved 25 March 2020, from https://www.britannica.com/technology/factory

Factory. (2013). In C. McIntosh & Cambridge University Press (Eds.), Cambridge advanced learner's dictionary (Fourth edition). Cambridge University Press.

Falk, N. (2000). New uses for old industrial buildings. In M. Stratton (Ed.), Industrial buildings: Conservation and regeneration (E & FN Spon).

Falk, N. (1984). Our Industrial Heritage: A resource for the future? Journal of the Royal Society of Arts, 133(5341), 31–46.

Farr, J. R. (2000). Artisans in Europe, 1300-1914. Cambridge University Press.

Ferry, G. (2017). A Better World is Possible: The Gatsby Charitable Foundation and Social Progress. Profile Books.

Flusser, V. (1999). The Shape of Things: A Philosophy of Design. Reaktion Book.

Giedion, S. (2013). Mechanization Takes Command: A Contribution to Anonymous History by Sigfried Giedion. University of Minnesota Press.

Griffiths, S. (2017). Manufacturing Innovation as Spatial Culture: Sheffield's Cutlery Industry c.1750-1900. In I. Van Damme, B. De Munck, & A. Miles (Eds.), Cities and Creativity from the Renaissance to the Present. Routledge.

Grimaldi, R., & Grandi, A. (2005). Business incubators and new venture creation: An assessment of incubating models. Technovation, 25(2), 111–121.

Gripaiors, P. (1997). Industrial decline in London. An examination of its causes. In Urban Studies, 4.

Hackett, S. M., & Dilts, D. M. (2004). A Systematic Review of Business Incubation Research. The Journal of Technology Transfer, 29(1), 55–82.

Hardin, E. (1993). Syracuse Landmarks: An AIA Guide to Downtown and Historic Neighborhoods. Syracuse University Press.

Harkness Report. (2014). Nicholas Falk Profile. http://urbed.coop/sites/default/files/HFA%20Report%20July%202014_Nicholas%20Falk%20Profile.pdf

Hausberg, J. P., & Korreck, S. (2018). Business incubators and accelerators: A co-citation analysis-based, systematic literature review. The Journal of Technology Transfer, 45(1), 151–176.

Hochberg, Y. V. (2016). Accelerating Entrepreneurs and Ecosystems: The Seed Accelerator Model. Innovation Policy and the Economy, 16, 25–51.

Holliss, F. (2012). Space, Buildings and the Life Worlds of Home-Based Workers: Towards Better Design. Sociological Research Online, 17(2), 24.

Horace, A. (1896). Modern Machine-Shop Economics. Part II. Engineering Magazine, 11.

InBIA, 2015. International Business Innovation Association, https:// www.inbia.

org/.

Koolhaas, R., & Mau, B. (2002). S, M, L, XL (Subsequent edizione). Monacelli Pr.

Kuratko, D. F., & LaFollette, W. R. (1987). Small Business Incubators for Local Economic Development. Economic Development Review, 5(2), 49–55.

Industrial Age Fed Syracuse Boom. (n.d.). Retrieved 12 October 2019, from http://syracusethenandnow.org/History/IndustrialAgeFedSyracuseBoom.htm Kilcrease, K. (2012). The Batavia Industrial Center: The Hatching of the World's First Business Incubator. New York History, 93(1), 71–93.

Laboratorio Prato PRG (Ed.). (1996). Un progetto per Prato: Il nuovo piano regolatore. Alinea.

Lalkaka, R. (2001). Best Practices in Business Incubation: Lessons (yet to be) Learned. International Conference on Business Centers: Actors for Economic & Social Development.

Landes, D. S. (1997). The unbound Prometheus: Technological change and industrial development in Western Europe from 1750 to the present (Reprint). Univ. Press.

Latouche, P. (2019). Open innovation: Corporate incubator. Wiley-ISTE.

Lewis, D. A. (2001). Does technology incubation work? A critical review. Reviews of Economic Development Literature and Practice, 11, p 48.

Lumpkin, J. R., & Ireland, R. D. (1988). Screening Practices of New Business Incubators: The Evaluation of Critical Success Factors. American Journal of Small Business, 12(4), 59–81.

Marsh, C., Martinos, H., McIntosh, A., & Morely, S. (2003). Industrial and Business Space Development: Implementation and urban renewal. Taylor and Francis.

Mian, S., Lamine, W., & Fayolle, A. (2016). Technology Business Incubation: An overview of the state of knowledge. Technovation, 50–51, 1–12.

Mian, S. A. (2014). Business incubation mechanisms and new venture support: Emerging structures of US science parks and incubators. International Journal of Entrepreneurship and Small Business, 23(4), 419–435.

Milizia, F. (1781). Principj di Architettura Civile.

Morley, S. (Ed.). (1989). Industrial and business space development: Implementation and urban renewal. E. & F.N. Spon.

Ogilvie, S. (2018). The European guilds: An economic analysis. Princeton University Press.

Ogilvie, S. (2011). Institutions and European Trade: Merchant Guilds, 1000-1800. Cambridge University Press.

Ogilvie, S. (2008). Rehabilitating the guilds: A reply. The Economic History Review, 61(1), 175–182. https://doi.org/10.1111/j.1468-0289.2007.00417.x

Ogilvie, S. (2004). Guilds, efficiency, and social capital: Evidence from German proto-industry. The Economic History Review, 57(2), 286–333. https://doi.org/10.1111/j.1468-0289.2004.00279.x

Palo Alto History. (n.d.). Retrieved 26 January 2020, from http://www.paloaltohistory.org/stanford-research-park.php

Panerai, P. (Ed.). (2004). Urban forms: Death and life of the urban block. Architectural Press.

Plosila, W. H., & Allen, D. N. (1985). Small Business Incubators and Public Policy: Implications for State and Local Development Strategies. Policy Studies Journal, 13(4), 729–734. Sennett, R. (2008). The craftsman. Yale Univ. Press.

Price, G. M. (1912). The Modern Factory; Safety, Sanitation and Welfare; HardPress Publishing.

Smilor, R. W., & Gill, M. D. (1986). The new business incubator: Linking talent, technology, capital, and know-how. Lexington Books.

Stratton, M. (Ed.). (2000). Industrial buildings: Conservation and regeneration. E & FN Spon.

Rock, D. (1986). Making Things Happen [Interview]. Pidgeon Digital. https://www.pidgeondigital.com/talks/making-things-happen/

Temali, M., & Campbell, C. (1984). Business Incubator Profiles: A National Survey. Hubert H. Humphrey Institute.

The history of Ghirardelli Square. (n.d.). Ghirardelli Square. Retrieved 2 April 2020, from https://www.ghirardellisq.com/history

The story of more than a century of industry at Chiswick's Barley Mow. (n.d.). Retrieved 5 February 2020, from https://www.workspace.co.uk/community/homework/growth-and-strategy/century-of-industry-at-chiswicks-barley-mow-centre

Todd, G. (1984). Creating New Jobs in Europe: How Local Initiatives Work. The Economist Intelligence Unit Ltd.

Udell, G. (1990). Are business incubators really creating new jobs by creating new business and new products. Journal of Product Innovation Management, 7(2), 108–122. Weil, S. (1951). La condition ouvrière. Éditions Gallimard.

Weinberg, M. L., Allen, D. N., & Schermerhorn, J. R. (1991). Interorganizational Challenges in the Design and Management of Business Incubators. Review of Policy Research, 10(2–3), 149–160.

Wilkinson, T. (n.d.). Typology: Artist Studio. Architectural Review. Retrieved 25 March 2020, from https://www.architectural-review.com/essays/typology-artist-studio/10017316.article

Wright, C. D. (1884). Report on the Factory System of the United States. Government Printing Office.

Chapter 3

How to study the factory. Methodology and instruments of analysis

3.1 European industrial environment overview

3.1.1 Introduction. A challenge for European industry

European manufacturing is in decline. Service sector and the knowledge economy has risen from the advent of ICT technologies in the nineties, but the global crisis that particularly affected the financial sector in 2009 has taken back into focus the benefits of a stable manufacturing base. After a long period of decline for manufacturing, in the last decade a change of direction has occurred. Europe and western countries have attended a slowdown in the fall of manufacturing with episodes of re-shoring and a more visible deceleration of the off-shoring of jobs to Asia (Hurley, Storrie, & Peruffo 2016).

These considerations about the state of European industry has contributed to questioning a re-industrialization on the European territory, following a thriving debate taken place in the US, that produced a wide range of publication on trends, statistics and academic research on the current state of manufacturing. The debate has questioned the role and characteristics of *Urban Manufacturing*, the impact of new technologies on the working environment and the strategies to bring production back to the American territory, documented through the work of research centers and institutions such as the *Pratt Center for Community Development* or the *Urban Manufacturing Alliance*, the *MIT Task-force on Innovation and Production*, the *Boston Consulting Group* or *The maker City Movement*.

The return of manufacturing under the spotlight of the public debate is also caused by the transformations taking place inside the working system. From the manufacturing supply side, a wave of innovation and new technologies is providing opportunities and products on the market, redeveloping production process and their performance. We are changing the way we produce goods and a revolution through robotics, IT services, Big Data, and additive manufacturing is already part of this transformation. These technologies heighten mass customization of durable products and rapid prototyping with the opportunity of producing small batch or low-volume of products reducing entry barriers for new players in the market and the related high setup cost of machinery[1]. As a consequence, the relative advantages of off-shoring production in remote countries, a lower cost of production for economies of scale and low wages for the workforce are losing their attractiveness in favor of places where innovation a high value-added can be achieved[2].

In addition, a generational change in the workforce requires different and higher skills to manage complex processes in a global supply chain. Manufacturing activities increasingly involve and are involved in service sectors: research and developments, design, logistics, and other high value-added activities take a strategic role in supporting manufacturing. Companies have to tackle with an ageing labor force which needs to be trained to face technological requirements and the changing patterns of consumers behavior, who pay more attention to the product they consume, to the use of environmental resources and the quality of the products they buy (Barbiero et al., 2013, p. 39-47).

As human and technological characters are facing a makeover, the spatial environment that host them need to face this transformation and innovate, adapting itself to new requirements. In this regards the production space, the *factory* and its technical systems need to adapt to the collaboration between robots and the workforce through digital technologies, but also to new workers requirements and layout, such as the smaller size of machinery and the removal of barriers between production and customers, thought experiencing the factory atmosphere and the production process of innovative products (Arup, 2015). Sometimes this means coming back to the urban environment to benefit from competitive advantages related to knowledge economies and R&D with the necessary rethinking of urban

1 In 2015, the engineering firm Arup published a document entitled “Rethinking the Factory”. The publication highlights the characteristics of flexibility and resilience necessary for new industrial buildings, integrating new production technologies and new technical knowledge. (Arup. , 2015, p. 27-38)

2 The analyzes on the impact of technologies on the factory space and on production processes have been developed both by private companies such as Arup and KPMG, and by local and national public bodies such as The British Government Office for Science. (KPMG, 2016; KPMG, 2017; The British Government Office for Science, 2013)

industrial policy and its relationship with the urban economy.

Global trends and challenges that are shaping the future of manufacturing globally will also influence the future of European manufacturing. This set of factors will determine regions and countries in which manufacturers will locate their activities and jobs. Although access to the labor market and resources will remain primary elements in the location of industrial production, increasingly important for Europe will be the achievement of a competitive advantage in offering specific technical capabilities in production and research, high quality in supporting services in the value chain and strengthen an extensive and local network of suppliers and customers (Barbiero et al., 2013).

Probably the characterizing decline in terms of production and value added of the European manufacturing is likely to continue in the next future as a result of a relative slow growth in demand for manufactured products in relation to service. Similarly employment will continue to decline as result of a strong productivity growth and due to the constant growth of Asian markets as manufacturing capacity. Nevertheless manufacturing will continue to matter for Europeans economics, primarily for its, direct and indirect, innovation and productivity-growth capacity (G. Leigh & Hoelzel, 2012).

The renaissance of manufacturing in Europe[3], beyond the number of jobs that it will be able to create contrasting a strong global competition, will constitute an important asset for urban economies. Leigh and Hoelzel have reported a lack of attention in urban planning to the industrial sector that remains external to urban policies while possessing decisive economic attribute for the revitalization of the urban environment with the highest economic multiplier of any sector[4]. The result is a substantial loss of areas destined for the industry, converted to more profitable uses[5].

Urban industrial areas were generally perceived [..] to be functionally obsolete,

---

3 In January 2014, the European Union published a document entitled "For a European Industrial Renaissance" which highlighted the importance of the industrial sector in Europe's recovery policies after the 2009 crisis. The document insist on the importance of industrial activities which account for the 80% of Europe's exports and 80% of private research and innovation. Nearly one in four private sector jobs is in industry, often highly skilled, while each additional job in manufacturing creates 0.5-2 jobs in other sectors (European Commission, 2014)

4 The American manufacturing Institute together with the Manufacturing Alliance / MAPI and Manufacturing Extension Partnership / NIST published in 2009 a study on the characteristics of manufacturing in the United States, highlighting the role of industry in producing the largest multiplier factors in other sectors compared to the service sector (The Facts About Modern Manufacturing, 2009)

5 Nancey Green Leigh and Nathanael Z. Hoelzel through the analysis of different urban plans and land use on the American territory denounce the lack of attention towards the planning of urban industrial resources. They declare: "*[...]planning practitioners and academics should rectify smart growth's blind side by acknowledging the lack of attention to issues and priorities for revitalizing urban industry in the smart growth movement and by promoting the fact that, for sustainable cities and regions, a vital industrial presence in urban neighborhoods is as important as a dynamic commercial and residential presence."* (G. Leigh & Hoelzel, 2012, p. 88)

underutilized, or otherwise insufficient to support the dense, mixed-use development smart growth advocates to combat sprawl and improve urban neighborhood quality. Subsequently, [...] authors placed greater emphasis on improving local conditions (including the conversion of industrial land) in order to attract the type of real estate development that would support the mix of residential and service- and knowledge-based economic activities more consistent with the popular conception of the new economy. (G. Leigh & Hoelzel, 2012, p. 91)

In a time of scarcity of resources and environmental issues, cities risk to miss out significant new economic development opportunities from advanced and sustainable manufacturing and related industries, with a direct effect on the quality of life and on the possibilities of building a stronger and resilient local economy. The following sections provide empirical evidence to help answer these questions.

3.1.2 Europe is rethinking its industrial policy

The realization of the right local policies to support the improvement of manufacturing in the urban environment requires an understanding of the changing characters of the working system at the global scale[6] and the changing role of manufacturing in the European agenda.

From 2012, the European Commission aims to "*raising the share of industry in GDP from the current level of around 16 percent to as much as 20 percent in 2020*" and the realization of a comprehensive vision "*mobilising all the levers available at EU level, notably the single market, trade policy, SME policy, competition policy, environmental and research policy in favour of European companies' competitiveness*" (European Commission, 2012). In the last decade, the focus of the European agenda on designating the right support to the industrial sectors opened to a debate on what kind of industrial policy Europe should pursue[7].

A vertical approach would have supported specific sectors or firms, instead, a horizontal program envisioned the role of policies as an instrument for creating the conditions for investment by eliminating barriers and aiding entrepreneurs in facing the difficulties of starting a new business. Encouraging the objectives set out in the 2020 Agenda, The European Commission recognized the central importance of industry for creating jobs and growth implementing the instruments of regional development in support of innovation, skills, and entrepreneurship (European Commission, 2014). The last publication of 2017 added a series of prescriptions in encouraging smart, innovative and sustainable industry embodying this horizontally

6 Chapter 1 give an overview of the changing value of the working system in relation a change in the desing of factory buiding and the city.

7 The debate on European industrial development policies was divided into two main approaches: vertical and horizontal. While in the 1970s and 1980s, a "vertical" approach was more common with targeted support to specific sectors and firms, since the early 1990s the approach moved to a more integrated approach, "orizontal", to stimulate R&D and innovation and provide the framework conditions and incentives for investment. (Barbiero et al., 2013)

integrated approach into regional tailor made industrial policy.

In supporting the industrial sector, the European Union faced the necessity to identify what type of activities Europe should focus on in the productive value chain to create sustainable jobs and growth in Europe and within what global networks these activities should be developed. A question that still matters as the scarcity of natural resources, climate change and the democratic crisis, need a rapid renovation of industrial approaches to support the radical changes that these global problems entail. An inquiry that crosses sectoral boundaries, affecting also architecture and urban planning.

After a loss of interest during the last decades in the spaces of production, architects and urban planners are called to take a position within this debate, bringing their disciplinary knowledge as an active tool in the design of the new connection between city and production. As Lucius Burckhardt has written in a brilliant article published on Domus in 1998,

"the next generation of job will be no part of the agricultural, productive or service sector but rather they will be part of a "new mode of production" which also includes some traditional activities. The production will be organized for small units, with reduced capital, highly specialized and forced for most of the tasks to create joint ventures that will dissolve again when the job is finished." (Burckhardt, 2019, p. 221)

How to design spaces for these actors? what are their needs? What advantages do these activities bring to the city and how many jobs? architects and researchers in this field can construct efficient tools to respond to these new and future needs.

The following paragraphs will focus on the characteristics of companies and industry within the European territory, portraying the importance of Small and medium enterprises (sMEs) as the backbone of European economy. The European macroeconomic environment strengthened SMEs activity in all industries although the European Union is not yet on a par with the dynamism of other partner regions and countries, such as the United States. In recent years, SMEs have been counting on high-rate growth thanks to favorable economic conditions for the European Union, but it is not reliable that the same conditions will extend indefinitely into the future. For this reason, European policies are providing targeted support to this business segment, most notably through its *"Start-up and Scale-up initiative"*. As they are recognized as drivers of economic growth, since 2016, the *Start-up and Scale-up initiative* initiative provides support to high growth firms and Start-up with a range of actions to reduce existing barriers to growth so as to enable start-ups and scale-ups to expand their business across Europe.

These actions results in fostering better governance system, better accessibility, financing and higher education level of the population. In particular accessibility to the urban environment has been indicated as a fundamental element to allow the birth and growth of new business, from advanced technologies to artisan and creative industries, ensuring a fertile environment for the development of a stable network (European Commission, 2016) .

Once again, architecture and city planning are fundamental practices for the development of good and varied regional based economy with the realization of mixed-use districts where industrial space merges with living activities. The case studies analyzed reconstruct these dynamics: large industrial buildings hosting small and medium-sized enterprises within the dense urban fabric while providing the necessary space for production and a dynamic urban context, far from the model of monofunctional peripheral industrial districts isolated from others urban activities.

3.1.3 The business environment of Europe

In the European economic landscape the 99.8% of enterprises which operated in the non-financial business sector in 2018 were SMEs. They employed 94 million people, accounting for 66% of total employment in Europe non-financial business sector, and they generates 57% of value added. Almost all, 93 % of the total of SMEs were micro SMEs employing less than 10 persons. (Muller et al., 2018, p. 8) (Table.1)

As the European annual report on small and medium enterprises proclaimed, SMEs' contribution to the growth in employment and value added in 2018 overcome what was assumed on the basis of their relative importance in the economy, recovering from the economic and financial crisis of 2009 and even slightly exceeded the 2008 level of employment, marked by range of differences between the various countries of the European Union. The level of value added generated by European SMEs showed even greater recovery, 11% higher than per-crisis values of 2008 (Muller et al., 2018). Performance analysis on SMEs proved that the reference market for European small and medium-sized enterprises is the internal market of the union, which counts for 80% of exports. The analysis on indicator between 2012 and 2016, showed that the 88% of European companies exporting goods were SME, counting for a 36% of all export, and generating an added value that for 70% reach other Member States (Muller et al., 2017).

Datas on companies' dimension, represented for the majority by micro-enterprises, and the basin of influence of exports, relating to a market that often refers to local commercial connection, highlight the advantage that these companies produce not only in the macroeconomic system of the European Union, but especially as economic driver for regional development. SMEs are at the core of our economy and the fabric of our society, they are crucial in providing service and local products for the daily life of European, playing a decisive role for social stability at local and regional level (Muller et al., 2017).

In the relation with the urban environment SMEs showed contradictory patterns. One-person enterprises have the highest shares of employment in urban areas, even if studies from the first period of 2018 have shown a general predominant share of employment in SME in rural and peripheral areas than urban and capital region. However, these dynamics are subject to large variations between region of analysis

	micro SMEs	small SMEs	medium size SMEs	All SMEs	large enterprises	all enterprises
enterprises						
number	22.830.994	1.420.693	23.857	24.483.496	46.547	24.530.050
%	93,1	5,8	0,9	99,8	0,2	100
value added						
value in €	1.525,6	1.292,1	1.343,0	4.160,7	3.167,9	7.328,1
%	20,8	17,6	18,3	56,8	43,2	100
employment						
number	41.980.528	28.582.254	24.201.840	94.764.624	47.933.208	142.697.824
%	29,4	20	17	66,4	33,6	100

Table 1. Number of SMes and Large enterprises in the EU-28 non financial business sector in 2017. Source: Annual report on Europe SMEs 2017/2018 European Commission

which suggests the need for tailor made policies, capable of strengthening the existing economic sectors while encouraging the birth and growth of new activities in a broader and diversified economic context. Notably, a higher share of the Creative and Knowledge economy proceed together with a higher or at least average share of SME employment, localizing their activities in urban and metropolitan regions, which are more specialized in knowledge intensive business.

The development of small and medium-sized businesses in the European territory has a strong bond with the building environment due to its role in the generation of employment. As most Europeans live in urban areas, this number has reached 72% of 513 million people living in Europe in 2016 (Schuh et al., 2018), the impact of employment rate touch directly the dynamics of urban development and the living conditions of citizens. How to increase jobs and how encouraging the creation and growth of businesses in the region are two of the important themes that municipalities and policy-makers are addressing in order to foster an equal improvement in social welfare. (Table 2.)

Even if the mortality rate of SMEs, especially among young enterprises is very high, european reports indicated that for each new SME surviving the period between 2012-2015 there were 9 companies that did not, the cumulative increase in non-financial sectors employment and the between 2008-2017 was 52%; which is related to the amount of people employed in SMEs, 66% of the total employment of europe, define a significant role of SMEs in fostering employment growth (Muller et al., 2017 p. 62).The sectors presenting the higher share of employment are clustered in a group of five, counting: accommodation and food service, business service, construction, manufacturing, and wholesale and retail trade. Technology intensive sector played a prominent role in SMEs' growth, in particular high tech services as Scientific research and development, Computer programming or Information service activities.

Small and medium-sized enterprises are also subject to a high rate of self-

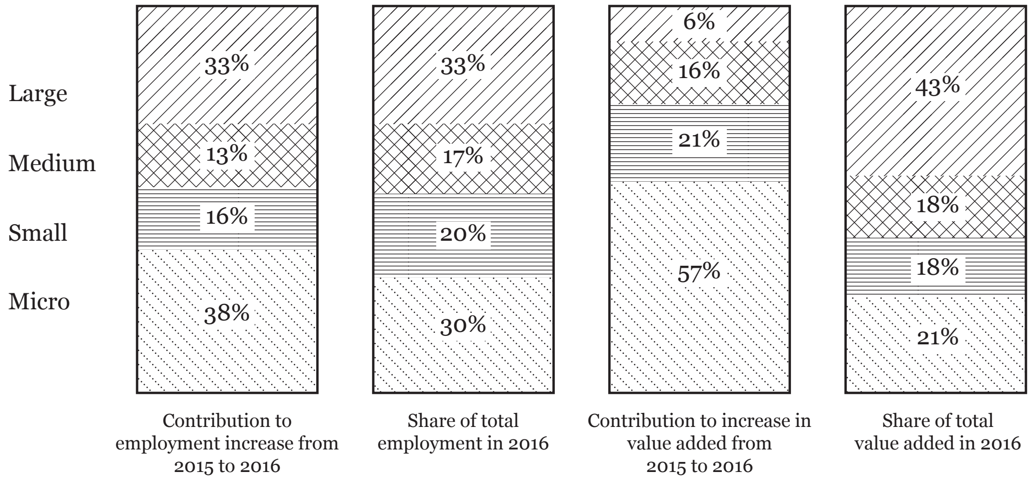


Table 2. Contribution of different enterprises size class to the increase in employment and value added in the EU-28 non-financial business sector in 2016. Source: Annual report on Europe SMEs 2016/2017 European Commission.

employment. Numerous European SMEs are run by self-employed individuals. In 2016 the analysis on the 28 european member states has reported that 14% of all employed in europe were self-employed, for a total of 30 million people considered operative in a business but without a paid employment position. 71.5 % of these self-employed did not employ any staff. New information technologies led to new working opportunities and production methods supporting more dynamic working practices (Muller et al., 2017 p. 49). Even if these practices are present

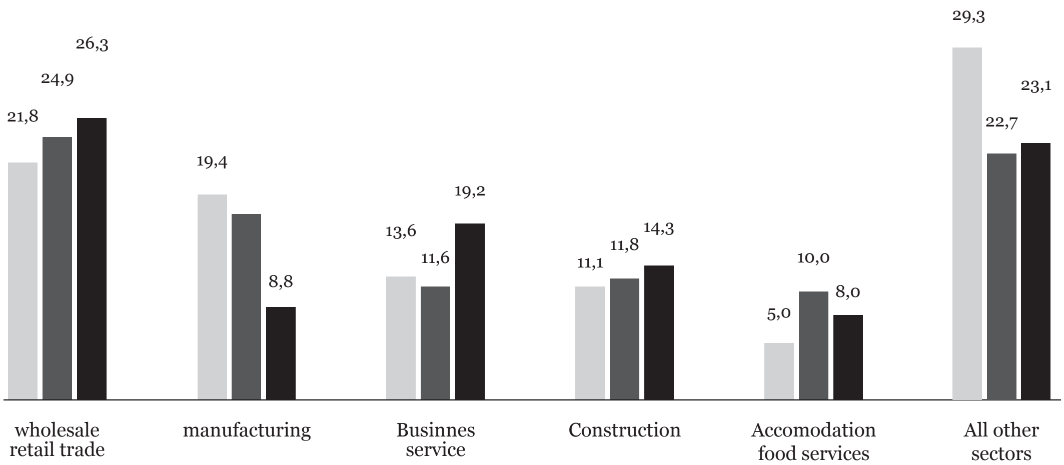


Table 3. Shared of SMEs value added, employment and number of SMES enterprises in the EU-28 non-financial in 2017 accounted for by the 5 Key SME economic sectors. Source: Annual report on Europe SMEs 2017/2018 European Commission

in an increasingly consistent manner within the working dynamics, the analysis of these protocols outside of specific cases is intrinsically difficult to measure. The emergence of the so-called “platform” or “gig” economy outlined around the presence of online instrument of matching individuals offering a specific service with people looking for these services has had a considerable wide impact on the european phenomenon of self employed.3.1.4 European cities looking back to manufacturing

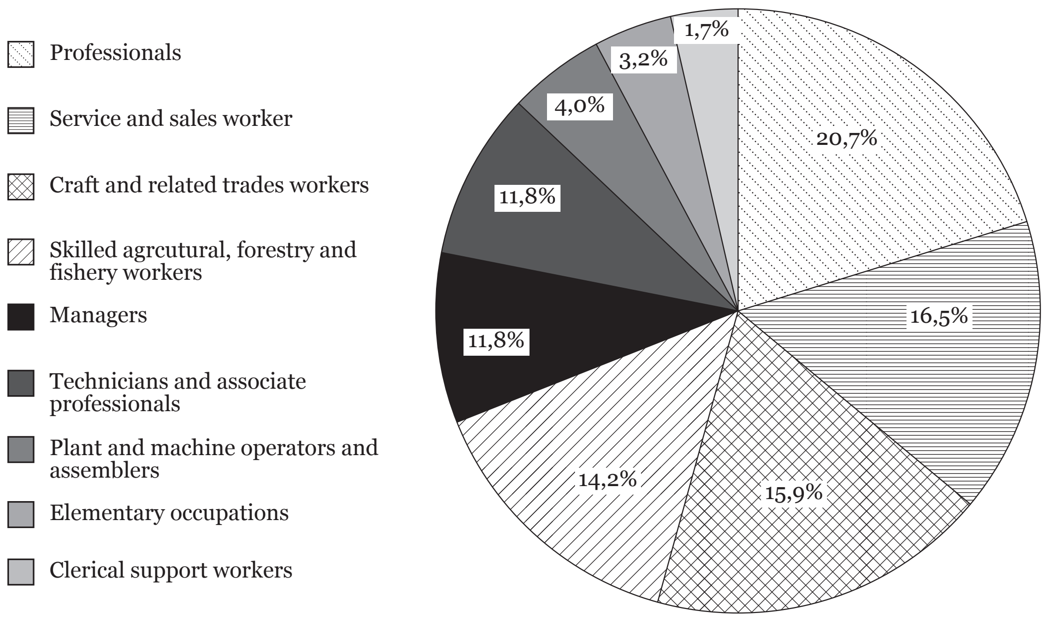


Figure 4. Share of EU-28 self-employment by occupation in the EU-28 - 2016 Source: Eurostat

3.2 Case studies framework

3.2.1 Research design and methodology

Inside the context of the European Union, the analysis framework was applied in a number of city/urban regions by developing a case study methodology, looking simultaneously at different levels of analysis in order to identify the cases that most satisfied the requirements subsequently described. The research has proceeded with a series of fieldwork in the selected cases studies to acquire the necessary information and monitoring possible transformation during the three years of research.

The European territory is characterized by two preeminent conditions. The first refers to the economic structure of the European Union characterized by strong presence of small and medium-sized enterprises, in particular of micro-enterprises that need favorable conditions for their development and a flexible network to respond to the inflections of a constantly changing global market. The second has historical origins. The European context, the cradle of the first industrial revolution, allows us to highlight the dynamics of continuity and discontinuity that the relationship between industry and the built environment produced, and how these dynamics move inside the narrow meshes of stratified urban contexts, in which it is possible to visualize all the phases of transformation of production models still today: from the proto-industry of the late eighteenth century to the high-tech forms of today advanced research centers.

The resilience of the urban form that characterizes the European city is connected to the central theme of the research: the phenomenon of *Urban Manufacturing*. The research contributes to the study of the phenomenon with the analysis of industrial incubators located in dense mixed-use urban areas. Incubator has been identified as a strategic model to foster the development of local enterprises while promoting the reuse of the empty industrial building stock. Most incubators present an adaptive reuse strategy and a high density of companies in the same place, making possible to investigate the phenomenon of urban manufacturing both in terms of economic sectors involved and by analyzing spatial conditions and characters required by urban manufacturing activities. The selected case studies are characterized by being located or spatially connected to residential areas and services, moving away from the most common circumstances described by industrial districts or large peripheral industrial areas.

Incubators spread in numbers worldwide over the last decades. A study conducted in 2000 by a team from *Harvard Business School* showed the number of incubators rising globally from 14 in 1995 to 348 as of May 2000. Between November 1999 and May 2000, Internet incubator startups more than doubled worldwide (Morten et al., 2000). While the U.S. is still the leader in the number of incubators, estimated to be 1400 in 2016 by International Business Innovation Association (InBIA) (Impact Index – Inbia.Org, n.d.) incubators are spreading rapidly in Europe and Asia. In 2002, the study realized by the European Commission classified around

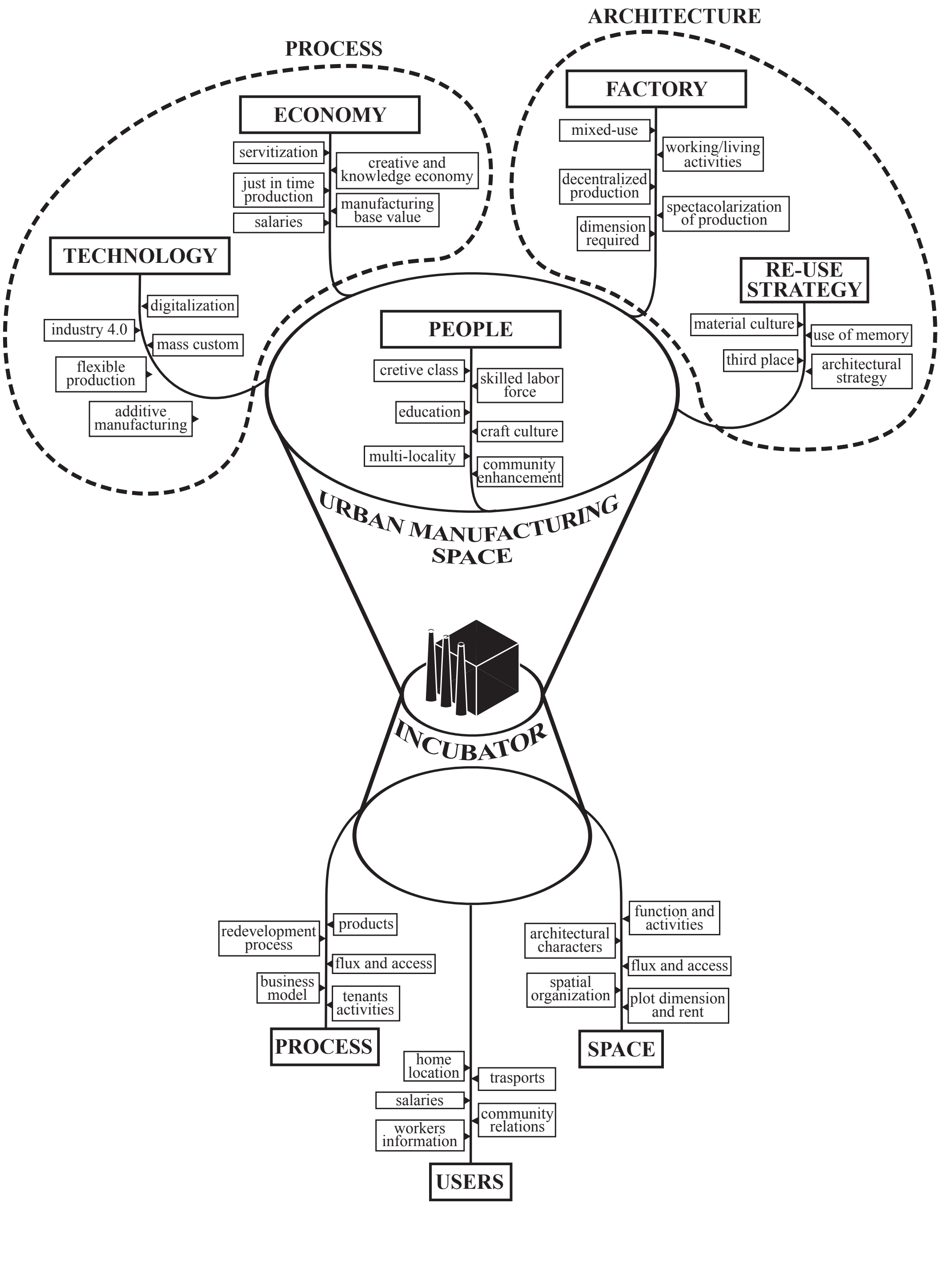


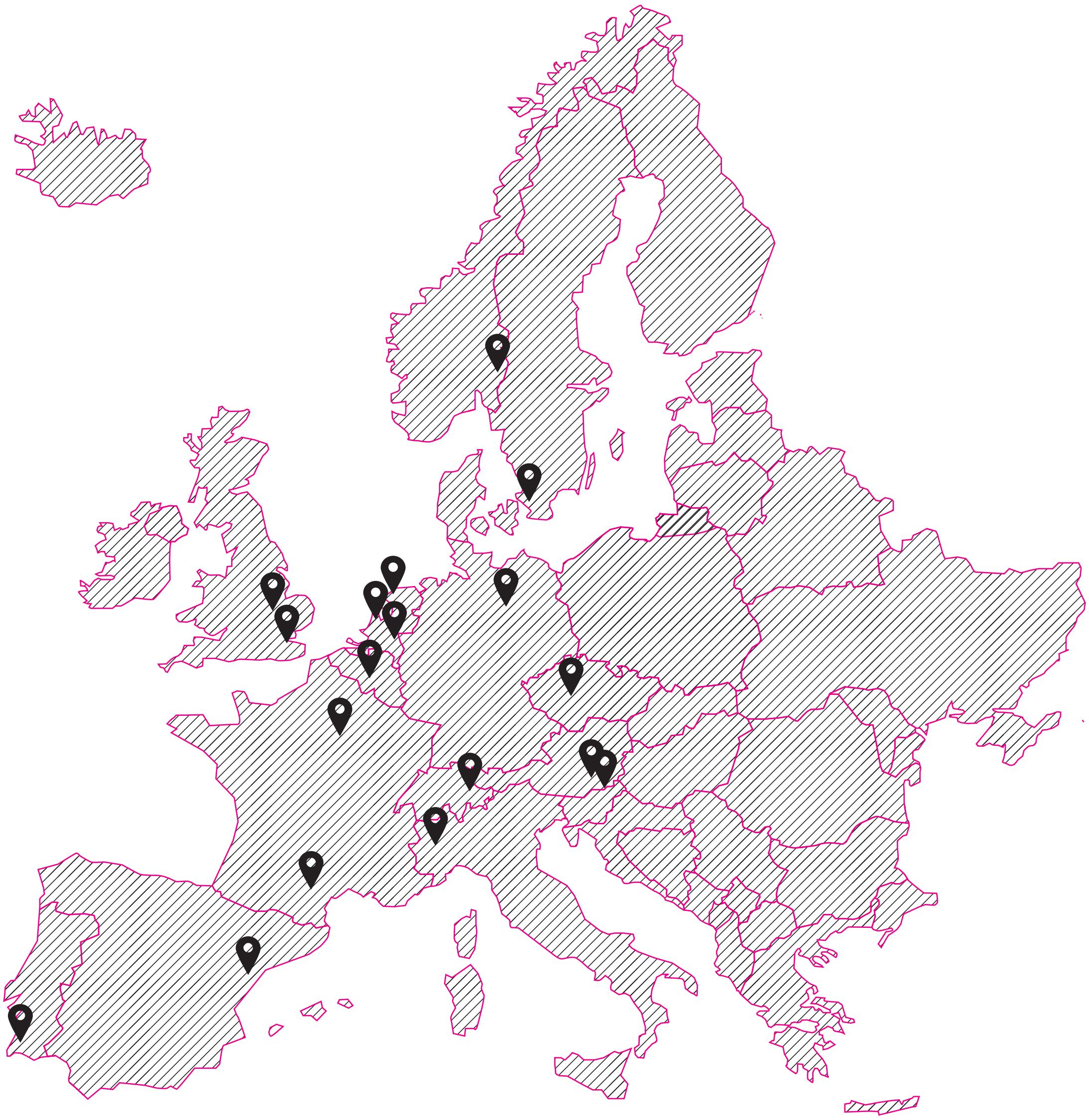
Figure 5. Graphical representation of research topics and tools.

900 incubation environments in Western Europe. The compound annual growth rate for accelerators in Europe multiplied since the start of the crisis in 2008 to a 29% annual growth rate in 2013 (Salido et al., 2013: 5). The United Kingdom, in particular, has become primarily engaged in incubator activity, counting for 205 active incubators in 2017 (Bone et al., 2017). At the same time, the growth of the incubators phenomenon involved Germany, France, Sweden, and the Netherlands. Incubators are also emerging in Ireland, Italy, Austria, Belgium, Finland, Spain, Norway, Switzerland, and the Czech Republic. In 2018, the research team of Social Innovation Monitor (SIM) based at the Politecnico di Torino identified 171 incubators and accelerators in Italy.

As the nature and definition of the incubator are still under discussion between different fields of study, categorization and performance analysis presents a broad spectrum of approaches, making comparative case analysis a challenging task. Research has mostly focused on economic and entrepreneurial performances, identifying methods and indicator to analyze the impact of incubators in fostering the development of new enterprises. Researches are primarily focused on business incubators or specific sectors, notably about ICT technologies and digital companies due to the importance assumed by digital tech companies and their clusters, like Silicon Valley, and the rise of the accelerator model, differing in the standard of services offered. Moreover, official reports, like the one realized by the European Union, base their analysis on certified data, including only incubator responding to selected criteria, resulting in an incomplete or fragmented picture of the entire panorama. In the broad spectrum covered by incubators, industrial incubator represents a small understudied percentage.

At the same time, every incubator relies on specific characters related to its specific location, local and regional economies and type of business hosted, making their monitoring and comparison even more challenging. Criteria involved in the analysis of incubator hardly included spatial analyses, a factor which rely on the shift of incubator from focusing on the provision of affordable space to service and mentoring (Paragraph 2.4). The conducted analysis is focused on the study of industrial incubators to highlight the spatial characters required by manufacturing and creative activities and their relation to the urban environment. For this task, the research proceeded with a field research supported by internet and digital databases to find the most prominent case studies corresponding to the reuse of urban industrial building for new productive porpouse in the european context. All the selected building (Figure 6) presented a mixed program and where chategorized according to their primary activity as *multi-tenants*, *co-making* or *training*. Multi-tenants building where idetified as appropriate in size and characteristics to the purpose of the study, presenting incubator and community dynamics as well as multi-functionality. Secondly, the following spatial and urban criteria has been applied to identify the case studies.

Referring to the categorization proposed by Wilden at all. , the selected case studies are placed within two urban categories: traditionally industrial metropolises



MULTI-TENATS

Keilewerf - Rotterdam
De Kron - Rotterdam
Sectie-C - Eindhoven
Campinas Terrein - Eiondhoven
NSDM - Amsterdam
Atelier de Renens - Lausanne
Ca l'Illa - Barcelona
Building BloQs - London
Peckham Levels - London
Thames-Side Studios -London
Lanificio di Torino - Torino

CO-MAKING

Piet-Hein-Eek-workshop - Eindhoven
TMDC - Barcelona
TODOS - Lisboa
Fabrica Moderna - Lisboa
Blackhorse Workshop - London
Werksalon - Wien
Nord Bahn Halle - Wien
Microfactory - Bruxelles
DRAFT atelier - Paris
L'etablisienne - Paris
Nod Makerspace - Bucharest
Fellesverkstedet - Oslo
Kaosberlin - Berlin

TRAINING

RDM - Rotterdam
CENFIM - Lisboa
Factory Hub - Wien
Prusa research - Prague
electrolux innovation factory - Venice
Industriepark Kleefse Waard - Arnhem

in transition and small industrial cities[8]. The examined incubators are located in a mixed-use districts in transformation. These dynamics, dictated by a transition towards a redevelopment of the neighborhood and a partially demolition of the industrial apparatus, produce a conflictual relationship with the analyzed activities, making possible to highlight the relationships between the latter and local urban policies. The choice of these cases is interesting for the analysis of the dichotomy between resistant productive activities, remained in the urban context even if pushed to move, and new activities in search of a stimulating and functional environment. In the same way, this condition of transformation, monitored in different phases of the research allowed to verify social and spatial transformations in a long time span.

The removal of industrial production from the fabric of the city has led to the demolition of entire industrial districts and the affirmation of zoning prescription towards more profitable use, as residential or commercial. The buildings still existing, due to their size and architectural features, struggle to find a new use within economic dynamics capable of creating value from the reuse of these imposing buildings. In most cases, such practices hardly include re-use for industrial purposes. The identification of cases in which the industrial building has found a new productive function is an opportunity to investigate the strategies adopted in the architectural, economic and social fields. Align with these strategies, the material and immaterial memory of the place becomes an integral part in the construction of the new image of the place and possible instrumental value in the process of reuse.

In addition to the reuse of existing industrial spaces, the research identifies the mixed use of the spaces as fundamental. The selected cases host various activities in-house, related to light manufacturing, craft and creative activities, artistic ateliers and commercial activities but also public or recreational. The spatial flows and dynamics developed in the re-use strategy define how the community is organized and structured in the space, making possible to identify processes of knowledge spillover and forms of cooperative work.

Finally, the last characters chosen to evaluate the case studies is the possibility to reconstruct the transformation of the spatial and managerial strategies over time. The aim is to explore and reconstruct the process that led to the reuse of the industrial facilities, their grow until maturity and possibly the causes of their death.

8 Wilden at all. in their study about manufacturing in new urban economies organized cities through five “manufacturing profile”: Traditional’ industrial cities in transition, Post-communist industrial cities; Advanced diversified cities, Smaller industry towns; Emerging giants.

3.2.2 How to study factory space. An investigation through space, process and user.

"Work is not a regrettable necessity, but a sense of purpose in life. A person's working day, cultural development and leisure can only be organised by taking the processes of work as a starting point"[9] *(Ivan Leonidov)*

As introduced, the complex realities of industrial architecture need to be investigated with the use of a series of different tools capable of describing its individual elements and linking them together. The previous chapters described the socio-technical system that constitutes the factory, organizing the different elements by theme. A task of the methodology is to put together the described pieces, finding the links that connect them and describe the complex system through a single treatment.

During the organization of the methodological apparatus for the analysis of the factory system, a need for an interdisciplinary theoretical background emerged to support the architecture discipline. The elements that the research has identified as constitutive for the study of the factory are the following: *Space*, *Process* and *Users*.

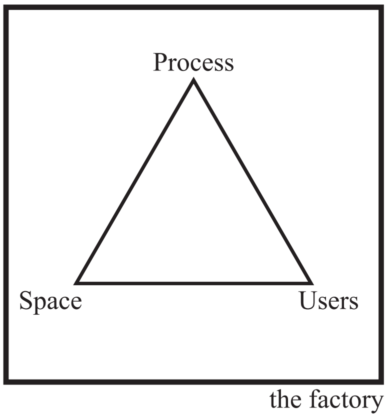


Figure 7. Graphic representation of the elements that constitute the factory as a place. Space, users and processes are the three fundamental elements of investigation to depict the complex reality of the factory.

9 Ivan Leonidov detailed his idea of productive life during an interview with Club novogo sotsial'nogo tipa (Project for a Club of a New Social Type), Sovremmenaja Arkhitektura, no. 3, 1929. In the last century work has been recognized as essential part of everyday life, assuming different prospective from a coercitive action over humanity to a foundation for a prosperous society. In this context, organization is not seen as an instrument of control, but as a necessary condition to create a colletive union where people could perform their activities in a context of consciuos collectivisation, imagining an architecture that through the creation of a new lifestyle would enhance political and social awareness and highlight the importance of education.

In order to describe the complex realities of the incubator model with an extensive viewpoint able to gather together the different aspect that define the birth, growth and sometimes the death of the these places, the research has identified three main elements to be analyzed: the *architectural space and its management*, the *economics features* and *productive processes* taking place, and the *social characteristics* of users, which are investigated individually and by highlighting the value that connect them together.

This decision comes from taking into consideration that a research focused only on the architectural aspect would have missed the complex interrelation that space produces with social uses and practices taking place in its boundaries, reporting a partial investigation. In the description of factory space, this complexity is even more determinant, interlacing scientific aspect as economics, management and technical operation with social and anthropological dynamics that need to be taken into consideration to envision the role that these places possess within the urban dynamics of the contemporary city. At the same time, we cannot forget that spatial environment is conditioned by time, from past events and their legacy, an inheritance influencing constantly the possible paths to be taken, and the images of the next future, with which we confront in order to draw up strategies and resist the sudden changes occurring in our present. We can therefore say that the physical space, the architectural space is in a continuous movement attracted by the transforming forces of an imminent future, and harnessed by a past that shape its possibilities. How to reconcile the different elements that collide within the forms and boundaries of architectural space is a question that is difficult to answer in practice through the classical instrument of architecture.

3.2.3 Movement and space of the factory

This condition is highlighted by the text written by Latour and Yaneva *"Give me a gun and I will make the building move"*, where the authors argue theoretically the necessity to move away from the static Euclidean tools of the construction of space, integrating the fourth dimension, Time, as a key factor in the process of designing, constructing and using the building.

Building is not a static object but a moving project, and that even once it has been built, it ages, it is transformed by its users, modified by all of what happens inside and outside, and that it will pass or be renovated, adulterated and transformed beyond recognition. (Latour & Yaneva, 2008, p. 80)

Time is an essential element for describing and investigating the nature of a place. What type of tools, techniques or supports could be functional to describe graphically, through the architectural language, this phenomenon remains unresolved. What makes the reflection on time, movement and architecture, proposed by Latour and Yaneva even more interesting within the field of industrial architecture is the object used as an example to describe the difficult task of representing movement: the *"photographic gun"* invented by Etienne Jules Marey. The physical object turns out to be very similar to a rifle of the time but it was modified in order to take a series of rapid photographs, used by Merey to study the flight of birds, until then impossible to be represented as drawing even if visible to everyone, due to the speed of their movements. Through the invention of a new instrument, Merey makes it possible to study what previously seemed impossible.

Collected in the book "*Le Méthode Graphique dans le science experiments*" published in 1885, Marey's researches on the graphic method of representation of movement were the beginning of an important season for the physiological investigation on the topic as on graphic methods to analyze it, driven by the invention of the camera. Sigfried Giedion in "*Mechanization takes command*", reported that the prosecutor of Merey's work has been Frank G. Gilbreth, in the industrialized America of 1912[10]. He will use these methods to study workers in his own factory to "correct" and optimize their movements within the assembly line. Gilbreth becomes one of the first production engineers and from the modern era, the study of movement will always have a leadership role determining the characters of industrial space, their transformation and the role of man within this system. Movement will also have an important influence in all the arts such as in the Futurism movement, strongly influencing the architectural style of the following decades.

In the field of industrial architecture, the interpretation of movement turns out to be an important element of investigation of the factory space. Openings, structural dimensions, distribution system, internal heights, they are all elements that served the ultimate purpose of optimizing production and work[11]. Movement can be interpreted as a key to understanding industrial space in its present conditions, depicting spatial and productive characters of activities hosted today but also for investigating the past and the history of a building.

As the analyzed buildings are typified as projects of adaptive reuse of disused industrial complex positioned within the dense urban fabric, movement also represents an interpretation key of the stratified characters presented in the buildings and how the building changed spatially to accommodate the upcoming of new

10 Sigfried Giedion describes Etienne Jules Marey and Frank G. Gilbreth as pioneers in the scientific study of the movement. Giedion begins to describe the phenomenon of mechanization, the introduction of machines into human life, describing the born of movement scientific studies between the nineteenth and twentieth centuries. From the scientific and naturalistic field, the study of movement had a wide use in the production management, used later also for the optimization of domestic works and apartment layouts. Movement studies will not only influence the scientific management of work and the development of the assembly line but will become an instrument for optimizing human actions in every area.

11 In this field we must remember the work of Albert Kahn, an American architect who designs many of the most famous factories, as the Packard Motor Car Company's factory and the Ford Motor Company's Highland Park plant. Albert Kahn together with his brother Julius patented an industrial construction technique for reinforcement of buildings which was very successful in the field of industrial construction. Albert Kahn's work is among the most important achievements in the field of industrial architecture. He also wrote a successful book on the design and construction of industrial buildings. (Kahn, 1917)

function over time. The same happens to more social characters as management stategies: as an adaptive reuse approach is characterised by a continue evolution through different phases of development in a continuous feedback cycle, past choices influence accessibility and future development of what is “already there” (Smithson & Smithson, 1990).

Movement is a key of interpretation in the observation of Industrial space and its scientific formalism, allowing to decode material and symbolic characters, design choices and relation dynamics through a socio-tecnical knowledge still grasped in the everyday operations of production, in the functional knowledge of “doing”[12].

Likewise, Architecture has never really dealt with movement inside the industrial building. Architects work is usually limited to its envelope and the supporting structure, and if present internal services for workers. In architectural drawings, there are few traces of the production process. The most exhaustive documents indicate the working areas or the presence of warehouses but the material handling process, the machines, the core of industrial buildings has never been examined in the architectural field. Jeannette Kuo in her essay about production space has highlight the lack of information presented by industrial building plan, an empty space delimited by pillars and walls in line with the idea of typical plan (Kuo, 2016), preferring the section as a drawing instrument describing information about industrial building as relations between interior and exterior, technical installations, volume ratios, internal light, atmosphere which characterized more and less famous industrial buildings.

In a time in which different kinds of information becomes important to decode the complex nature of the world that surrounds us, architectural research, influenced by phenomenology, needs to experiment possibilities to document and build knowledge from more accurate, diversified and re-designed instruments.

The repeated visits to the study areas carried out over the years highlighted the continuous state of transformation of the cases analyzed, at a rate that validates labeling them as *“fast-changing realities”*. This continuous state of transformation is an important variable in the identification of relevant and stable actors, to investigate their role, as well as determining a time frame in the analysis of spatial, managerial and community advancement and what factors led to changes.

Linked to the issue of the transformation of the working system and how spaces are conforming to it, the presence of rapid changes, especially with regards to tenants change-rate, often possible for the presence flexible contractual regime, can influence urban dynamics of *multi-local working (Marino & Lapintie, 2018)*,

12 The process of production is a process of creation by experimentation and errors. It is a process of knowing by acting, also called “learning by doing”, a hands-on approach to learning, where people must interact with their environment in order to adapt and learn. As production is an experimental act, the construction of the production space also reflects this characteristic. It is built on the same principles, on rules dictated by the act of making. These rules are a technical knowledge at the basis of the design principles of industrial spaces.

an increasing phenomenon in contemporary cities, where the activity of working in multiple places thanks to ICT technologies, from the domestic to shared or public environment, is shaping human attitude to work and the spatial characters they are looking for. As muli-local workers are shaping public space to respond to a change of lifestyle, the tenants' high change rate can influence the spread of successful practices, giving birth to other similar experiences through process of knowledge spillover, investigable through mapping all the relevant entities involved in the governance of the building at different level and at different time phases.

In a context of making, the concept of movement leads to focus the attention also on another element of the system. Connected to the theme of reuse, inheritance and the renaissance of craft culture, movement or gesture, are part of a learning process connecting tradition and technique to problem-solving through the act of making. A process of "*learning by doing*"[13] that advanced countries risk losing in favor of countries where the industrial sector plays a prominent role and where this knowledge from being imported is reaching a higher performance level. We can design the most beautiful or functional object ever existed, but we need to know how to "make" it from matter, whatever it is.

In this context movement is a form of *memory*: a physical one, because we are imprinting on the matter knowledge and characters of a specific process of transformation, an immaterial one, connected with an immeasurable quantity of information deriving from a process of learning through experiences and culture. This process recall the last pages of "*L'allégorie du Patrimoine*", where Choay concluded her refelction on the relationship between memory and heritage affirming that Memory manifests itself first in practices, and only later in forms, recognizing the role that the act of "*performing*" in space, its daily transformation through functions and "happenings", and of making could have as a cultural act of perpetuating memory in place. Without "action" to be performed, even if the place is preserved integrally, its nature risk to be lost. Sometimes losing its meaning, the place could also lose the capacity to evolve through it, losing not only actions by also the legacy surrounding them.

From a long time now, in the culture of advanced countries, the factory moved away from the everyday life. Productive spaces, with their memory and knowledge, have been replaced by oblivion or in the most fortuitous cases by the preservation of "what remained": the ruins.

Investing a return to the action of making, from traditional craftsmanship to its more evolved, more radical forms, in a new definition of Craft towards a stimulating avangard, could keep alive a tradition, a knowledge that is founding part of man,

13 The "learning by doing" process is a hands-on approach to learning, based on the idea that people must interact with the environment in order to adapt and learn. In the case of Making and Craft, as Ingold explains in its book "Making. Anthropology, archaeology, art and architecture", learning through the physical approach with the matter, analyzing its characteristics and its possible transformations, is a fundamental process in the interaction with our world.

as stated by Flusser describing the *Homo Faber* (Flusser, 1999) or by Sennet in *The Craftsman* (Sennett, 2008). But above all it can keep alive the memory of the places, an active and constantly evolving memory, present in those parts of the city that in the last century have been it's beating heart and now float between a forgotten memory and a future that despises their past.

3.2.4 Process

The factory space was created to accommodate the machine and to optimize the production processes that take place inside it. For this reason, unlike domestic space or public places, inside the factory we assist to a change of perspective: mankind is not at the center of the universe. On the contrary, everything is designed around the production process, influenced by the rise of complexity, new products standards, hybridization with service sectors and new technologies. A demand of continuous innovation through flexibility. Production processes define how we make the objects that surround us and changes taking place in their production could have a strong influence on the way in which we live, even outside the space of the factory[14].

The recognition of the systemic influence of production is at the origin of the research approach in the analysis of the processes that take place within the case studies analyzed. Although the object of investigation is delimited by physical space of the factory, the investigation has set the goal of maintaining a broader view to identify whether and in what intensity practice taking place in the factory affect other systems at its surrounding.

The investigation on process refers to four main topics: the redevelopment process, the business model adapted, business characteristics and the relation between the building and the city.

The first element to be analyzed is the business characteristics. Scholars and policymakers have described the possibility of a renewed link between industry and metropolitan areas through the urban manufacturing phenomenon, recognizing its role inside urban economy and pointing out the need for new policies able to enhance these activities, allowing their growth and development. Inside this context the character of business that are actually "resisting" or repositioning themselves

---

14 An example of interrelation between products, process and standard of life could be found in the mechanization of the bathroom and its relative standardization. From 1915 the bathtub started to appear inside the house, generally inserted on the back wall opposite to the entrance of the bathroom. Produced in cast iron and covered with a ceramic layer, a technique made possible by production experiments started during the 1870 replacing the heavy ceramic type that was previously installed in luxury homes, the new bathtub model became the defining element of the standard dimensions for the modern bath. The cast iron bathtub with its 5 x 7 feet size sets the width for the realization of the compact modern bath while the length was determined by the minimum distance between the sink and the toilet, constituting a norm still today. The standardization of bath dimension thought the innovation of bathtub production is an example of how the influence possessed by industry extends beyond the physical space of the factory and its design, transforming living practice that may appear far from the factory context, as the domestic environment.

within the urban context still lacks an in-depth knowledge, making difficult the realization of accurate policies at the urban scale. More accurate data could be found in annual reviews edited by association or companies managing industrial cluster or incubator, especially as a showcase for the promotion of their managed space and tenants business. An interesting case is presented by the *GreenPoint Manufacturing and Design Center* in New York, where the no-profit agency managing six industrial buildings in Brooklyn redacts every two years a tenants survey presenting an overall view about the hosted activities and their impact. For this purpose, part of the research was dedicated to the inspection of the activities located in the case studies, investigating the following components: business typology and years of activity, workers statistics, relation with the building community and the impact on city level thought housing location.

Related to the tenant survey, the analysis has individualized the necessity of outline the redevelopment process approach as a key feature identifying the type of activities that are hosted inside. A wide range of differences could be found between no-profit, for-profit or public managed buildings and during different phases of the redevelopment process. In fact, the process of recovering industrial buildings, except for a large and risky initial investment, takes place through informal forms of use to assume a more rigid structure in the development stages. This transformation changes the character, the organization and sometimes the owner of the place, often followed by a generational change of the activities and actors involved.

The third element, the business model adopted in the management of the building, has been analyzed in its main features such as rental contracts, types of services offered to the ecosystem of business and the organization of common areas. Every case studies have noticed a different approach in managing the building, due to different experiences and contexts that have influenced the direction. The analysis of these processes highlights common elements and those in contrast between the different case studies, making possible to identify their evolution over time. These are significant information for the literature on the subject, in particular, linked to incubators management, in which it is still absent an extensive investigation on how success and failure of a place are determined by a series of different choices that affect the management model.

The last element of the survey about process refers to the relation between the building and the city. This relation is difficult to investigate and evaluate due to the long gestation to which urban processes are subjected. The research focused on identifying whether and in what ways there is support from the municipality in the redevelopment phases or as business incentives, if there is a direct relationship with the neighborhood through partnerships with other entities , community engagement in public open activities or if the building is being recognized as an attractive pole in the urban network.

3.2.5 Space

Space is pure act (Joseph Raphson)

At the same time container and content, the space of the factory is the main subject of the research. As a container, the factory space has been studied and documented by architectural historians for two main themes: the first concerns cutting-edge technical and engineering solutions, often applied to industrial buildings, characterized by being a field of avant garde experimentations. The second concerns the advent of the Modern Movement and the influence that industrial structures had in the construction of a new formal image representing a decisive detachment from historical movements.

In this research, the case studies identified do not possess distinctive elements, details or architectural solutions that make them unique and worthy of being documented for their style or for excellent technical innovation. On the contrary, they are often anonymous buildings, located in areas for industrial use, built to be functional without paying too much effort to their external image within the built landscape. It can be said that these constructions are part of the broad baggage of *Minor Architecture*, which operates outside the main economy, potentially even outside the dominant cultural paradigms of the architect's profession and its theoretical and critical frameworks.

These places instead are strongly characterized both as material and immaterial content. The space of the factory, especially after being abandoned by industrial activities following the delocalizing thrusts of a global economy, assumed a new important value: the freedom of becoming something different, the possibility of producing new space in its inside. The typical plan, from a state of alienation, assumes the quality of spatial freedom.

Becoming a container, the factory space became available for any use: to be illegally occupied, to host theaters and spaces for art, to become apartments and even to return to production activities. In this way, the value, the story it communicates, no longer concerns the building, but what they represent as a content. Therefore it could be said the content is what matter. In the case of factory adaptation, it would be the process of reuse and new function inserted the key element of investigation, but it would be a wrong conclusion. Inside these spaces, the applied architectural solutions contribute to the disciplinary debate with more daring dynamics than those produced by the wide transformations in hand to the profit of real estate companies. As Venturi, Brown and Izenour has depicted in the incipit of Learning from Las Vegas,

"Learning from the existing landscape, for an architect, is a way to be revolutionary" (Venturi & Brown, 1977)

As minor architecture, the space of the (reused) factory tends to operate with minor resources, thought complex multiplicities and stratification of meanings, transcending conventional categories. The reuse of the factory space in the case analyzed is often categorized as adaptive, in the direction of the description proposed by Jill Stoner.

"If, as Michel de Certeau suggests "space is practice place", these minor operations might be construed as practiced space. Through action that are often small in scope but powerful in their effects, and in the absence of both behavioral and aesthetic agendas, minor architecture can seem simultaneously insignificant and subversively instrumental, possessing an alchemy that dissolves material, privileges air, inscribes meaning into surface, folds exteriors inward, and blurs definitive objects into contingent relationships. The idealized modernist belief of physical determinism is turned into its head, revealing those conditions in which space can be the results of action rather than the cause of behavior." (Stoner, 2012: 16)

The spatial analysis of the case studies relates to these arguments. The research activity is not aimed at bringing to light the material features of the container space but rather to highlight how these places, through their spatial features, allows the establishment of new activities, using its intrinsic potential of being a practice place. Three main elements are being investigated: spatial characters and dimension, space re-use strategies, materiality and symbolism.

Spatial characters and dimension are the fundamental basis for the analysis of the case studies. The objective is defining not only the characteristics of the factory space but also the individual production units. In architectural studies, the interior of the factory has never been studied at the microscale of the single production unit. The intent is to produce an in-depth analysis through the accurate survey of the spaces and their use in order to document the complexity of the practices that interact within it and identify the functional spatial strategies for managing these spaces. The modern factory was characterized by the insurmountable limit of the perimeter wall, from which only the staff had access. The new production spaces are characterized by a willingness to open to external users as a tool of business development but also of relationship with the surrounding urban fabric. Through spatial investigation, the research highlights the relationship between public, semi-public and private space, identifying common spaces and public areas and the paths dedicated to them.

Each case analyzed has faced a series of restructuring, transformations, changes that have modified the internal structure to meet the needs of individual tenants. Different strategies and improvements have followed each other over time. The goal of spatial analysis is to portray these transformations and identify their evolution.

Following the success achieved through fairs, media and digital platforms, the Maker's movement, the do-it-yourself culture and the new craftsmanship have begun to produce a series of imaginaries that correspond to what we can define as Makers style. This imagery has struck above all the new workspaces from Fablabs, to co-working but also inside the traditional offices, transforming them through the DIY culture, using a style and a symbolism born in the autonomy of a niche movement to renew the generic working spaces. The research aims to identify the material features of analyzed workspaces, the atmosphere that characterizes them and the differences between the informality of the raw and functional machine shop opposed to the glossy office space, often placed one next to the other. In the same way, the re-use of production spaces previously dedicated to a single large industry intercepts the historical memory of the place, using its entity as an advertising tool in the construction of a new identity. The spatial analysis sets the task of investigating such a material and symbolic transformation which alters a process of taking back to live a historical memory with a possible distortion of collective memory.

3.2.6 Users

The literature has identified a transformation of the workforce under the request of productive activities for greater technical knowledge, high skills and managerial capacities. Tatiana Mazali in her work on industry 4.0 highlights how the individual worker is invested with more responsibility in his work. While previously the operator had only to perform a series of precise actions, with the advent of a new organizational structure, the worker has to deal with a decidedly higher complexity of operations, faced thanks to digital technologies.

The figure of the traditional craftsman is replaced by a particular form of worker, called digital "craftsman": the user of digital media who applies the skills acquired through his personal use of digital media to his work. (Mazali, 2018: 407)

From the organizational point of view, work is organized completely by teamwork, involving most workers in decision-making but especially in processes that can trigger innovative transformations.

At the same time, the advent of new production technologies such as 3D printing and numerical control machines, at affordable prices even for individual users, has allowed the rebirth of new craftsmanship, as described by Susan Luckman in *"Craft and the creative Economy"*. In this context we are witnessing a new approach to the entrepreneurial activity of the individual craftsman who, using greater technological skills, a network of knowledge and markets supported by digital platforms (for example Etsky) decides to set up his own activities and follow his passion.

Through an analysis of the users working in the selected case studies, the research wants to identify the characteristics of the workers, their level of training, the distance between home and work, the type of contract and if this is supported by other jobs in different places.

3.3 Methodological procedures

Following the first phase of research and screening, fieldwork and case studies analysis were developed from February 2017 to October 2019. The case studies were selected from a database of urban production buildings created during the

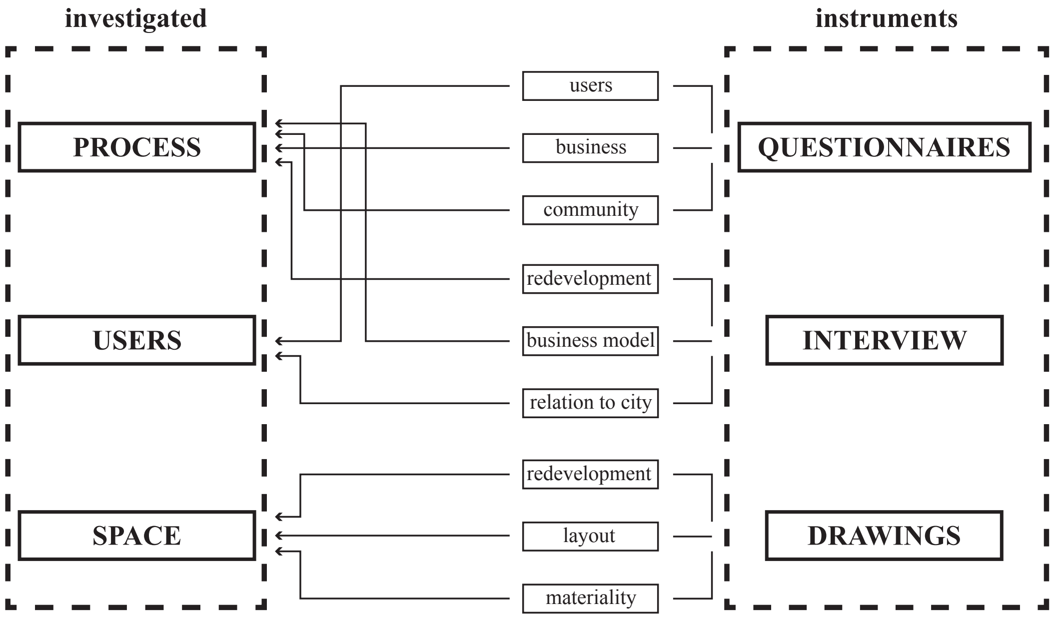


Figure 8. Graphic representation of the elements that constitute the incubator. Space, users and processes are the three fundamental elements of investigation to depict the complex reality of the incubator.

first phase of the research. The databased was realized taking into consideration a variety of different buildings, organized in three main groups, based on their primary activity: *multi-tenants*, *co-making* and *training*. Within this database, five case studies were selected as they responded to the characteristics previously identified: they were located in traditionally industrial metropolises in transition (Barcelona, Rotterdam, Eindhoven) or small industrial cities (Renens, Sheffield), they created a relation with the surrounding mixed-use neighborhood, they presented incubator and community dynamics as well as multi-functionality.

Case studies analysys has been based on qualitative data collected through three different instruments: semi-structured interview with key players in each case under analysis, a questionnaire submitted to the tenants in order to collect data on the activities that are located within the analyzed buildings and a series of architectural drawings for a spatial analysis of the buildings and its relation with the context. For each case study the research has also considered a diverse array of quantitative and qualitative secondary data: city reports and policies, statistical source, previous studies, archive documents about the buildings. They have been fundamental for the contextualization of the area and the building, as reported in Chapter 4.

3.3.1 Semi-structured interviews

The semi-structured interviews were submitted to various key players in the management and organization of individual case studies. The interviews were conducted through the use of pre-established questions to guide the discussion with respect to the subject under investigation. The reasons that led to the use of semi-structured interviews concern the complexity of the topics investigated, the use of open questions aim to investigate as much as possible an event, a situation, a fact in order to reconstruct the dynamics that constitute the following themes: the redevelopment process, the business model adopted for building management and the community-based relations.

In the various interviews, the order was not rigid as in the case of the structured interview but followed the flow of the discussion, adapted to the situation and to the progress of the interview. During some interviews, it was necessary to point out the reasons for some questions since the interviewee was not aware of the issues addressed with the risk of omitting particular or decisive events.

The starting objective of the semi-structured interviews was to collect qualitative data on the dynamics of the requalification processes, on the managerial structure and on the community present within the case studies, but it turned out that the person interviewed spontaneously tended to tell part of his own personal story in reference to the history of the place, to its birth or to the conflicting dynamics that they were experiencing. The result was the possibility of reconstructing a storytelling of the individual case, supported by the collected data and memories to describe the uniqueness and peculiar characteristics of the place. In each case study, a minimum number of six interviews were carried out, identifying, where possible, the following subjects: the building owner, organizers and managers, founders, and tenants with a defined role within the structure organization.

3.3.2 Questionnaire

The questionnaire tool was used to analyze the characteristics of the business hosted inside the analyzed case studies. The reasons for this study derive from the following considerations: firstly, the literature on the subject of Urban Manufacturing is missing an in-depth structured survey on the characteristics of productive activities located within the urban fabric. The systematic survey of these data within the urban context as well as giving an image of the organic nature of these activities and their characteristics can provide strategic support for the implementation of targeted local policies, providing a higher degree of detail than the data provided by the statistical tools on a regional basis.

Secondly, the use of structured questionnaires gives the opportunity to correlate case studies radically different in location, history, and economic context, allowing for comparability and cross-case analysis on a smaller scale, that of individual companies. As pointed in the previous paragraph, the nature of the factory is not just that of a spatial object but its identity refers mainly to productive activities using its spaces. The collected questionnaires portray the identity of these spaces while providing useful data to validate how urban manufacturing activities are structured, validating or not the trends proposed in the literature regarding the transformations taking place in the labor system.

The topics investigated with the use of questionnaires are divided into four groups: location of the business, structure of the business, relations with the building and the community, characteristics of workers. All data collected has been used in aggregate form in order to respect the privacy of individual users.

The first group of questions about business localization aims at identifying how many localization changes have been made, the reasons for such movements, what are the challenges in locating the business in the reference city and the type of contract to which they are subjected. Several authors including Saskia Sassen and Leigh et all. have strongly criticized the elimination of the urban industrial fabric to make room for new residential neighborhoods or services with a relative increase in the cost of rents for industrial buildings, especially those located in central locations. The proposed questions aim to verify if and for what reasons the localization is a critical issue for the selected companies.

The second group of questions is aimed at understanding the structure of the enterprises, the questions refers to: the years of total activity and those within the analyzed building, the product level distribution and the instruments for business development, digital platforms and their influence in the business, tools or machines used during the production process. This group of questions is more heterogeneous and each question refers to a specific topic of investigation. Questions related to the years of activities allow to identify if the analyzed space attracts mature or developing businesses, by correlating this information with the type of services offered it is possible to identify whether the case studies can be outlined as incubators. The products level of distribution, the instrument of business development and the use of digital platforms relates to the changing nature of production through the hybridization with the service sector and the use of the internet as a shop window for products. The analysis of tools and machines used in daily production allows us to identify what kind of productive activities are carried out and the dimensions of the machines used. Together with the spatial analysis these data can provide information about the characteristics of the work spaces and the technical specifications concerning pollution, noise and the average spatial dimensions required.

The third group of questions refers to the internal community structure of case studies. The questions concern the engagement in community activities and desirable changes in the spatial layout to solve specific problems. One of the most interesting features of the cases analyzed is the possibility of creating collaborations, support or subcontract between the various activities present. Being part of a community instills attachment to the place and an investment in its growth with the construction of synergies that can go beyond the spatial limit of the building and activate the process of redevelopment of the surrounding area.

The last group of questions concerns the characteristics of the workers. The questions concern: the number of employees, their training, the type of contract, the annual salary, the means of transport between home and work, if they carry out other jobs in places than the one analyzed and where they live. This group of questions aims to investigate a possible transformation of workforce requirements correlated to an increasingly specific demand for skilled labor, with a high level of education and managerial skills and higher salary than other sectors . At the same time the needs of the workforce have changed, like the characteristics of the place to live, the possibility of working in different places based on needs, increasing the phenomenon of multi-local working, or the resourcefulness to leave the employee status to start their own business within a flexible market thanks to the use of new technologies and digital systems, where even small producers can compete.

The construction of the questionnaire was based on the research conducted by the non-profit agency Greenpoint Manufacturing Design Center, carried out on the six buildings under management. In this way it will be possible in a subsequent research to compare the results produced with the research carried out overseas by verifying possible similarities and differences.

3.3.3.Spatial Analysis

The spatial analysis of the case studies uses different representative tools to visualize in graphic form the complex nature of the relationship between the container and the content. The graphics apparatus can be divided into three different scales: the macroscale of the city and the neighborhood, the intermediate scale of the building and the microscale of the single work unit. Architectural drawings are used to analyze three main themes: the re-use strategies of the factory and the realization of new structures inside it; the internal layout and the work unit; the renewed image of the factory through the use of its memory, new symbols and materials.

The macroscale refers to the urban analysis, organizing the information about the building and its relation with the neighborhood and the city, visualizing information about the localization, the transport system and the distance from downtown.

At the building scale, the research focuses on the analysis of the technical and managerial aspect of the building, using drawing as a visualization and documentation tool.

Structural layout, section, and elevation are used to describe the architectural characters of the buildings, the relation with the re-use of the internal space and to document the symbolic or architectural intervention. The systematic survey of the interior of the building highlights the relationship between production, services and domestic activities. The plot subdivision investigates the average size of workspaces and the relationship between the surface and rental costs, while the flow analysis highlights the use of different areas and the different degrees of privacy between private work zones, common space and space accessible to visitors.

3.3.4 Photographic apparatus and social platforms

In addition to the three tools indicated, the research also made use of the use of the photographic tool and social platforms as a tool for investigating and documenting the analyzed case studies.

Given the complexity of the spatial organization presented by some analyzed cases and by the rapid changes that have occurred during these years of research, the photographic tool has proved to be essential for documenting and representing space. In the same way, this instrument was extremely useful in the production phase of architectural drawings, providing a precise control tool. In the material analysis photography alongside the use of the axonometric and the section allows an accurate understanding of the case and of the relations of this with the context.

The use of social platforms was the most innovative tool in the research. First and foremost, many of the case studies in order to match the activities present internally have an internet site where it is possible to rent spaces, view the events or activities proposed or simply learn about the tenants and their activities. In the last year of research, these platforms were joined by very active social profiles that are intended to provide a 24-hour digital showcase. The research used these platforms as a tool of knowledge and sometimes as a tool for a first contact with administration bodies or individual tenants.

Bibliography

Arup. (2015). Rethinking the factory.

Barbiero, F., Blanga-Gubbay, M., Cipollone, V., DeBacker, K., Miroudot, S., Ragoussis, A., … Zachmann, G. (2013). Manufacturing Europe's future (R. Veugelers, Ed.). Brussels: Bruegel.

Bone, J., Allen, O., & Haley, C. (2017). Business incubators and accelerators: The national picture (No. 7; BEIS Research Paper). UKGovernment, Department for Business, Energy & Industrial Strategy.

Burklin, T., & Reichardt, J. (2019). Albert Kahn's Industrial Architecture: Form Follows Performance (1 edizione). Birkhauser Architecture.

Europe Commission, & OECD. (2019). Policy brief on incubators and accelerators that support inclusive entrepreneurship.

European Commission. (2016). Europe's next leaders: The Start-up and Scale-up Initiative.

European Commission. (2014, January 22). For a European Industrial Renaissance.

European Commission. (2012). A Stronger European Industry for Growth and Economic Recovery.

European Commission. (2012, October 10). A Stronger European Industry for Growth and Economic Recovery.

Giedion, S. (2013). Mechanization Takes Command: A Contribution to Anonymous History by Sigfried Giedion. University of Minnesota Press.

Hurley, J., Storrie, D., & Peruffo, E. (2016). ERM annual report 2016: Globalisation slowdown? Recent evidence of offshoring and reshoring in Europe (Eurofound, Ed.). (pp.30-42) Publications Office of the European Union.

Impact Index – Inbia.org. (n.d.). Retrieved 10 August 2020, from https://impactindex.inbia.org/ecdata/

Kuo, J. (Ed.). (2016). Space of Production: Projects and Essays on Rationality, Atmosphere, and Expression in the Industrial Building. Park Books.

Kahn, M. (1917). The design and construction of industrial buildings. Technical

Journals.

KPMG. (2016) The factory of the Future. Industry 4.0 The challenges of tomorrow.

KPMG (2017) Beyond the Hype. Separating ambition from reality in industry 4.0.

Latour, B., & Yaneva, A. (2008). Give me a Gun and I will Make All Buildings Move: An ANT's View of Architecture. In G. Reto (Ed.), Explorations in Architecture: Teaching, Design, Research (pp. 80–89). Birkhäuser.

Leigh, N., & Hoelzel, N. Z. (2012, February 9). Smart Growth's Blind Side. Journal of the American Planning Association, 78(1), 87–103.

Mazali, T. (2018). From industry 4.0 to society 4.0, there and back. AI & SOCIETY, 33(3), 405–411.

Morten, H., Berger, J., & Nohria, N. (2000). The State of the Incubator Marketspace. Harvard Business Review.

Muller, P., Mattes, A., Klitou, D., Lonkeu, O.-K., Ramada, P., Aranda Ruiz, F., … Steigertahl, L. (2018). Annual Report on European SMEs 2017/2018. Publications Office of the EU.

Muller, P., Julius, J., Herr, D., Koch, K., Peycheva, V., & McKiernan, S. (2017). Annual Report on European SMEs 2016/2017. Publications Office of the EU.

Salido, E., Sabás, M., & Freixas, P. (2013.). The Accelerator and Incubator Ecosystem in Europe. Telefonica.

Schuh, B., Dallhammer, E., Derszniak-Noirjean, M., Kaucic, J., Kirchmayr-Novak, S., Stifter, E., … Kaufmann, P. (2018). Small and Medium-Sized Enterprises in European Regions and Cities. ESPON 2020 Cooperation Programme.

The British Government Office for Science. (2013). The future of manufacturing: A new era of opportunity and challenge for the UK.

The Facts About Modern Manufacturing (8th edition). (2009). Retrieved from

Winden, W. van, Carvalho, L., Clarence, E., Anderberg, S., & Partridge, A. (2015). URBACT II New urban economies How can cities foster economic development and develop 'new urban economies' | URBACT.

Winden, W. van, Berg, L. van den, Carvalho, L., & Tuijl, E. van. (2013).

Chapter 4

Case studies analysis

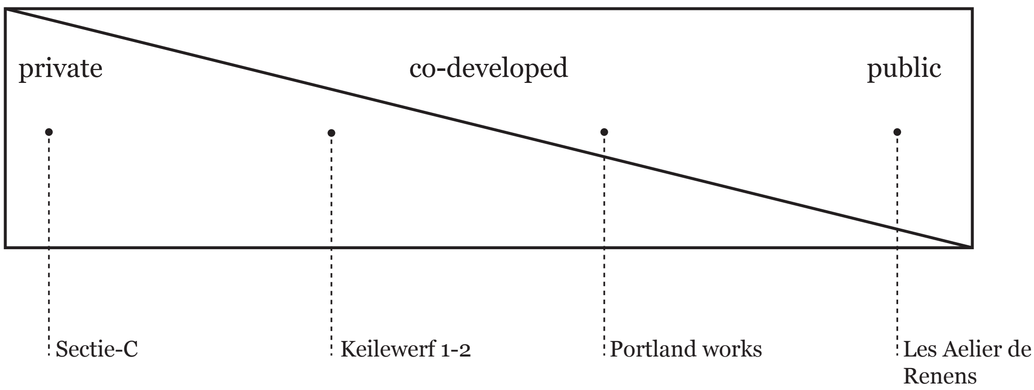
4.1 Introduction

The chapter illustrates the results of the analysis on selected industrial incubators within the European territory. The results are based on fieldworks carried out during the three years of research occurred in repeated visits to depict the complex and fast-changing reality of the incubators. In particular, photographic and graphic material, planning and building documents, urban policies and city reports as well as interviews with managers, owners and tenants were indispensable for the development of a detailed analysis of their complex and stratified reality.

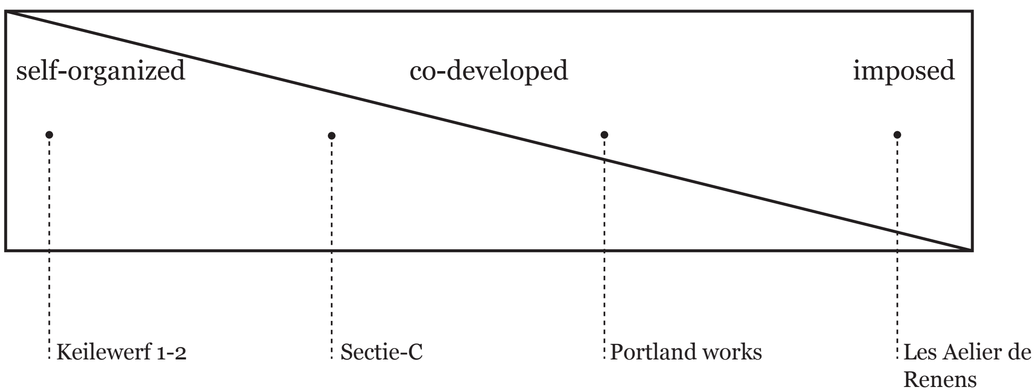
Case studies were identified in industrial neighbourhoods which are facing a transformation of the spatial and social apparatus, located in traditionally industrial metropolises in transition or small industrial cities. Moreover, the selected case studies concern the recovery and reuse of urban industrial buildings to host new activities referable as urban manufacturing and creative industries. Each case has been analyzed starting from the city scale, depicting the relation between urban development and industrial production during the last century, at the neighbourhood scale, describing actual transformations and at the building scale, depicting spatial, managerial and social characters.

The four cases analyzed represent different development strategies (private, community-related, public) and different organization strategies of the internal space (self-organized, imposed), permitting to visualize the phenomenon in its broad spectrum and identify shared character.

Owner | Developer



Space organization



In addition to the four cases presented in the chapter, the research identified a fifth case within the Saint Martì district in Barcelona. Ca L 'Illa is an urban industrial complex built between the 1930s and 1940s within the industrial district of Saint Martì. The building was realized to house a textile company which went bankrupt in 1975, leaving the building empty. In 1978 the building was bought by a private developer who decided to rent it to small local businesses. Today, the building houses a printing house, a manufacturer of precision mechanical parts, a fashion company, start-ups in the field of sound engineering and other light manufacturing activities. Ca L'Illa is one of the few urban-industrial complexes that remained active in the Saint Martì and Poblenou neighbourhood after the redevelopment plans for the realization of 22@Barcelona or Districte de la innovació. This project involves the transformation of the district, which presented a strong industrial matrix, into a mixed-use technological district. Unfortunately, during the fieldwork, the property and the industrial real estate company that manages the building did not permit to analyze the building by denying access to both firms space and common areas.

The episode of Ca L'Illa highlights the difficulties that industrial research must face during fieldwork. Companies are reluctant to provide information and data to external users to safeguard their industrial secrets. Moreover, having access to individual production units can also be problematic due to safety and security reason. Request for information is viewed negatively by workers or managers because it interrupts their job duties. During the research, the collection of data and the survey of workspaces required planning and persuasive communication with companies.

4.1.2 From experience to know-how

The analysis of the process of development of the incubators examined highlighted how the acquisition of practical experience and know-how in the organization and management of this complex urban model can be strategic for city-making culture. The development of an incubator requires practical and managerial knowledge, the capacity to deal with a large network, with companies, individual users or collectives, deal with different management needs, sstructure a building recovery plan and provide services to firms.

Mapping of the actors involved, especially in the early development stages of the project highlighted how these actors were subsequently involved in other public and private real estate operations for the recovery of disused industrial buildings, urban transformation and city management.

In the case of Rotterdam, the management team of Keliewerf started a collaboration with a local developer for the recovery and management of the "De Kroon" building, a multi-company building located in Schiemond 20-22 inaugurated at the end of 2018. Today all areas of the building are occupied. In Eindhoven, Rob van der Ploeg founder of Sectie-C, has been involved in the Campinaterrein development, a vacant factory complex housing the St. Joseph Cooperative Milk Establishment, today on the first phase of temporary reuse for the development of a new mixed neighbourhood in the inner city of Eindhoven. The city of Renens with Nicolas Servageon, the Economic Promotion Delegate of Renens, started a collaboration between the city, Les Atelerier de Renens and Sainte-Croix and its technology park, Innovaud, the national excellence centre for micro welding and additive manufacturing for creating new regional collaboration in manufacturing.

Case studies analysis and the interviews carried out with managers and founders of the incubators highlighted the importance of designing and experimenting with new models of urban development. Case studies showed how their development strengthened local know-how about city-making and a network of competence successively involved in other local projects, spreading a new approach to urban industrial redevelopment.

4.2 Case study: Keilewerf

4.2.1 The city of Rotterdam and the relationship with industry

Rotterdam is located in the province of South Holland, on the mouth of the Nieuwe Maas, near the North Sea and it is the second-largest Dutch city after Amsterdam. The city is part of the Rotterdam-The Hague Metropolitan Area which covers an area of 1.130 km^2 of which 990 km^2 is land. The municipality of Rotterdam occupies an area of 319,35 km^2 and Its urban area hosts 1.160.000 inhabitants[1]. It is the centre of the Rijnmond conurbation, which in turn is part of the southern wing of the Randstad, one of the densely European populated areas, with a population of 7.1 million inhabitants and one of the most important economic zones.

The city is a major logistic and economic centre and the largest European seaport, with the rivers Meuse and Rhine providing excellent access to the hinterland. In 2004 Shanghai took over as the world's busiest port and today the port of Rotterdam ranks 11th after the port of Dubai[2]. The main activities of the port are related to petrochemical industries and cargo logistics management due to its importance as a transit point of bulk material between continental Europe and the rest of the world. The city has always played an essential role in European commercial systems thanks to its strategic position on commercial water routes. The port can count on a developed infrastructure network made up of railways, canals, and motorways with which it connects to the main commercial routes. For these reasons Rotterdam earned the nicknames of "Gateway to Europe" (Walburg, 1984; Frijhoff et al., 2004). Today Rotterdam identity, historically strongly linked to the port, is changing embracing a post-industrial vision in the process of social, economic and spatial transformation (Nientied, 2018).

As major European cities, entering the age of globalization, Rotterdam has undergone crucial changes from the reconstruction of its bombed city centre, the redevelopment of the port and recomposition of its economic and social characters. After the post-war reconstruction and the development of residential districts for the growing labour force, the city was still tied to the port industrial economy developing two new port areas, the Botlek (1955-1966) and the Europoort (1957-1970) (Braun, 2008). These two areas were followed by the development of Maasvlakte 1 and 2, which facilitated the relocation of industrial facilities to the shore, freeing vast urban areas located in strategic and central areas for the city.

From the 1970s onwards, the urban, economic and cultural climate of the city changed. A new urban plan opted for a more compact city, with mixed land-use and taller buildings and the city embraced a post-industrial vision starting to redevelop derelict harbour areas in the city. Many of them have already undergone a process

1 Data on the city of Rotterdam have been consulted on https://opendata.cbs.nl

2 Information on world leading container ports and the volume of goods operated have been consulted on worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports/

of demolition or conversion to new functions, thanks to the pragmatism of local public politics, which from the 1970s was characterized by the willingness to engage public-private partnership for urban development (McCarthy, 1998). Other industrial areas have instead been entrusted to a temporary use regime, pending the interest of private actors to invest in urban renewal projects[3]. Today Rotterdam is recognized as a progressive city in terms of urban development and architecture but its physical layout still relates to the port function and its spatial form.

From an economic point of view, Rotterdam shares an economic development pattern that can be witnessed in many post-industrial port cities. After its relocation, the harbour was impacted by the development of container logistics and automation requiring skilled labour force and high professionals as engineers, IT professionals, planners, specialists in logistics, economists, etc. Even if the harbour economy still possess an important share of the overall economy of the city of Rotterdam[4], the importance of chemical industry and the port is destined to decline in the long run with a necessary structural transformation of its economy (Maarse, 2016). A robust cultural infrastructure is needed, and for this purpose, the municipality is supporting the development of creative and innovation economy in the city, through education, subsidies and place-making (Gemeente Rotterdam, 2016) as the new urban plan for the maker district between Heijplaat and Delfshaven.

The entrance in the era of globalization has also changed the population of the city from being mainly represented by Dutch since 2000 workers from central and easter Europe and international students followed the immigration from non-European countries of the previous decade (Entzinger & Engbersen, 2014). From 2016 the share of allochthonous was 49,8% (Gemeente Rotterdam, 2017), increasing in the following years and reaching more than half of the inhabitants of the city. This population is represented especially by younger people with a good educational level, who moved to the city to study or to find a job. Several younger people nowadays choose Rotterdam as their preferred city to start a business.

From 2014, as described by the empirical analysis of Nientied (2018), the city has undertaken a process of rebranding of its internal and external image. From a port city, the municipality sustained a new DNA composed by internationalization and entrepreneurialism with the motto "Rotterdam Make it Happen"[5]. This

3 Rotterdam has distinguished itself in recent decades for its ability to be an innovative city, especially for its approach to urban planning and urban transformations. Among the projects carried out in the metropolitan area of Rotterdam and which have experienced an innovative transformation model, we find the Luchtsingel pedestrian bridge made by ZUS, a crowdfunded project of urban renewal in derelict office areas behind the central station. Another interesting example is the redevelopment of the Fenix warehouses now subject to transformation and elevation carried out by the Mei architecture studio, where a private investor worked with the municipality for the feasibility study of the project and its realization.

4 Further details on the economy of the Port of Rotterdam and the effects of this asset for the city are available at the link https://www.portofrotterdam.com/sites/default/files/facts-and-figures-port-of -rotterdam.pdf

5 More information on the development plan of the city of Rotterdam and the rebranding process

transformation relates to a demographic change in the population living in Rotterdam as in its collective memory. Compared to the first post-war period, the new population is relatively connected to the port business and its labour force, while embracing a new hybrid image of the city which better represents the new coming citizens.

4.2.2 Delfshaven and the development of Merwe-Vierhavens

The case study analyzed within the city of Rotterdam is located in Nieuw-Mathenesse, the western part of the historic Delfshaven district, on the banks of the Nieuwe Maas, originally part of Delft, independent from 1795 and annexed by Rotterdam in 1886. The district covers an area of 5,80 km² divided between a residential area and an industrial area directly connected with the river.

Nieuw-Mathenesse is territorially divided between the Delfshaven district, part of the two municipalities of Rotterdam and Schiedam. The history of Nieuw-Mathenesse is intimately connected with the development of port activities and the construction of Gusto-Werf shipyard in 1905 on the Schiedam side. On the Rotterdam side, the first port wharf developed was the Keilehaven in 1910, followed by the Koushaven in 1911, and finally the Lekhaven e IJselhaven in 1912. The four dwarfs together are part of the Merwe-Vierhavens area. During 1923 in the western part of the district was excavated the Merwehaven port, an important area for fruit export.

Merwe-Vierhavens has always been characterized by an industrial vocation. The Keilehaven wharf was dug between 1911 and 1914, with a length of 750 m and a width of 50 m, characterized by the presence of factories, as the Rotterdam Municipal Gas Factory and storage areas, mainly located in the southern part. The wharf still maintains its industrial function today with different private and public industrial activities, as some water facilities for the power station on Galileistraat and a collection point for garbage transfer to the incineration unit at the Maashaven. The Koushaven was the last designed but the first dwarf to be completed in the area. The port was constructed to establish a retail warehouse owned by the American Petroleum Company and bring and distribute petroleum in small tanks.

The Lekhaven instead was realized to establish cargo transhipment facility. The most important company located inLekhaven was Thomsen's Havenbedrijf, a company combining a general cargo logistic function with a passenger terminal. The dwarf was also the site location of the Haka, a multi-company commercial building constructed between 1931 and 1932. The building was owned by a cooperative wholesale association "De Handelskamer" to provide workers with good quality food at a reasonable price. Haka also managed many self-made products such as bread, coffee, tea and other edibles. The building was used until 1960 and from 2002 is listed as industrial heritage with a status of a national monument. After the Second

can be found on the website http://www.rotterdammakeithappen.nl

World War part of Lekhaven canal was filled in to construct frozen warehouses for fruit storage and transfer and the production of juices, still active today. As for the Lekhaven, the IJselhaven was designed to host cargo transhipment facilities. It has a significant decline with the introduction of container standard logistic and was redeveloped as the European Juice terminal (EJT). Today the whole area of the four piers, together with Merwehaven area, located north-west of the district of Nieuw-Mathenesse are strongly linked to the fruit industry and the production of juices.

On the west border of the district is located the Marconiplein area. It was developed in 1920, and until 1930 it hosted a Ford factory (Gilijamse, & Bonke, 2009). The area has always been an important transportation hub, crossed by the bus and tram lines, metro and the port tracks and characterized by the presence of three office towers of the Europoint complex. Today two towers of the complex are vacant due to the relocation of the municipal department and the landowner is developing a plan for converting at least one tower into residential units.

The industrial area of Nieuw-Mathenesse is from the residential area on its border by the realization of the Dakpark, a linear green area that runs alongside Vierhavensstraat, a high-flow road connecting Marconiplein, the Merwe-Vierhavens areas and the central core of Delfshaven[6]. The park was released in 2012 as a redevelopment project of a former marshalling yard with 50000 m2 hosting today different commercial activities such as restaurants, warehouses and supermarkets with a shopping boulevard, a playground, and neighbourhood garden. A car park for about 750 cars is also combined in the structure. The park was designed as an element to contrast the noise of industrial activities and urban traffic, providing at the same time a public area to a neighbourhood which was suffering a lack of green spaces and public amenities. However, during the time it has proved to be a barrier between the inhabitants and the new activities that are taking place in the area.

4.2.3 The new redevelopment of the area: the maker district, RDM and M4H

The Nieuw-Mathenesse district presents several ageing characteristics, as obsolete and empty industrial buildings, soil pollution, insufficient representativeness and, as the rest of the Delfshaven district, a very high crime rate. Part of the problem relates to the moving of the tippelzone, a place where prostitution is permitted and sometimes regulated, from the central zone of GJ de Jonghweg to Keileweg in the early 1990s. The area was closed in September 2005[7].

Today part of the Nieuw-Mathenesse, the Merwe-Vierhavens (M4H) area is subject to a redevelopment project organized by Rotterdam municipality and the

6 https://urbanidentity.info/projects/dakpark-rotterdam/

7 Tippelzone Keileweg closed , RTV Rijnmond, September 13, 2005

Port Authority to develop a maker district together with RDM Rotterdam. The vision is to create an innovative living-working environment, equipped to support innovative manufacturing industries mixed with cultural, living, hospitality and educational facilities. The strategic position of the neighbourhood has been at the base of the desire to create a point of contact and cooperation between the city of Rotterdam and port activities. Starting from an initial strategic vision formulated in 2017, a spatial framework has been developed by experts from the municipality, the Port Authority, the DCMR environmental service and neighbouring municipality of Schiedam in collaboration with private entrepreneurs and developers, producing in June 2018 the first version of the development plan. In the same period, the International Architecture Biennale Rotterdam (IABR) took place in M4H, in the Haka building.

The AIBR is an important local and international actor, engaged in innovative and strategic visions for the city of Rotterdam and promoting well-designed, socially inclusive, resilient cities. The 2018 edition investigated the Test Site M4H+, to establish eight guiding principles for a sustainable development of the area. A series of in-depth strokes and tests were also carried out on topics such as the environment, mobility, resilience, subsurface and costs. The results were adopted in the spatial framework by the municipality and the Port Authority in 2019.

The M4H development project is focused on the creation of a mixed urban environment with specific attention on innovative manufacturing activities. The city recognized the structural changing going on in manufacturing, its relevance in terms of jobs and economic development and the importance of creating new urban policies that stimulate the localization of these activities in the area. The official document released by the municipality gives a number of indications about the characteristics of industrial activities which are interested by the new development plan. *"This manufacturing industry is flexible and specialized. It responds to new opportunities made possible by digitization and robotization. It uses materials that are not harmful to people and the environment. Decisive to the success is the proximity of creative talent, markets and knowledge centers. In addition, this industry requires flexible deployable space* [8]*"*

The M4H is part of the development project of the Rotterdam Maker district in connection with the RDM facility on the southern banks of the Nieuwe Maas. RDM is an interesting successful example of industrial reuse connecting business, multi-level education and research. The former building owned by 'Rotterdamsche Droogdok Maatschappij' (RDM, Rotterdam dry dock corporation) has been redefined as 'Research, Design and Manufacturing'(Hooijer, n.d.)[9]. As for the

8 https://m4hrotterdam.nl/nieuws/vaststelling-ruimtelijk-raamwerk-m4h/

https://m4hrotterdam.nl/wp-content/uploads/2019/07/M4H_brochure_website_2.pdf traducted pp 6

9 ooijer, B. (n.d.), RDM Campus, presentation online available at: http://www.transurban.nl/media/bestanden/stad%20water/Conferentie%20Rotterdam %20Waterstad/Bert%20Hooijer%20RDM%20Campus.pdf (accessed 5 February 2014)

M4H site, the aim of the municipality and the port authority was to develop a cluster of innovative production industries and create an important asset to bring manufacturing activities back in the city.

RDM was founded in 1902 by a consortium of almost all Rotterdam shipowners to ensure sufficient maintenance capacity in Rotterdam. It started with ship repair, but soon expanded its activities to new construction, first of cargo ships, but later also of tankers and passenger ships. Before the Second World War The RDM became one of the largest shipyards in Europe, starting a decline in the 1960s and going bankrupt in the mid 1980s. The port of Rotterdam authority purchased the building in 2002 making the first steps for its redevelopment[10]. The architectural qualities of the RDM buildings allowed to establish large scale production as well as introducing facilities for the educational institutes hosted in the complex. Flexibility and adaptation are key features of the spatial layout which is designed to facilitate cross-overs between creative industries and technology, and to promote knowledge exchange between research/educational institutes and business. The varied machinery set of the school, from traditional to high tech, can be rented by third parties and students are involved in internships and projects of companies incubated in the building. In this way RDM wants to achieve the goal of setting up a framework for cooperation between small and medium sized enterprises (SMEs) and education and research institutes. (van Tuijl & Otgaar, 2017) The development and recovery of the RDM complex has as its ultimate objective the creation of an attractive work and living environment and a focus point for the renewal of Heijplaat neighborhood, a workers neighborhood historically linked to RDM and port industrial activities today in decline.

4.2.4 Case study: Keilewerf

The analysis of spatial and social transformation going on in Rotterdam gives a clear vision about the role of manufacturing and its future in relation to city development. The spatial framework realized in the last two years by the municipality and the Port of Rotterdam for the M4H has been realized taking into account the know-how and experience of critical actors and the role of experimentation taking place in the area by new located activities which had an important role in redevelopment process and transformation of the image of the derelict Merwe-Vierhavens area.

Keilewerf, as a physical place and a community, had a fundamental role in this process, thanks to critical factors which has developed an interesting case study from an architectural, managerial, social and industrial point of views.

10 https://www.rdmrotterdam.nl/geschiedenis/

4.2.4a History of the place

The two buildings Keilewerf 1 and 2 are located in the Keilehaven wharf. Keilewerf 1 is located at the corner between Keileweg and Keilestraat at number 56, while Keilewerf 2 is located at 5a in Keilestraat. The two buildings were warehouses for the activities present on the site. Keilewerf 1 was empty for a long time and before it hosted material and products for the shops on the other side of Keileweg street. Keilewerf 2 hosted a warehouse of materials, furniture and leather products and an illegal mosque on the third floor of the office block. The owner of the two buildings is the Municipality of Rotterdam. Keilewerf 1 is still in nomination for demolition; for this reason, the activities carried out inside are still within a temporary regime. (Lenard Vunderink, interview 21/02/2019)

The Keilewerf was born from the necessity of Bas van den Berg and De Bende, at the time a collective of creative people, to find a new space for working and producing in the city of Rotterdam. In 2012, they found an empty warehouse in Keilehaven, (Keilewerf 1) a potential building to place their activities. After assigning a first contract for the use of the building without paying a rental fee, the group found other tenants who wanted to share the space to build their own business.

The first period of development was restricted to a small group of people who used the place to store their material, machines and tools. The place started to grow organically with the realization firstly of material storage, benches and other small elements, then the first workspaces and offices (Hugo Nagtzaam, interview 04/03/2019). At that time Bas van den Berg was investigating the potential of the building as a place to host manufacturing and creative activities and involved Lenard Vunderink to work on the project with him and create what today is the Keilewerf. They assigned a four-year contract with the municipality in 2014 and started a process of renovation and re-organization of the building to attract new and diversified tenants. The occupation rate grew slowly in the first period, but it had an escalation with a more stable managing structure, reaching its full capacity. The success of the operation led van den Berg and Vunderink to assign a new four-year contract for a second empty building of the same block which has become Keilewerf 2 in 2015. The second building presents the same condition as Keilewerf 1 except for an office block which provides available space to host more standard office space next to the warehouse for manufacturing activities. In 2018 in conjunction with the opening of the AIBR in the Haka building and the realization of the N4H+ test site, Keilewerf community opened the Keilecafè, made by containers structure creating an open court in the open field between the two building to host a bar, a stage and a tribune. The Keilewerf community engagement and the hosted events have helped to make the Keilecafe a vital meeting point not only for the young people living in the neighbourhood but for the whole city.

4.2.4b Architectural redevelopment

Keilewerf 1 and 2 have very different stories. The spatial strategies implemented in the renovation of the two buildings of Keilewerf moved from a first informal organization to a more rigid functional distribution, in a continuous feedback loop to optimize the previous results. This variation is still visible in the spatial layout of the two places, enabling the findings of correspondences between spatial strategies and the evolution in activities management. At the same time, all the architectural operations proposed inside the two buildings fall within the temporary regimes scheme that on the one hand has allowed considerable freedom in uses and functions distribution, on the other has affected the investments for redevelopment and technical improvements. As the rent contracts were subject to a short period of four years, now renovated year by year (Lenard Vunderink, interview 21/02/2019), in the next future the buildings may undergo significant variations for the development of other functions. In this case, in the interests of the M4H development plan, both buildings will be re-functionalized or demolished to make room for new buildings. We are therefore in a case of adaptive reuse, where the different parts of the buildings were developed at different times, with different strategies that reflected the conditions of that precise moment in which they were implemented. This condition made it possible to analyze and document how managerial and social strategies are transferred into architectural practices that, in turn, influenced processes, production and sociality within the two buildings.

When the first group of tenants set up their activities in Keilewerf 1, the building was totally empty. As established in the contract with the municipality, they had to provide electricity and water as well as take charge of all the renovation works and standard maintenance. They initially opted for a shared centralized energy system, a choice that was not implemented in the renovation of Keilewerf 2 in order to monitor the costs of the individual tenants and avoid energy waste (Lenard Vunderink, interview 21/02/2019).

In this phase, the group occupied only 2.000 m2, one-third of the available space, near the public entrance, completely sharing the space at their disposal (Buro van Wieren, 25/02/2019). They started to occupy the space by inserting materials, machines and tools inside. The reorganization proposed by van den Berg and Vunderink produced a first change of the place: a shared kitchen and public restrooms where installed and tenants started to rent a plot and build their own workshops. The physical layout of this part has followed tenants requirements resulting in an incredibly organic distribution, organized around a central plaza, a shared open working space equipped with machinery, material and worktable. The single plots possess different and irregular dimensions, overlapping each other, sharing connections and storages. Proof of the community organization process developed.

The success of this first operation is also related to the entrance of an important actor inside the building: Buurman, a workshop and store for reusing material which provide affordable material for the construction of the workspaces directly on-site, which resulted in a successful strategy for the development of an internal economy able to be self-sustainable especially in the first critical moments of settling.

Aware of the problems that such an organic layout had produced, especially for logistics and material transportation, starting from April 2015 the remaining two-thirds of the building were organized accordingly to a standardized layout. The maximum length of the plots was set at 9 meters, while the width was established based on tenants needs. In this way, two central corridors were created, allowing the entrance of vans for loading and unloading of material and final products. Workspaces have a mainly vertical development with the possibility of realizing up to two floors thanks to the high internal height, superior to 8 meters. In this way, it was possible to divide the shop floors from the office spaces and the material storages usually realized on different floors. Especially in Keilewerf 1, it is possible to observe an integration between working and domestic activities with the realization of personal kitchens or "living rooms" with sofas, music instruments, bookshelves, plants and a high degree of personalization. This experimentation indicates a functional mix not only related to the various manufacturing and creative professions but also connected to personal and social life. Keilewerf 1 space, even if its industrial character prevails, is experienced as a social space, where work mixes with domesticity.

The know-how developed in managing Keilewerf 1 was invested in the renovation of Keilewerf 2 building starting from late 2015. In this case, the building is composed of a three floors office block and a warehouse. The office block was renovated as standard offices with the realization of a shared kitchen on the ground floor, accessible both by the office block and by the working spaces in the warehouse. The building possesses two entrances, one facing Keilestraat with direct access to the office block, the second from the inner courtyard to the warehouse as vehicular access. The renovation of the building was focused on the warehouse with the opening of skylights on the roof of the building, allowing natural lighting in the space, the creation of a new glass facade on the internal courtyard and the realization of a second-level through a prefabricated metal structure. Finally, a new electrical system was created for each individual tenant.

4.2.4c Management and its evolution

After a first commitment that was to find a space for their activities, van den Berg and Vunderink developed a strategy to provide space to companies and single manufacturers in searching for a space for productive and craft activities in the city of Rotterdam. In the first moment, the development of the project moved very organically but the group understood immediately the need to structure a more rigid organization.

The management of the place started with a small organization committee with only two people, Bas van den Berg and Lenard Vunderink. They took the commitment to administer the two buildings, find new tenants, maintain the buildings and organize the place. They provide space for productive, craft and creative activities offering the possibility to rent space a fixed monthly cost with a short lease, giving a high rate of flexibility to the companies. A strategy made possible thanks to the high request of space in Keilewerf, due to its vibrant and diversified community, but also promoted by the high demand of low cost working space in the whole city of Rotterdam.

In Keilewerf 1, the rent fee covers only the cost of the rented lot, as part of the warehouse but anything else is provided. This has allowed maintaining rents fee very low, producing other interesting results: at their entrance tenants had to invest a lot of time, energy and money to realize their workspace. This process of constructing their own space has resulted in an appropriation by the user of the space they occupy. It is not simply a matter of paying rent for a co-working office; this process has ignited a sentimental attachment in what they were building, in what they continue, as a community to keep active. (Lenard Vunderink, interview 21/02/2019). The rent paid by tenants is based only on the area occupied on the ground floor, but the dimensions of the building allow the construction of another floor, making it possible to duplicate the available space. This investment is at the discretion of the user, but it is an advantage that it is not covered by the payment of a surcharge on the rent.

In the development of Keilewerf 1 resulted strategic to include in the first group of tenants not only production activities but also a resale activity: in this case, it is Buurman. Buurman is a woodshop and workshop for reclaimed wood and other building materials which actually have a space in Keilewerf and a new venue in Utrecht. At the entrance of the first tenant's group in Keilewerf, Burmaan's business played a key role by selling low-cost material for the first individual user investments on their workspace. In this way, a virtuous process between actors was activated, leading to success in the opening of Keilewerf.

Keilewerf 1 also presents other spatial experiments. Taking into account the possibility of growth in space of some tenants, flexible plots are rented to temporary tenants monthly than in case of need can function as additional space for the structured activities for expanding their workspace. This strategy actually worked, and some tenants had the possibility to grow without moving to find a bigger place. In the past years, it has also happened that activities, becoming too big to be hosted, choose to change places and open their own independent workspace. This was a necessity in order to maintain a high diversity between activities and above all, to accommodate other small businesses, sustaining them with a good workspace for their products. (Lenard Vunderink, interview 21/02/2019

In Keilewerf 2, managers decided to adopt another strategy to simplify the internal organization, the construction and maintenance of the electrical grid and the realization of the individual workshops. The plots were organized with a standard unit of 9 m deep for 8,60 length and tenants can choose between renting one or more of the standardized units. Moreover, with the refurbishment of all floors in the office block, a metal structure was realized in the warehouse, already involving the realization of a second-floor and accelerating construction works by the tenants as all structural elements had already been positioned. Tenants had to deal only with the investment in the construction of external infills and internal elements. This has definitely decreased the entry time of the tenants. At the same time, a new electrical grid provided electricity to all tenants. In this case, the rent costs are higher as they must also cover the renovation construction costs.

4.2.4d Social organization

The third important aspect in the development of Keilewerf, an important element to decode the complex reality of this place, is its social organization. During the interviews and the field analysis, the strong bond between the different users of the space has been particularly evident as a strategic value for the success of this experience. At the same time, the analysis of the social organization and companies profiles permitted to understand the evolution in the development of the project as well as supporting a deeper understanding of how small manufacturing and creative activities are structured in the European city.

Keilewerf experience was born from the original group of De Bende, Bas van den Berg and later by the join of Lenard Vunderink. From the first moment, the mission of the initiators of De Bende collective was to bring people to work together, and they realized the necessity to find a bigger space to allow better collaboration between different professions as architects, woodworkers, designers and other artisans. When they found the empty warehouse of Keilewerf 1, the initiator of the group split up, and everyone started their own business occupying a space inside the building. It was the original spirit of De Bende that led to the development of Keilewerf (Hugo Nagtzaam, interview 04/03/2019). Today De Bende company which still occupies a big space in Keilewerf, under the experience of Hugo Nagtzaam who was introduced in that moment of reorganization.

As the place started to grow organically, it was predominantly composed of carpenters and woodworkers. The managers understood the necessity to provide a more mixed environment and started to rent space to other manufacturers categories as stoneworkers, blacksmiths, upholsterers but also to innovative manufacturing such as laser cutting and 3D printing or filmmaking companies. The strategy helped in creating a vibrant community which declared to be engaged in the space as their own place, due to the investment in personal workspace construction and mutual help.

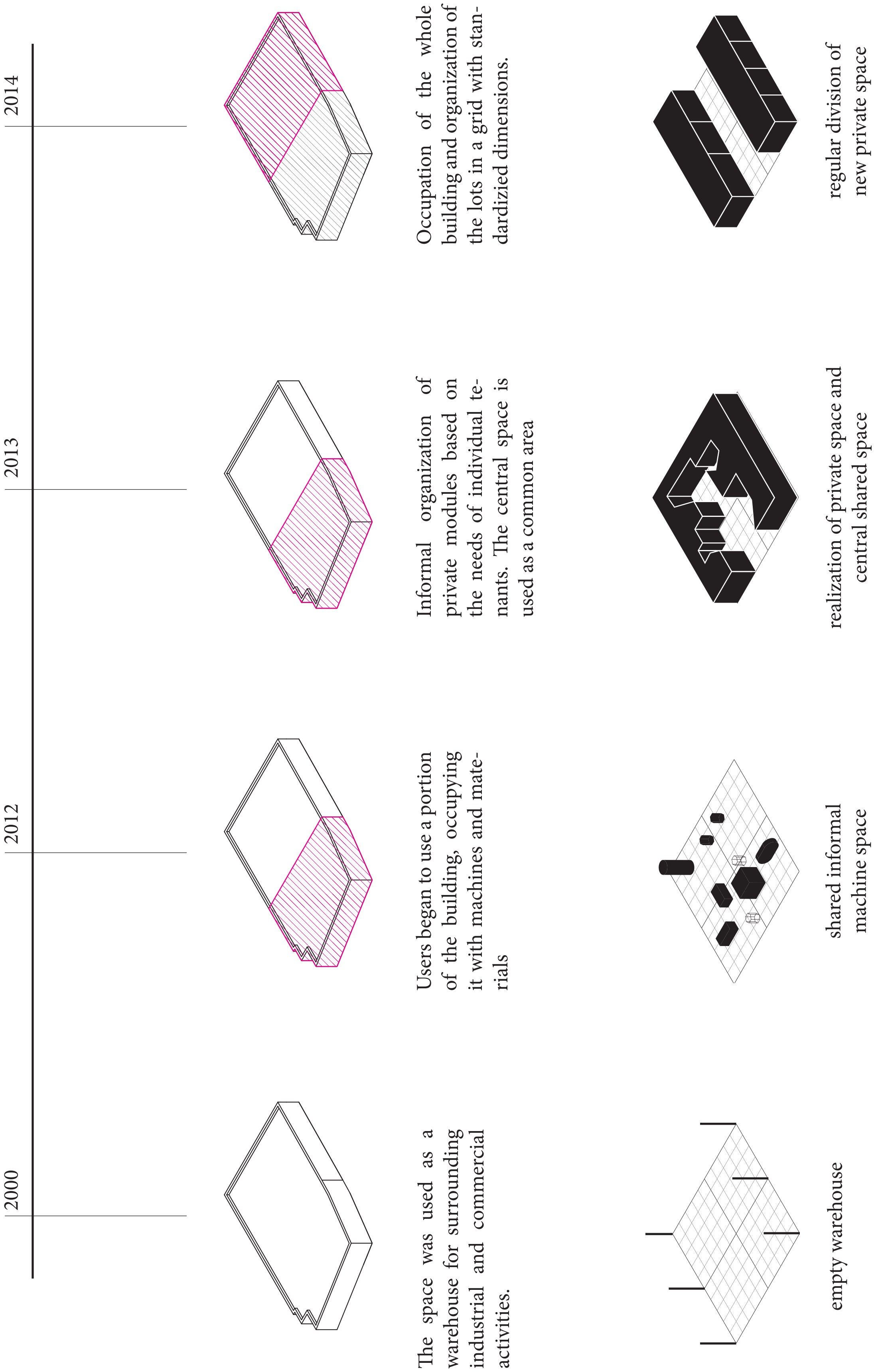
The prevailing mindset of people working in Keilewerf with their own expertise enables them to have access to different knowledge areas resulting in a better work environment with reliable and durable collaborations (Buro van Wieren, 25/02/2019). Many tenants declared to realize projects in collaboration with other tenants both in direct collaboration rather than by subcontracting parts of the work. The sense of community and the different know-how of the companies allowed the single company to take bigger projects and commission and collaborate with an extended group to finalize the whole work. (Buro van Wieren, 25/02/2019).

At the same time, the exit rate is very low, and it mainly refers to companies that have become too big and were unable to expand inside the building. Many of the activities present have been located for a long time, and this stability has allowed companies to grow both economically and from a community perspective. At the same time, the place permits to expand without really the necessity to move. Some areas are left empty to permit companies to rent these spaces under the necessity for bigger projects (Hugo Nagtzaam, interview 04/03/2019).

Within the space, there is a great sense of community. People feel space as their own because they have invested their time and money in building a workshop that responds to their needs. At the same time, most of the people are starting a business, and the interaction with other people creates trust and mutual help which motivate them to be in the place as much as possible and collaborate. In this sense, the community helps them in business. The community also has a group on the WhatsApp messaging platform, a fundamental tool for rapid communication between tenants both for day-to-day matters and for long-term organization.

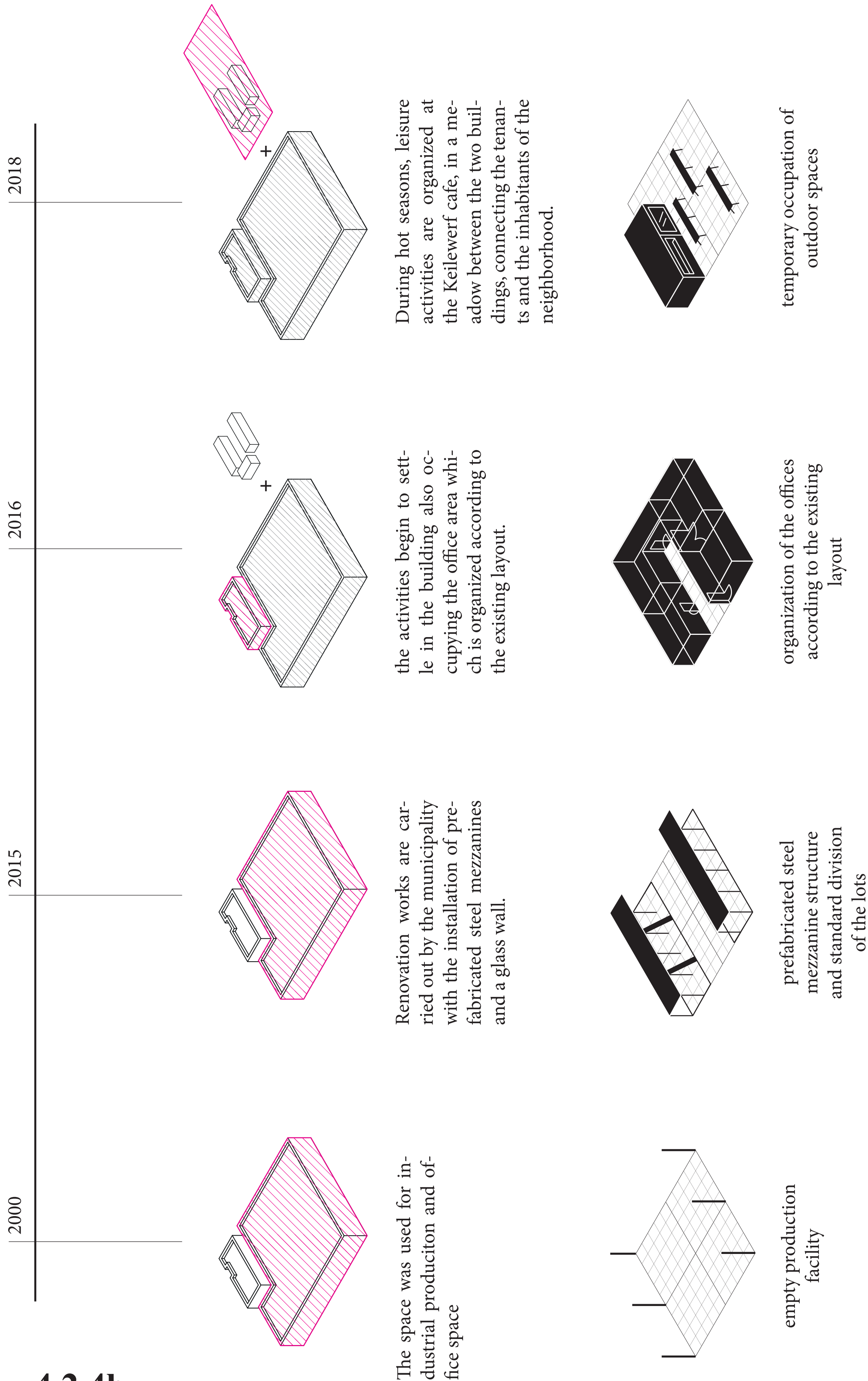
The high degree of freedom in space organization permitted to realize a place that combines an inspiring atmosphere for design and office work and at the same time, a right place for making. Usually, this type of space is divided, and it is hard to find a place which combines these two fundamental aspects.

At the same time, the two realities within Keilewerf 1 and Keilewerf 2 have different characteristics. In part, these characteristics are given by the fact that the two spaces are born at different times and with different objectives, but another critical factor is the spatial distance that separates them. In a day to day reality, people use to frequent their own place of work and its difficult to create the same type of contact with people that are just in front but not in the same building (Buro van Wieren, 25/02/2019). In Keilewerf 1 and Keilewerf 2, the ecosystems are different. In the office building present in Keilewerf 2 there are activities more related to creative economies and services, while in the warehouses there are crafts and production activities as in Keilewerf 1. (Lenard Vunderink, interview 21/02/2019) The Keilecafè, a temporary space open only during the hot season in the green area between the two buildings, became the connecting element between the realities that inhabit the two spaces. The Keilecafè hosts daily events and performances by artists, and over time it has become a meeting point not only for the community present in the two buildings but also a meeting place for the neighbourhood.4.3 Case study: Sectie-C



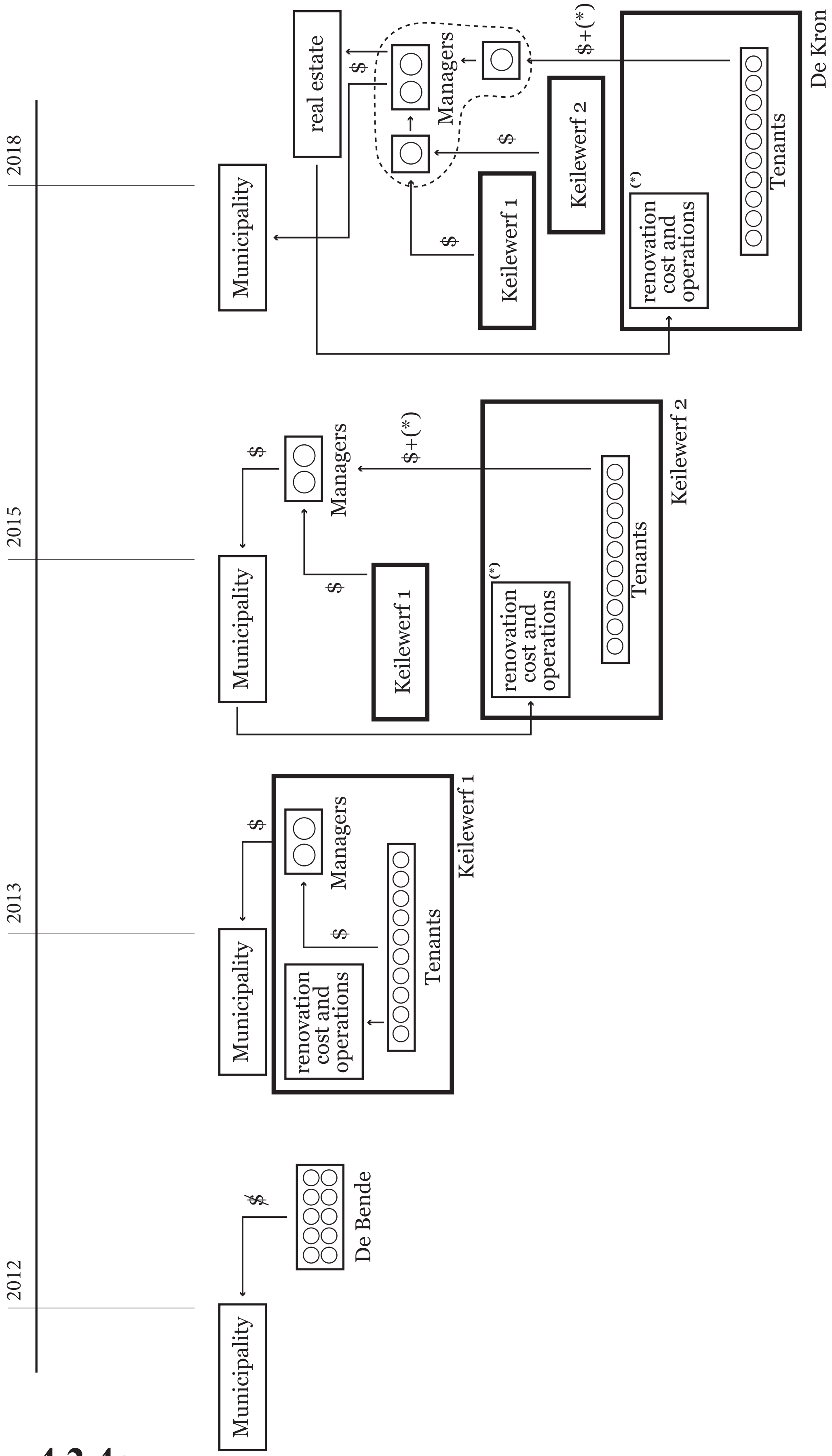
4.2.4b

Keilewerf 1| **time strategy transformation** | architectural strategy



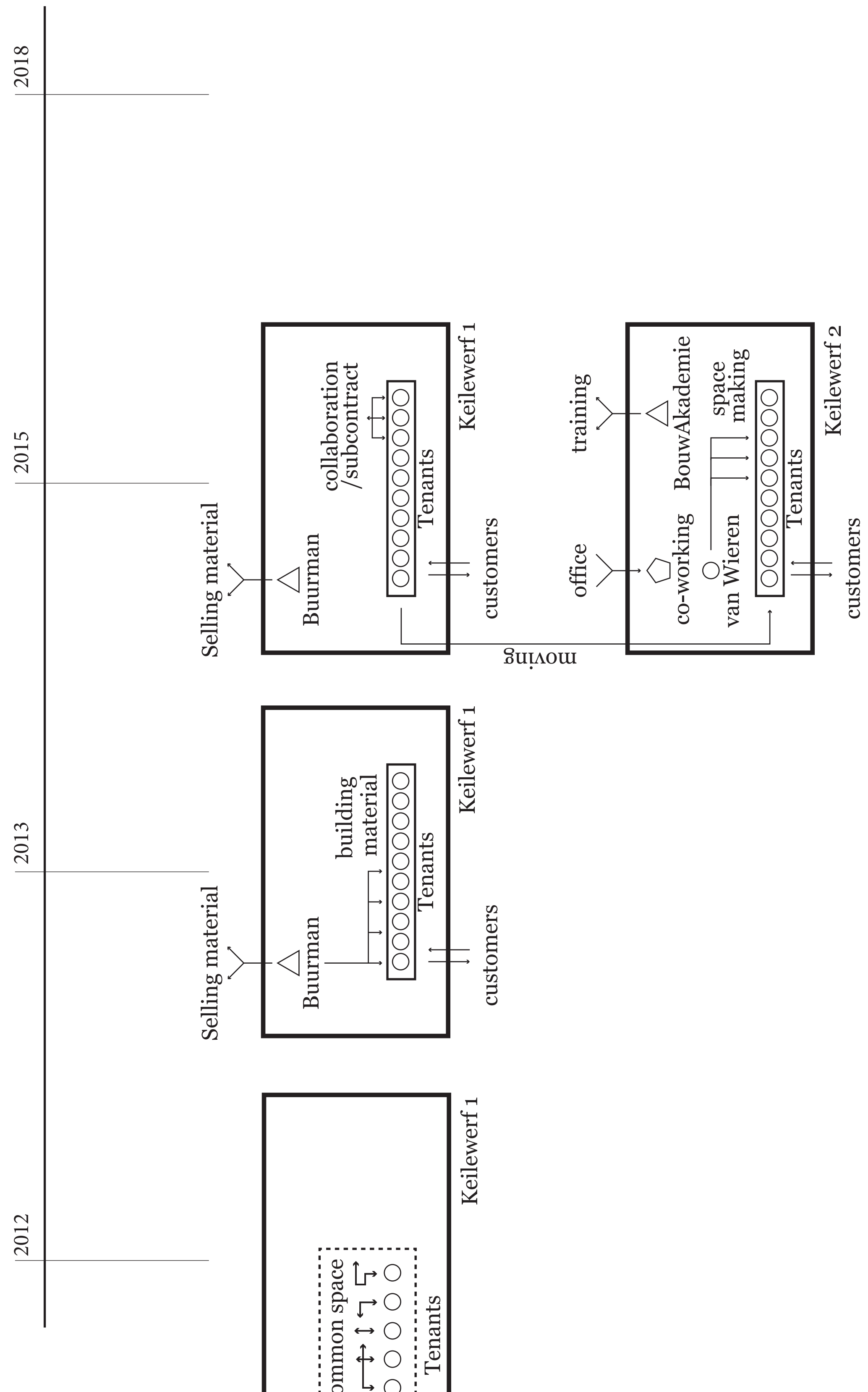
4.2.4b

Keilewerf 2| **time strategy transformation** | architectural strategy



4.2.4c

Keilewerf 1-2| **time strategy transformation** | management strategy



4.2.4d

Keilewerf 1-2| **time strategy transformation** | tenants relations

4.3 Case study: Sectie-C

4.3.1 Eindhoven the company town of Philips transformed

Eindhoven is a city located in the south of the Netherlands, in the southeast of the province of Noord-Brabant. In January 2019 it had 231,642 inhabitants on a territory of 88.84 km². The municipality is part of the Eindhoven Metropolitan Region (MRE) with an area of approximately 540 km² and around 750,000 inhabitants. Eindhoven in collaboration with Breda, Helmond, 's-Hertogenbosch and Tilburg and the province of Noord-Brabant is part of the BrabantStad urban network, also referred by planners as the Brabant City Row. The network aimed to create cooperation between the different municipalities for economic, spatial, cultural and social development. Today the BrabantStad is one of the most significant urban regions in the Netherlands with 20% of industrial production located in the area. In 2019, 64% of the Eindhoven population was native, 14.8% were western foreigners, and 21.3% were non-western foreigners.

Eindhoven has always been characterized by a robust industrial attitude thanks to its localization on the railroad junction towards Belgium and Germany becoming an attractive point for entrepreneurs. Its industrial development started around the last decades of the nineteenth century, when the city expanded due to the large number of workers attracted by the spreading of textile, tobacco and leather industries but also thanks to the expansion of the royal matchmaking factory, the cigar box makers Mennen & Keunen, the development of the Van Doorne's AutomobielFabriek N.V (DAF) and the opening of the Philips light bulb factory. This strong industrial development has led to an explosive growth of Eindhoven and the surrounding municipalities. (Schippers, 2007). The growth of Philips into the largest company of the city made Eindhoven a "single company town", a settlement built and operated by a single business. In visiting Eindhoven in October 1930, Henri Ford was impressed by the "robust large buildings" and "the rational modern manufacturing" established by the Phillips family (Oord, 1990). The growth in population and city area continued during the 1940s, thanks to the growth of the Phillips group which from the production of incandescent lamps became a multinational and global player in electronics. The vast influence of the Phillips company on the city of Eindhoven was not only caused by the presence of its production plants but also by its corporate real estate. The company built dwellings, shops, schools, sport and recreational amenities, establishing a "state in a city" that in certain areas has more power than the local community (Schippers, 2007).

The decline of the company started in the 1960s due to product failure and competitiveness decline. (Havermans et al., 2008). Production and other activities located in Eindhoven were closed with the consequent transfer of the headquarters in Amsterdam. The company's real estate activities were privatized or closed. The only activities of the large Philips industry that remained actively located in Eindhoven concerned the research and development of new products and technologies.

In 1990, still, 25.000 people were employed in Philips and even if its influence started to decrease many outsiders saw the company and the city still as a unity. This public image of the city started to change in the last decades, due to Eindhoven conversion in a post-industrial city. In this new city, Philips represents one of the big players besides emerging and old companies as Asml, Nolte-group and Daf-trucks but also institution as the Design Academy, the Philips Design centre or the Dutch Design Week. Active actors in a rebranding process that brought the city to focus on ICT, mechatronics, automotive, design and high-tech. (Havermans et al., 2008) The abandonment of the city by Philips' industries, the development of a post-industrial economy and the emergence of new cultural actors has led the municipality to focus its attention on the knowledge produced by Philips' related industries and on the formulation of strategies to enhance the knowledge spillover between the academic and industrial sectors to raise new collaborations and a new entrepreneurship class.

From the 1990s, one of the initiative promoted by the municipality has been the realization of the Brainport, a collaboration between the government, private companies and knowledge institution (the triple helix concept)realized with a high presence of creative industries, knowledge-intensive program and high technological products development to encourage the creation of an innovative milieu (Huang, 2013). Brainport has been in the top three places for patent density, accounting for over a third of all Dutch private R&D expenditure. In 2011 it was awarded as the "Intelligent Community of the Year" by the Intelligent Community Forum (Maldonado et al., 2009; Fromhold-Eisebith, 2012), recognized as an important European research and development centre, involving public and private investments for its development.

In the rebranding process and transformation of Eindhoven economy, design and creative economies also play an essential role in the creation of added value, in settling down a new entrepreneurship class and in expanding the internationalization of the city. This role is visible in the growing impact of the universities and research centres. An example is the Design Academy, a school for higher professional education specialized in design and by international events as the Dutch Design Week (DDW), bringing visitors from all over the world for exhibition, lectures, and shows related to the design, architecture and performative practices.

4.3.2 The transformation of the city: the close connection between urban space and innovation

Eindhoven, since it was an industrial city during the twentieth century to the internationalization and creative expansion, has always manifested its social and economic transformations through its urban development.

The Strijp-s area presents an example of how urban development catalyzed the city's economic and social changes. The Strip-s is a neighbourhood and former business park in the Strijp district of Eindhoven. The area belonged to Philips and was developed firstly to host a glass factory for light bulbs in 1916, a research centre in 1923, three industrial production buildings named Hoge Rug from 1927 to 1930, followed by other buildings as the Klokgebouw. The concept was to establish a complete industrial site to control all the phases of Philips products development from design to production and shipping. The area has been known as the “Forbidden City” because even if the site was located within the urban context of Eindhoven, it was not freely accessible in order to maintain a high control over trade secrets and new products development.

When Philips progressively departed from Eindhoven, from the 1990s the factories in Strijp-S has undergone a process of abandonment which ended in 2000 with the purchase of the site by the Park Strijp Beheer BV, a Public-Private Partnership between the Municipality of Eindhoven and VolkerWessels for 140 million euros. The new masterplan for the revitalization of the 27 hectares of the former industrial land was designed by West 8 in 2001 with the aim to renovate the area creating affordable working and living space and retain creative talents for the city[11]. Strijp-S has become the most extensive urban redevelopment area in the Netherlands, hosting high-tech creative and cultural industries, houses, office spaces and a new urban public space connecting the different facilities. It has gained international recognition both in innovation, as part of the Brainport region, and in urban development by winning in 2019 the NEPROM Prize, a prize for honouring successful cooperation between municipality and market parties on area development. Today the Dutch Design Week and STRP Biennale (art, technology and pop culture festival) also take place in the area creating a mix that has made Strijp-S, even more, an attractive location, especially for creative industries.

As mentioned before, spatial planning and urban development in Eindhoven are not only influenced by private and public actors in the real estate sector but also by cultural entities and institutions. They have been operating in the city for years in a constant search and experimentation of new ways of living the urban space. One of these is the Dutch Design Week (DDW) a large-scale and international annual nine-day event which welcomes more than 350,000 visitors, showing the work of more than 2600 designers through exhibitions, shows, conferences, public events, installations in more than 100 locations across the city. The DDW has become over time a real engine of urban development for the strategic growth of the city of Eindhoven; in fact, the design context takes on a broader meaning that ranges from the product scale to the urban scale, with a strong focus on research, experimentation and innovation for the city of the future. DDW was born in 1998 as a “Design day” and then took on its current form in 2005. It was developed from the efforts of the Design Academy, born from the Akademie Industriële Vormgeving Eindhoven, which after the abandonment of Philips became a social actor capable of engaging a systemic transformation of the city. The first DDW headquarters was located one of the abandoned buildings of Philips in the Strijp-s as a starting point for the renovation of the building. The event does not focus on the commercial aspects but

11 for more information about the urban project of Strijp-s, its history and the urban project created by West8, together with the guidelines and the awards, consult http://www.west8.com/projects/strijp_s/ and https: // strijp -s.nl/en/history/

to give space to research through a widespread event that becomes a strategic tool for the reactivation of the urban fabric (Frigerio & Galateo, 2019).

From industrial activities to new tech and creative industries, the urban renewal of Eindhoven is characterized by a strong commitment between private and public actors. A practice that is also favouring other real estate developments as the Campina Terrain.

The Campina Factory was built in 1957 as the most extensive and modern dairy facility of the Netherlands. (Korenberg & Haans, 2015). It is located in an industrial business park along the south side of the Eindhovens canal and enclosed by the ring road (Hugo van der Goeslaan) on the east side of the terrain. The production stopped in 2015, all the machinery was moved, and the factory closed down. After only two years of inactivity, in the summer of 2017, the land was purchased by BPD (Bouwfonds Property Development) with the aim of renovating the 3.5 hectares of the area for new work and living activities. The redevelopment project of the Campina factory area is organized in phases, involving a step by step approach for the renovation of the factory buildings and the addition of new facilities in a constant feedback loop process. The first two phases of the project have been characterized by temporary use of the factory for public and private events as well as the adoption of an adaptive reuse strategy for renting industrial space to craft, design and creative companies. In this phase of development of the area, six buildings of the entire complex were available, five of these redesigned to host industrial and craft activities and one to host events. With a total area of 4460 m2 divided between the ice factory (1310 m2), the canteen (2370 m2), the lab (190 m2), the boiler room (590 m2) and the milk reception (420 m2), the first phases of reuse of the complex takes advantage of the wide demand of industrial space in the urban context. The proximity of the complex to the city centre, its spatial qualities and the low rental costs are potential successful features of its reuse.

The functions and strategies adopted in the development of the Campina area place emphasis on three main issues. The first concerns the functions, craft and industrial. The second concerns timing, the temporary use is a starting engine of the recovery process and the third concerns the location, urban context as attractive space for urban manufacturing characterized by being at the intersection between industrial and service activity.

The development strategy applied to the Campina case has its origins in successful experiments previously carried out in the Eindhoven area, also involving its initiators and actors, as consultants. They acquired crucial know-how from previous experiences of management and the success into a real estate activity of this kind. One of the most critical cases in the Eindhoven area which constitutes a virtuous precedent in the development of abandoned industrial areas for a new production class made up of artisans, blue-collar, artists, designers, architects but also social workers and entrepreneurs, is Sectie-C which is the case study selected for the research in the Eindhoven area.

4.3.3 Case Study: Sectie-C

Sectie-C is an important creative and manufacturing cluster located in the Oud-Tongelre district, within the Tongelre neighbourhood, on the eastern outskirts of Eindhoven. The district is crossed by the city's central railway line which connects it to the major urban centres of Holland and Europe. The building is located within an industrial fabric characterized by sheds dedicated mostly to car dealers, but supermarkets and smaller businesses are also present. Residential buildings mainly characterize the rest of the neighbourhood. The complex is not well connected by the public transport network, with a half-hour journey from the central station, forcing many of the workers to use the private car or the bicycle. The complex is not well connected by the public transport network, with a half-hour journey from the central station, forcing many of the workers to arrive by private car or bicycle.

4.3.3a History of the place

The history of the place started with the construction of the building by the Nolte group in 1976. The company was a fully electro-technical and mechanical industry specialized in lighting systems. Today the company is part of the VDL Group, an international industrial and manufacturing company that focuses on the development, production and sale of semi-finished products and other end products for the car and buses industries.

The Nolte NV was founded in 1923 by Coen Nolte in Eindhoven, where he opened his workshop in Bleekstraat, producing mounting hardware, switchboards and installing cabinets. The company suffered the crisis during the decades of the 1930s, improving its state of affairs only after the Second World War with the production of lamp posts, metal products for Philips and electrical parts for the state mail service. In the 1950s, the company began manufacturing emergency lighting systems. This was a success, and Nolte remained the leading producer in the Netherlands for many years. In the mid-eighties, the company turned its focus toward working as an industrial subcontractor, especially for metal parts and assembled printed circuit boards. The company was taken over by Stork in 1989, which has in turn been annexed by the VDL group in 2004 and continued under the name VDL Industrial Modules[12].

The office buildings, the workshops and warehouses constructed in the 1970s by Nolte NV on the Daalakkersweg replaced the workshop constructed in 1938 at Tongelresestraat, which was the headquarters of the company's operations from 1939 to 1970 when the crisis of the 1930s was overcome, and the company left its

12 Information about the VDL group and the Nolte NV company reviewed at https://www.vdlindustrialmodules.nl/en/vdl-industrial-modules/geschiedenis

first building in Bleekstraat, demolished in 1951. The annexation of the company by Stork and then subsequently by VDL group, led to the delocalization of the industrial and storage operations that were present on the site, which was definitively closed at the end of the 1990s.

The redevelopment of the area of the industrial company Nolte in what is today Sectie-C is linked to the figure of Rob van der Ploeg, an entrepreneur living in Eindhoven. The concept that was implemented in the renovation of the area evolved from van der Ploeg ideas about the realization of a hybrid space connecting workspaces for the creative professionals to a central area for sociability, exhibition, and food. After a few years of research of a suitable space for his purpose and the opening of Smalle Haven, a creative place in an old empty big workshop in the city, in 2007 he found the Nolte area. The place at the time was owned by a real estate investment company from Canada, and he started a conversation with the owner to rent the space and realize his vision. (Sander Wassink, interview 28/02/2019, Rob van der Ploeg, interview 22/10/2019)

Due to the crisis in the area and the lack of interest of large industries in buying or renting the complex, van der Ploeg had the opportunity to rent the space at a reasonable price with the first contract of one year which evolved in a five years contract for the next few years. Following the initial concept, he personally chose the new tenants trying to build a community interested in investing in space. He had no interest in business searching only for working space or established professionals interested in developing a commercial venue, choosing young creative people who wanted to grow professionally and as a community within the space and invest in its development. (Rob van der Ploeg, interview 22/10/2019). In this sense, the operation had a place-making approach.

After three years of managing the place, in 2013 the owner went bankrupt and the property after a short period under the ABN AMRO bank was bought by a private owner who took over the management of the spaces. Rob van der Ploeg left his role as manager of Sectie-C, and the management was entrusted to Anne Geenen who is still in charge of the complex today. In 2013, more than ten companies and collectives were located within Sectie-C for a total number of around fifty people. (Hanne Geenen interview 22/10/2019)

Today Sectie-C hosts more than 180 companies and more than 250 people. Not everyone works in the field of crafts, industry or other creative activities as conceived in the first concept for the area. The new owners set the renovation of the complex by phases, starting from the rented building to the empty building on the east limit. In particular, the renovation of the warehouses on the south edge of the complex has allowed increasing the space dedicated to creative companies with the creation of small two-storey ateliers, and the renovation of the two office buildings in front of Daalakkersweg street has promoted the inclusion of companies related to the world of ICT and services. The terminal buildings were the last to be developed, inserting a theatre, an art seller and offices. (Mies Loogman, interview 26/02/2019)

Today the area is recognized as the cultural and creative centre of the city by hosting private and public events such as Dutch Design Week, continuing to support the growth of designers, artisans, artists and new companies entering the market.

4.3.3b Architectural development

Sectie-C presents different architectural strategies for the adaptive reuse of the former industrial complex of the Nolte company. The variation in space occupation and the transformation strategies are directly linked to the different transitions occurring in the managerial organization, produced by the discordant visions of the different owners who followed each other since the complex began to be reused.

The first space to be occupied has been a part of the central building of the complex, constructed for production purposes. It was occupied by a collective called Collaboration O, and even today, although its members have changed, it is still located there. Space has been organized only by subdividing it in plots, rented by a single person or a small group and organized around a common shared space for machines and tools. The idea of the collective was to maintain the personal freedom of the private working space combined with the benefits of shared space and machinery that would not have been affordable individually. As described by Floor Frings, architect and member of the collective, the painted lines on ground floor delimiting every private space have been made as a visual and practical tool to divide the space, but its organization is an ongoing verbal collaborative discussion between the members involved in the collective to maintain the freedom of creating and modify the space due to common and personal necessity. (Floor Frings interview 01/03/2019)

Even if the whole space was rented under the supervision of Rob van der Ploeg, the process of space reuse of Collaboration O started as a squatting practice. The desire that has moved the collective to search for this type of space was not different from other squatting practice taking place in Eindhoven. In other cases the motivation has been the necessity for affordable domestic accommodation, in this case, it was the research for an affordable workspace, having the spatial requirements that group was searching for, a specific type of working environment with no spatial constraints for manufacturing and craft activities, and it was perceived as an urgency. (Floor Frings interview 01/03/2019). A flexible solution was necessary to sustain new business entering the market, permitting people to develop their own way of working, experiencing and failing. Low-cost rent was a requirement to explore and examine without feeling the pressure of rent cost to be paid every month. (Nacho Carbonell interview 01/03/2019, Floor Frings interview 01/03/2019). Spatial results present this idea of freedom in an informal layout organization with private spaces realized on the perimeter and a central shared space on the ground floor. The private working space has been organized maintaining the ground floor mainly as a workshop and the first floor instead, delimited by glass or light partition as office space.

After the first period, other people and companies joined the collective and rented space inside the complex with different strategies depending on the spatial qualities of each building. Part of the building in which Collaboration O was settled and another building near it were developed in the same way, hosting several companies in an informal organization of the space, made up of private working space and offices and a shared shop floor. These spaces have been recognized to be all characterized by a great height between six and eight meters, by the presence of skylights for internal lighting to support the perimeter windows not accessible to all single workspaces and no structural internal partition. The other buildings were partitioned to meet the requests of individual companies through light partitions, which can be modified according to demand. In the last five years, the first members of the collective "Collaboration O" split up and moved to occupy other locations inside the complex. Sander Wassink, together with five other companies, decided to refurbish a large area of the building in front of the entrance of the space of the collective. In this case, the renovation planned the realization of three main areas and the realization of mezzanines for private office space and storage space. Some additional space has been added by cutting the external facade and inserting containers structure as office space.

Many of the workspaces have a high degree of domestication. The purely industrial workspace is modified by the presence of devices or furnishings that connote a more personal character, almost as if this rigidly functional space can be transformed, in some hours of the day, into a real home. In particular, almost all workspaces present a private space for cooking or shared with other tenants (Mies Loogman, interview 26/02/2019). This practice identifies how the ideal type of working space for the creative worker is characterized by a high degree of hybridization between the space of production, ideation and personal life.

Most of the buildings were redeveloped by the people renting them. The maintenance is made by the owner, but the tenants had to invest in the refurbishment of the internal space as well as internal electrical and plumbing works. (Mies Loogman, interview 26/02/2019) The owner instead is in charge of refurbishing the general electrical water and heating system, making structural works and roof maintenance. Not all spaces are equipped with all the systems required, they had to prove fire security standards, but some technical elements as filters for machines and air purifiers are not mandatory.

The eating system is centralized for the whole area and works six days per week for a business timetable from 9 am to 6 pm, becoming an issue for business working at night time or during the weekend. (Mies Loogman, interview 26/02/2019)

After a first period organized under a temporary use regime, the tenants of Sectie-C have obtained greater stability on future developments in the area which will not be modified for other uses, thus maintaining the creative and industrial character developed over the years. Although temporary use allows high flexibility, this strategy has a positive impact only if limited to a short period. Subsequently, this strategy can turn against the same activities that have taken place in the area, limiting their development and producing an adverse effect for the involved actors, for the community, the neighbourhood, and even for city development.

Obtaining a long-term contract was a necessary condition to sustain the effort and the energy that tenants invested in the redevelopment of their workspace. In a temporary regime, tenants do not care about the physical space; they do not do maintenance if not strictly necessary, merely using the space and not caring about it. It can deteriorate rapidly and become obsolete. This process affects not only the spatial use but also the social relation and the development of local networks. Durable social relations and a local community are difficult to develop when people change continuously; people tend to isolate and not collaborate. (Floor Frings interview 01/03/2019) In a working environment like Sectie-C where creative work is developed side by side with industrial and artisanal knowledge, the establishment of a local strong social network has opened the way to collaboration and improvement in quality, connecting in a virtuous process prototyping and design attitudes with the strong industrial market-driven production located in Eindhoven. This again underlines the importance of the presence of a physical proximity network for the development of a virtuous process of local growth, in this case, linked to industrial production for the creative industry. As described by Floor Frings, with a more stable contract people started to take care also of the external common space, building furniture, planting trees and redesigning the common areas as a space of interaction and sharing. (Floor Frings interview 01/03/2019)

In 2018 the association of Sectie-C had created a “vision book” for the development of the complex for the next five years from 2018 to 2023. This project involves the improvement of some internal spaces but above all the remaking of the external areas and the realization of small interventions for the improvement of the use of the buildings, in perspective shared by the tenants and the owner. The first step of this commitment was the renovation of the covered walkway that connects the first floor of the two office buildings on the main street and the creation of a small café at the entrance of the complex. The project aims to become a symbol, to make the complex recognizable from outside, and a connection spot between the neighbourhood and the complex, providing a meeting point between customers and businesses located in the area.

4.3.3c Management and its evolution

Sectie-C’s first period of activity has been characterized by the management of Rob van der Ploeg. As a supervisor, he was in charge of facilities management, rents and tenants evaluation. In particular, the evaluation of new tenants application has been described by van der Ploeg as a primary aspect for the right growth of the area and the located creative community (Rob van der Ploeg, interview 22/10/2019). The first group of tenants was the collective “Collaboration O”, at the time formed by eight designers. From 2010, other parts of the complex were rented reaching in 2013 ten tenants, for a total number of almost fifty people, composed by self-employed or collectives. In this first phase of development, part of the rent was used for building maintenance costs and safety regulations, but the renovation of indoor spaces, electrical and water systems and its maintenance was not included. Workshops refurbishment was tenants responsibility, involving an adaptive reuse approach to functional needs. Architectural results and layouts manifest this approach through the freedom in the use and organization of the space, mixing domestic and working character. As declared by Floor Frings, the atmosphere and architectural style of the workspaces are the expressions of freedom that has characterized the renovation of the complex. (Floor Frings interview 01/03/2019)

From 2013 the management of the complex passed to Hanne Geenen which faced the necessity of renovating the out of date complex heating and electrical system. Today more than 250 people are working inside Sectie-C in one of the 180 businesses located in the complex. Rents usually have a quarterly duration, ensuring flexible management. The rental price starts from 35 euros per square meter per year up to 60 euros per square meter per year, depending on the characteristics of the space. To the rental price is added a fee of 15 euros per square meter per year for electricity consumption. (Mies Loogman, interview 26/02/2019, Hanne Geenen interview 22/10/2019)

Today a committee represented by the owner, the manager and tenants representatives meet every month to discuss problems and organize future activities. The board is supported by ten building managers, who have the task of managing individual buildings and support the activities of the board. In 2018 the association of Sectie-C had been created to support the growth of the community and represent it as a public entity. All companies pay a membership fee of 90 euro per year for financing activities, public events and communication. From 2019 there is also a foundation to apply for funding, organize bigger projects or events and promote a better legal structure (Mies Loogman, interview 26/02/2019). The realization of a vision book for a five-year development of the area in 2018, has been an important step for engagement and agreement about a shared vision on the future of the community in Sectie-C. A vision characterized by a spatial reorganization deriving from a participatory decision-making process, which in its simplicity highlights the aim of improving community relationships and the use of the shared space.

4.3.3d Social organization

From the last decades, Eindhoven has found a strategy to exit the crisis produced by the decrease in industrial production and the role of large companies in the local economy.

The first period of management has been characterized by Rob van der Ploeg administration. He had a clear idea in mind about what type of space and atmosphere he wanted to realize and what type of people from designer to artisan he needed to be involved in the project. Sectie-c concept has never been a commercial operation, a showcase for users already established on the market who were looking for a location that represents them and their business, nor a real estate operation with the simple aim of renting disused spaces and making profits (Rob van der Ploeg interview 22/10/2019). Van der Ploeg's idea was to create a group of creative people sharing the ambition of growing together shaping the place, through the creation of a community that wanted to put their effort, money and time into developing the area and collaborate to express their creativity.

This resulted in a limited selection of users even if the demand for renting space within the complex was very high (Mies Loogman, interview 26/02/2019). Van der Ploeg declares that a correct and meticulous selection of tenants is extremely important, especially in the first phase of project development.

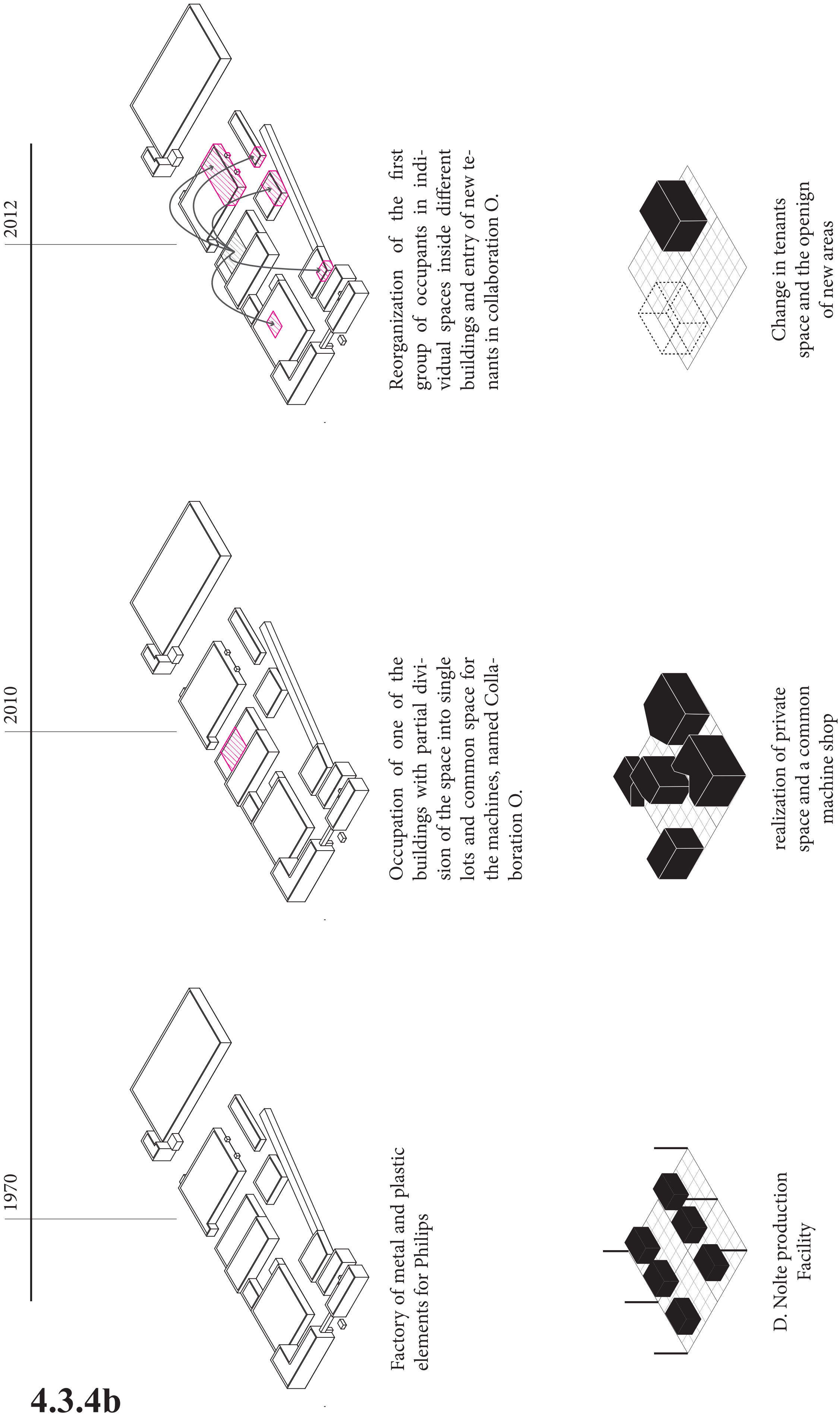
The first group of tenants was the collective "Collaboration O", today still located in the complex even if its members changed over time. The collective was already formed before moving inside the complex. In 2009, they had been expelled from a previous rented industrial space of six hundred square meters, having to dismantle all the structures built internally and rent a temporary warehouse for all the machinery, tools and material until a new location would be found. At that time they tried to rent a location in Strijp-S, area subject to the first requalification processes, but there was no possibility of modifying the space layout to accommodate their need (Sander Wassink, interview 28/02/2019). As Collaboration O, also Nacho Carbonel, an internationally renowned designer, has been one of the first tenants to locate in Secie-C. He studied in Eindhoven at the Design Academy and after completing the master, he started working as an independent designer in a deconsecrated church on the outskirts of Eindhoven. After a first move into a building near the Philips stadium supported by the owner, who saw in the creative movement an effective "anti squatter" model to contrast the previous building's illegal occupation, he was looking for a more stable place to organize his atelier. (Nacho Carbonell interview 01/03/2019). Collaboration O collective and later Carbonell moved into Sectie-C attracted by the low rent and the characters of the industrial space which support the construction of big projects and flexible use of the space. Today Sander Wassink, Nacho Carbonell and Collaboration O collective are important actors of the Sectie-C community, taking an active part in space organization. In particular Sander Wassink is part of the organization board.

Sectie-C is characterized by a strong commitment between a designer attitude and craftsmanship. Floor Frings described how entering inside the collective of Collaboration O has changed her way of dealing with architectural projects, increasing her skill in craftsmanship, but above all, making possible to work with customized material and items instead of relying only on standard products already on the market.

"As an architect I wanted my artistic freedom back" (Floor Frings interview 01/03/2019) Working in an environment where a diversified knowledge is present, becomes a strong support element in project development encouraging feedback and problems solving between professionals. In the dialogue between designers and craftsmen, solutions or new possibilities came out, sometimes taking form in a better design respect of what was the previous versions, shaping also personal attitude, the aesthetics sensitivity to how things are made or built. (Floor Frings interview 01/03/2019)

A "learning by doing" process where social and professional local networks become an instrument for developing knowledge and long-term professional relationships. Numerous companies described how being located in the same area permitted the development of a strong network and collaboration between professionals. What started as a collaboration for single projects has often evolved into stable cooperation (Mies Loogman, interview 26/02/2019). Community relations and working networks are not related to internet platforms but to local contacts. The construction of a stable internal network has also made it possible to reach industries within the metropolitan area of Eindhoven. Contacts that would have been difficult to create through social platforms, as many of these companies do not have a website or it is not updated. In this way, the working relationships that have been established within the area have brought benefits to a wider user base, thus allowing designers to come into direct contact with local industries (Floor Frings interview 01/03/2019). One of the success factors of Sectie-C is the constant work with local industrial operators who help designers to finalized industrial production from prototypes, even in small volumes or customized.

At the same time, the characteristics of the Sectie-C complex have changed over the years. From a place developed only for creative and industrial activities, the different owners of the area applied different models of management and use of the buildings. The two buildings on the main street front have been recovered to house digital companies and start-ups, while offices, a theatre and an art shop have been set up in the buildings at the back. Dynamics are changing and old tenants complain about a transformation of the area in a more general business area pushing out the creative energy behind the growth of the area (Sander Wassink, interview 28/02/2019). For this reason, the vision book created in 2018 is an important starting point. A document which, although not legally valid, highlights a common idea of development and a strategy for maintaining the fundamental aspects of the area.



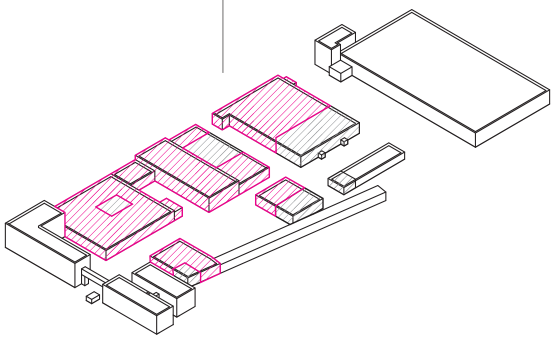
4.3.4b

Sectie-C| **time strategy transformation** | architectural strategy

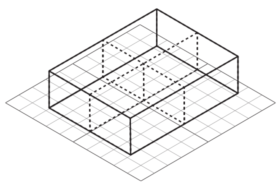
4.3.4b

Sectie-C | **time strategy transformation** | architectural strategy

2014

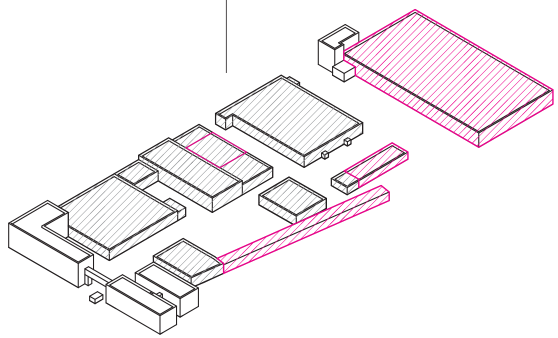


Reorganization of spaces and entry of new tenants with the occupation of new buildings

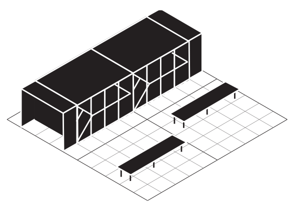


larger companies located on the site

2016

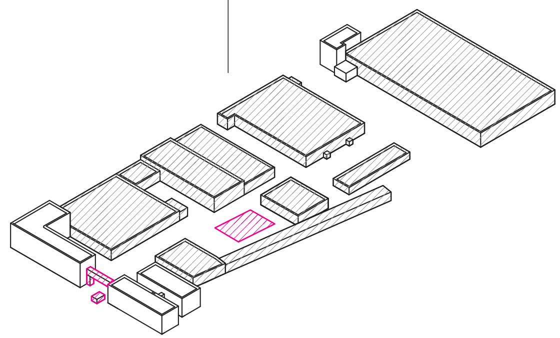


New owner restructures unused areas together with maintenance of the energy system. These renovations bring new tenants in with almost all available areas.

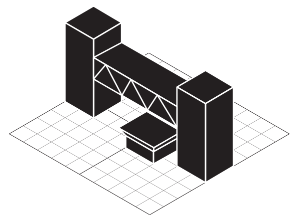


Reconstruction and maintenance of the area

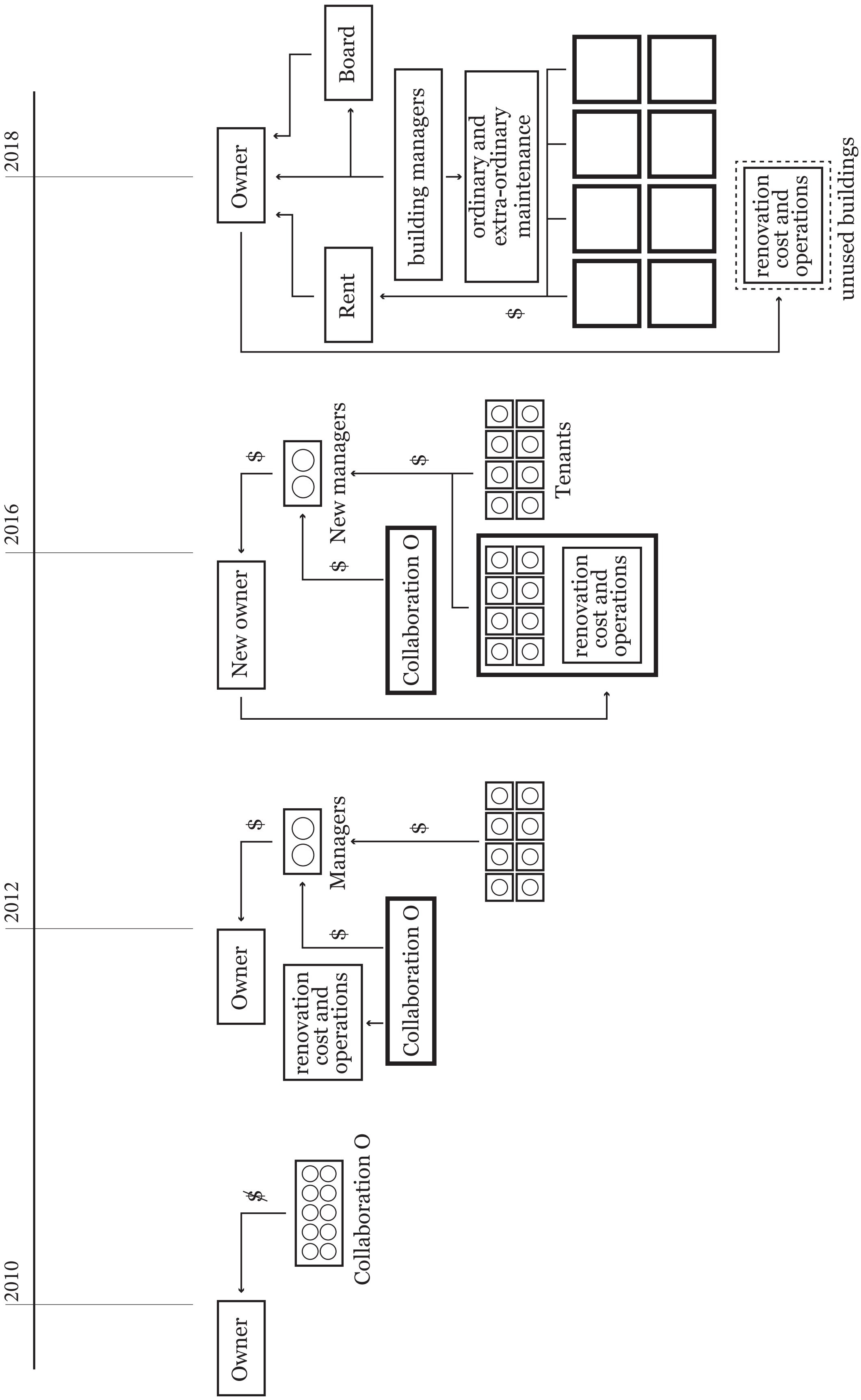
2019



renovation of external areas, the entrance and realization new for a new relationship with the neighborhood

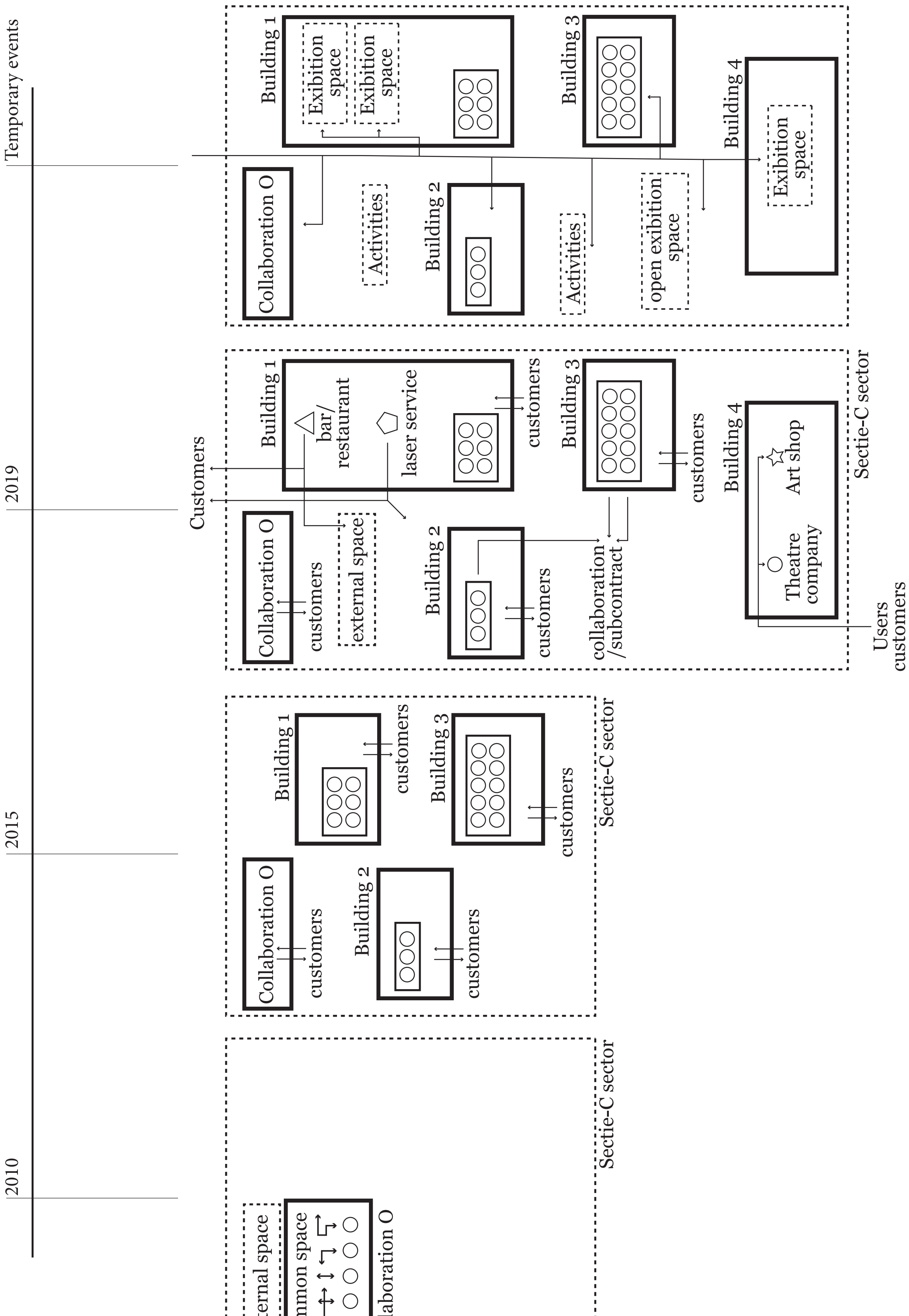


new relationship with the neighborhood



4.3.4c

Sectie-C | **time strategy transformation** | management strategy



4.3.4d

Sectie-C | **time strategy transformation** | tenants relations

4.4 Case study: Portland Works

4.4.1 Sheffield: the Steel city

Sheffield is a city and a metropolitan borough located in South Yorkshire, in England. The city is geographically located on the eastern fringes of the Pennines, at the confluence of two river valleys, that of the Don and the Sheaf. To the west, it is bordered by the Peak District national park, and a third of the metropolitan area is located in its inside[13]. The city has been erected on a hilly area which characterised the urban morphology of the city. Sheffield is recognised for its "greenest reputation", the sixty-one per cent of Sheffield's metropolitan borough is green space, with more than 250 parks, gardens and woodlands within the city limits, which is estimated to host around 4.5 million trees.

The city has grown from its extensively industrial traditions during the first industrial revolution to embrace today a broader economic base. In 2008 the city was placed among the top ten good locations for business by the UK Cities Monitor (Cushman & Wakefield, 2008). In 2018, a survey on Sheffield inhabitants indicated an urban population of 575,400 people, and a metropolitan population of 1.569.000 confirming Sheffield as the third-largest English area by population[14]. As one of the eight largest regional English cities, Since 1995 Sheffield has been part of the Core Cities Group, a collaborative advocacy group of large regional cities in the United Kingdom outside Greater London. The group formed by the city of Belfast, Birmingham, Bristol, Cardiff, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield has wide-ranging interests, including business support, transport organisation, employment, culture and finance, and also governance.

Sheffield played a crucial role in the Industrial Revolution, with many relevant technologies and inventions developed in the region. In particular, the city saw an expansion of its traditional cutlery trade, when stainless steel and crucible stell techniques were developed locally. The Sheffield tradition in knives production was already known in the 14th century[15], becoming the most important centre of cutlery manufacture outside London during the 15th century (Binfield & Hey, 1997). The increase in industrial activity during the 19th century fueled an almost tenfold increase in the population. The prosperity of Sheffield as an industrial town was stimulated by innovations introduced in iron and metal industries (Southall, 2000).

13 Sheffield is located fairly centrally in Britain in the metropolitan county of South Yorkshire and it is the only English city to include part of a national park, the Peak District, within its borders. More information at City Profile Introduction". Sheffield City Council.

14 More information about Sheffield and its metropolitan documented on "British urban pattern: population data" Study on Urban Functions realized by European Spatial Planning Observation Network and on the website of Sheffield City Concil.

15 Geoffrey Chaucer in The Reeve's Tale from his book The Canterbury Tales wrote: "Ther was no man, for peril, dorste hym touche. A Sheffeld thwitel baar he in his hose. Round was his face, and camus was his nose"

Its rapid growth led to the construction of many back-to-back dwelling that, along with critical pollution from factories, in 1937 inspired George Orwell to write: “Sheffield, I suppose, could justly claim to be called the ugliest town in the Old World” (Orwell & Blair, 1980: 72).

The great depression of the 1930s with vast impact on the economy and industrial export and the increased tension of Second World War affected the city of Sheffield, where the steel factories were set to work for the production of armaments for the war effort. As a strategic asset for weapons and ammunition production, the city suffers bombing raids which severely impacted the city by destroying many buildings and production centres (Walton & Lamb, 1980).

The twentieth century has seen an extensive redevelopment of Sheffield. After the Second World War, from the 1950s and 1960s other significant parts of the city were cleared to realise new dwellings and a new system of roads (Vickers, 1999), city’s slums have been demolished and replaced with a new housing scheme as the famous Park Hill, a council housing estate built between 1957 and 1961. The area was previously a back-to-back housing neighbourhood, a mixture of 2 or 3 storey tenement buildings, waste ground and steep alleyways (Sheffield City Council’s, 2010). The clearance of the area started in the 1930s, followed by the decision of the municipality to rehousing the area after the Second World War. The buildings, inspired by Le Corbusier Unité d’Habitation and the Smithsons’ housing unbuilt schemes, are distributively organised by a deck access scheme. From 1998 the buildings are listed within the English building heritage of historical importance.

During the immediate post wars years, the city was considered an area of relative prosperity in the region but international competition and automation led to the closure of many steel mills, also caused by the global steel crisis in the 1970s and 1980s. Steel prices dropped significantly as the market became saturated with steel from previous demand, and many steel mills in the Western world were driven out of business. A large part of the industrial area of the Lower Don Valley became a wasteland of vacant buildings and derelict sites, as jobs were lost in the traditional industries. In 1971, nearly half of the jobs in the city were related to manufacturing, especially in steel production or other related industries as cutlery and hand tools. Between 1981 and 1991, the transition into a service economy created 12.000 jobs in the area, but this was unable to offset the decline in the manufacturing sector which lost more than 33.500 jobs in the metal sector (Dabinett,1999). From 1986 the City Council was forced to give the private sector a more significant role in the city’s regeneration process, due to limited public funding (Dabinett,1995). The strategy stated that Sheffield needed a mechanism to convert good research work into a competitive advantage. The city started building regeneration partnerships to promote Sheffield as an innovative and learning city. The Sheffield 2000 aimed to elaborate a new economy bringing together industry, higher education and industrial partnerships to achieve a critical mass of activities and develop the research, education, and technology sectors in parallel with a high skill labour class (Dabinett, 1999).

The new Advanced Manufacturing Park (AMP) realised by Sheffield university and other independent organisations strengthened the search and the innovation in new advanced manufacturing technologies and techniques, following the research on modern high-strength low-alloy steels of precedents decades. Organisations located on the AMP include The Welding Institute, Castings Technology International, Rolls-Royce plc and McLaren Automotive and the Advanced Manufacturing Research Centre, a research partnership between the Boeing Company and the University of Sheffield. After many years of decline, the first years of the millennium revealed a revival of the Sheffield economy (Sheffield 'hotbed' for investment, 2005). The transition into the knowledge and innovation economy had a substantial impact on the urban and regional area, which started redevelopment of its assets to enhance this transformation. Today Sheffield is recognised as a significant research and university centre, the third-largest in the UK, with more than 37,000 students (of whom over 4,000 are international students), 4,170 staff and 747 courses.

4.4.2 The evolution of Sheffield steel industry and its relation with the urban environment

The industrial development of the city of Sheffield is particularly interesting as it is an exemplary case of how the artisan production and subsequently the industry was rooted within the urban fabric in a continuous relationship with other aspects of everyday city life. The industrial development of Sheffield has been certainly linked to its geographical position. Its location at the confluence of two river valleys, the abundant source of water power and the availability of low-cost local coal has been indispensable for the early development of the cutlery manufacturing industry and the subsequent development of the steel industry. Sheffield, became an industrial powerhouse in the 18th century, playing a crucial role in the Industrial Revolution for its innovations in steel-making and metallurgy, internationally recognized as the "Steel City".

Sheffield's competitive advantage is due in part to the metallurgical innovations that took place in its territory. Benjamin Huntsman discovered in 1740s the crucible technique for melting and producing a better quality of steel, previously impossible. In the same period, Thomas Boulsover developed a technique for fusing a thin sheet of silver onto a copper ingot to produce silver plating, which became widely known as Sheffield plate (Boulsover, Thomas (1705–1788), cutler, n.d.). Stainless steel was instead invented later in 1912 by harry Brearlay, bringing affordable cutlery to the masses. Techniques and knowledge developed in Sheffield were not limited to the production of steel and cutlery but were related to the whole supply chain of the production of metal objects, from raw material to finishing and ornamental features.

Behind the important geographical factor and the presence of local resources as coal and wood for steel production, social factors have been investigated as key elements for the success of Sheffield's cutlery trade. The culture and pride for the high quality of the finished products and the dislike for unregulated competition, undermining the quality and image of the industrial sector have been highlighted by Taylor as important factors in the growth of Sheffield's reputation as a center of production excellence (Taylor,1993) .

At the same time, scholars have depicted the high level of division of labour present in manufacturing production, which consist in a high degree of specialization of grinders, hafters, forgers, shapers even if the production system was still organized following an artisanal tradition (White, 1997). The rigorous division of labour has been a key characteristic of the strength of the Sheffield industry on local and international markets, together with the artisanal production flexibility which was able to react quickly to changes in taste and new design. (Pollard,1993: 262).

The metal-working city has been characterized by a stable workshop system of industrial organization, even when factory production became widespread in the second half of the nineteenth century. In Sheffield, workshops and other kinds of larger-scale production were located adjacent one to the other. (Crafts 1985; Berg 1994). The typical production unit was the small workshop, requiring a small amount of capital and a limited amount of physical space to be set up for the cutlery manufacture, hosting a self-employed master cutler supported by one of two journeymen. Berg notes that "even large firms were more like a collection of artisanal workshops under one roof than the organizational innovation represented by a factory system" (Berg 1994b: 132). The workshops system survived because skills, machines and space were broadly transferable and the entrance in the specialized market was relatively affordable.

The fine grain of Sheffield pre-industrial production model extended to the whole city, which has been described as an urban scale factory, one great workshop for the production of cutlery and edge tools (Wray et al 2001) . The structure of industry in Sheffield was complex and organic. A single great workshop for the production of cutlery and edge tools, where workers, masters, merchants and industrialists, linked together by the complex interdependence of products and skills, worked synchronized as one huge factory with separate departments in different parts of the city, connected by the manufacturing process chain (Taylor 1993: 203). The industrial network developed in the city of Sheffield was a fertile ground for bottom-up small-scale innovations able to answer to high quality demand of specialist market thanks to the adaptability and innovation characterizing the cluster. (Tweedale 1995: 55-6). This distributed network of industrial production has influenced the spatial organization of the city, from the single block where production occurred to the whole city and its logistic organization. The urban landscape acted as a regulatory element for the circulation of information, goods and people at the architectural scale, making visible or concealing completely some activities.

As Belford described, industrial activities and public life were not entirely distinct, street and courtyard became an extension of the house and workshops. Concealed behind the street frontage, the semi-public space of court or yard was the place where production activities occurred. After the transitional space of the gallery, between the public road and the internal courtyard that served to separate the two, facilitating the distinction between inhabitants, workers, strangers and customers, the internal ground floor acted as a contact point between public life, industrial and domestic activities (Belford, 2001: 110). The close intermingling of domestic and working life in industrial Sheffield was extended also to juvenile involvement in the cutlery and metals trades suggesting how a practical knowledge of industry could be acquired, as Marshall believed, simply by growing up there (Griffiths, 2017).

The smaller workshops managed by a master and a small group of journeymen were usually established in courtyards or dedicated rooms in house buildings connected to domestic activities. Larger workshops usually occupied a whole frontage, especially if connected with a store area, extending along the street when trade expanded. Instead, larger workshops could also be set back from the street to emphasize their separation from the everyday urban sphere. In this case, another distinction of larger metal workshops can be made between integrated and segregated factories on the basis of their internal organization (Beauchamp 2002: 99-104.). The integrated typology was common in a single company building, allowing direct communication between workers engaged in the different processing located in different areas of the building as well as easier monitoring of the entire production process. Segregated workshops were instead developed on opposite principles. These buildings housed various businesses, professionals and commercial specializations that occupied parts of the building through a lease. On each floor, the different areas of the building were usually accessible only by an external distribution system with the minimum presence of internal circulation. The internal architecture of these buildings inhibited the effective coexistence of different manufacturing specializations and different companies even in conditions of high proximity, placing the courtyard as the fulcrum of these relationships.

This virtuous and strong relationship between urban space, production and urban life was severely challenged in the late nineteenth-century, when the fragmented industry of the city was unable to compete on quantity and price with the centralized production methods established in other countries and territories, as in America and Germany. The internationally increasing mechanization in the industry leads many specializations, such as the hand-forging of blades, to become obsolete with serious repercussions on the structure of the city's urban industry. Sheffield innovative milieu had exhausted its organizational capability to adapt to competition through improving output or increasing quality (Pollard 1959: 203-05). Like numerous industrial districts, the closure of metal plants and the consequent fall in employment in metals industries arose from a number of factors, including technological shifts, production automation, the evolution of the industry life cycle, production overcapacity, a failure to adapt to low-cost international competitors, government regulations, aa reluctance to adopt new management methods, and the concomitant decline of many customer markets within the UK (TweedaleT, 1995; Sadler, 2004; Propris and Lazzaretti, 2009). Employment in the metal industry, following only the narrow definition of the category defined by the Standard Industrial Classification (SIC), fell from 42000 in 1981 to 20000 in 1991, to 17000 in 2001 and to 12000 in 2008. (National Manpower Information System 2008)

The important knowledge and innovation developed in Sheffield in more than two centuries of history linked to the iron and steel industry have led to the transformation of the local economy, converting its knowledge base into a competitive advantage. Today Sheffield university is leading the research in these fields with the development of the Advanced Manufacturing Park (AMP) where public and private companies are working together in the field of innovation for the steel industry. The Park was opened in 2004 and it hosts a research partnership between the Boeing Company and the University of Sheffield; the Castings Technology International, a member-based organisation with expertise in casting design, materials development, manufacturing technologies and quality control; the AMP Technology Centre, a 2,500 m2 facility for offices and workshops to cater for small high-growth companies in the advanced manufacturing and materials sector. During the last years also private companies moved research facilities inside the campus as The Rolls-Royce "Factory of the Future with Boeing, the Rolls-Royce plc lab and McLaren Automotive research center, which led the campus to emerge as an international industrial research and innovation center.

4.4.3 Case Study: Portland Works

Looking to the future of the contemporary economy and culture, Sheffield's urban landscape and its material and immaterial industrial heritage, should not be neglected. Inside its history and remains reside values for the development of its future manufacturing creativity and the development of light urban industrial activities connected to research centres, as the university cluster, and to the vibrant city life.

The case of Portland Works presents an excellent example of preserved industrial building heritage. The building, situated on Randall Street at its junction with Hill Street, close to Bramall Lane stadium in the Highfield neighbourhood, is still in use today to host small business related to the metallurgy and cutlery industry. The history of Portland Works began in the 19th century with the construction of the building in the 'John Street Triangle', today a heritage conservation area formed by an enclave of 11 surviving nineteenth-century industrial buildings.

Today it is a community-owned social enterprise administered entirely by volunteers, leasing workspace at affordable rents to support small-scale manufacturing and creative businesses. The building was saved from a project to convert the industrial complex into housing, and today the aim is to develop the site as an educational resource and heritage attraction, alongside its business use.

4.4.3a History of the place

Robert F. Mosley commissioned the design of an industrial building to J.H. Jenkinson Architects in 1876 to enlarge his production and bring under the same roof the different specialist who before worked separately. It was completed in one phase between 1876 and 1879 and named Portland Works from the previous premises of Misley, which was located at 188 West Street. Today the building maintains its original state with only minor changes and some extension, as the showroom area constructed later respect to the original building. As in Sheffield industrial tradition, the workshops within Portland Works were rapidly rented after the construction. At the end of 1879, the building housed the R.F. Mosley & Co. , a manufacturer of cutlery and silverware, William H. Green a spring knife maker, and George Gill, a cutlery manufacturer.

In 1888 the director of Sheffield's industries described R.F. Mosley & Co.'s Portland Works as: "A well-erected premises [that] provides every facility for the class of trade carried on. It comprises offices, handsome showrooms, systematically arranged stockrooms, well-equipped packing, cutters, silver and electroplating rooms, forge shops and grinding mills. The different workrooms are provided with all the necessary steam power, machinery and appliances required. Messrs Mosley & Co. manufacture every kind of cutlery and have earned a high character for the quality of their productions.

A valuable feature of their business and one, which has been made a speciality by them, is the manufacture of case goods of an exceedingly artistic and extensive scale. These cases are filled with satin and velvet linings for the reception of cutlery of the best and highly finished kind (mounted in pearl, ivory, silver metal and other choice mountings. A large quantity is always kept in stock and orders, owing to the resources of the firm and great numbers of hands employed, can be executed without delay. Mr Mosley and Sons are actively engaged in the management of the business and are to be heartily commended for the high position their establishment has attained under their guidance." (British Industrial Publishing Company, 1888)

The building was awarded the Grade II listed status by English Heritage in 1995 (Wray et all. 2001). It was subsequently upgraded to Grade II*, the second-highest listed status conferred by English Heritage, in 2007 following an updated survey of Sheffield's historic metal trades sites, recognising Portland Works as a building of national interest. The motivations praised the construction and layout quality of the building, as a good and complete example of significant integrated cutlery works, a complete example of this building type. It is a rare survival of buildings related to specific processes, demonstrating the limited use of power in cutlery manufacturing."the works were mechanised, with evidence for a steam engine, but there are also unpowered workshop ranges, illustrating the fact that Sheffield based its reputation upon the supremacy of traditional methods; it was said in 1879 that `the highest excellence can be attained only by the employment of intelligent hand labour'[16].

English Heritage – Listed Buildings Online (historicengland.org.uk)

16 Description of the project and the characteristics of the heritage on Listed Buildings Online (historicengland.org.uk)

Besides its architectural and spatial features, Portland Works is a unique place for Sheffield and the history of the metallurgical industry. In 1914 Harry Brearley, in an attempt to test the new metal alloy he invented, entrusted the company of Mosley with the production of a series of cutlery to test the resistance of the alloy to acid corrosion.

R. F. Mosley & Co. Ltd. was the first firm in the world to produce stainless steel cutlery in a collaboration between Harry Brearley and works manager Ernest Stuart. Stainless steel cutlery became famous and continued to be produced at the works until the 1950s. Today traditional metal manufacturing techniques which took place in the buildings still survive in the activities of some of the metal trade businesses that operate within the works, using original machinery and tools. Andy Cole Tools, Stuart Mitchell Knives, Shaw Engravings, PML Plating and Pam Hague Engineering are engaged in the production and plating of metal objects preserving the legacy of Portland Works.

However, the legacy of Portland Works as a metal trades complex was about to be interrupted. In 2009 the owner submitted a project to convert the building into residential apartments. Almost five years after this first proposal, the building was bought by a purchasing group to safeguard the future of the building and its industrial character. Since 2013 the group supported by a volunteer team is renovating the building, ravaged by half a century of neglect as a tribute to the original builders and the critical history of the city.

4.4.3b Architectural development

The architectural characteristics of Portland Works have been described in the Pevsner Architectural Guide to Sheffield as “On a corner site, the corner of the works is rounded with a two-storey entrance gateway with rusticated pilasters. Elaborate frontage, the works name flanked by panelled pedestals with ball finials. Round-headed sash windows to the first floor and sill and lintel bands, that on the first floor cogged and in contrasting cream bricks. Ornamental panels of diagonal brickwork and an octagonal chimney. A three-storey building used for grinding has a room with four transverse fireproof bays, suggesting the presence of a central engine house with the position of hearths indicated by ridge stacks. On the ground floor of the [west] workshop range are the best-preserved examples of hand forges in the city. These may have been let separately and retain combined stable-type doors and a window under a rolled steel lintel.” (Harman & Minnis, 2004)

Portland Works complex has been characterized by maintaining most of its original architectural and distributive characteristics in a regime of continuous use of the buildings, hosting different activities from artisans and small industrial productions, to groups of artists, musicians and activists. Today it houses a wide variety of 32 tenants including a specialist knife-maker, silver plater and other skilled metal workers in the tradition of the ‘little mesters’ (self-employed cutlery workers) on which Sheffield’s reputation and identity were forged. It also accommodates artists, musicians and other creative craftspeople.

When the Community Benefit Society bought the complex in 2013, most of the internal and external spaces were almost derelict, requiring an urgent renovation after almost half a century of neglect by the previous owner. (Donna Bate, Interview 25/10/2019) Due to the listed status of the complex, renovation works had to deal with the necessary precautions and permits to organize the interventions. At the same time, however, there is no document in the municipal archives or in other repositories that portrays how the building was in its original state, increasing the difficulties in managing the renovation works. (Donna Bate, Interview 25/10/2019) The first phase of renovation was organized to deal with safety works and everyday organization such as cleaning the premises, restoring the out of date and damaged electrical systems, the roof water drainage system, organizing the unused premises and cleaning common areas from waste abandoned over the years.

Keeping tenants rents low does not permit the management team to acquire enough money to finance repairs operations. For these reasons, all the restructuring operations are managed by a group of volunteers who meet every Tuesday inside the building to carry out the work. For more significant operations it was necessary to seek external funds. In 2016 the Society secured a Heritage Lottery Fund ‘Our Heritage’ grant for repairs to roofs and chimneys and for an Education and Development Worker to meet the demand for educational activities on the site.

The team is dealing with the poor condition of the building and with the practical needs of the tenants who now occupy the interior spaces organizing the internal works according to the rents and the occupation of the space. Today there is an on-going programme for repairs and conservation work to bring the still unused areas back to life and to deal with the restoration of all internal space. (Derek Morton, interview 29/10/2019) Next phases will deal with the repairs to the plumbing systems in the bathrooms, the arrangement of the flat roofs and the renovation of the interior. The total cost of the restructuring was estimated at two million pounds. (Donna Bate, Interview 25/10/2019)

4.4.3c Management and its evolution

In 2009, the owner’s plan to transform Portland Works complex into apartments alarmed university researchers, tenants and the local community about the future of the building, an essential part of the neighbourhood heritage, a place of work, knowledge, relationships and collective memories.

The first application for building conversion submitted by the landlords to the planning department of the city was withdrawn due to insufficient information. The informal group for Portland Works protection, initiated by Andy Cole of Wigfull Tools, Councillor Jillian Creasy and the researcher Julia Udall, understood that there were few precious legal grounds for opposing future applications, including buying the building. The group shared the same vision for the future of Portland Works, as a place of crafts and small scale manufacturing, and there were not many alternatives to safeguard this identity. The possibility of creating a purchasing group to buy the building already emerged during the meetings in late 2009. The group discussed about building management, its renovation, and how to raise the necessary funds. The building needed significant maintenance and a good management strategy to keep the tenants at work during the different phases of renovation.

At the same time, the group started to organize public meetings about 'Portland Works Alternative Futures' as the one organized by Udall in January 2010. They set up a website and social account to keep the public updated about the development and to create a shared communication platform. These first steps were followed by a long process for creating contacts with media, acknowledgement from the Council and the gradual construction of a business plan for the purchase, management and renovation of the building. The board was organized with a core group of about twenty people, between tenants and members of the community, to lead the fundraising campaign in a cooperative spirit. Parallel to media engagement, the group checked the state of the Works and the companies located inside. The survey depicted that almost every unit of the building was located with a total number of 35 people, working in 20 business and studios with a focus on metal and woodworking trades and creative industries. The survey revealed that the building was far from being under-occupied and underused, contributing actively to the local economy and the demand for industrial spaces within the urban context.

The interest around the future of Portland Works raised with the attention of media, contributing to spreading the knowledge about the importance of the place and its legacy. Local and national media such as the BBC, Sky News and the Sheffield Telegraph shared the recent history of Portland Works. This spread of information brought the attention of the City Council who recognized the building's contribution to Sheffield's history and economy. During may 2011 Stuart Mitchell and Derek Morton, members of the board, started a discussion with the landlords securing an offer in principle to sell the Works to the group. The group decided to form an Industrial Provident Society, based on the Community Benefit Society model, as a preferred legal system to purchase the building. An "Industrial and Provident Society for the benefit of the community" is a society structured as a cooperative group. However, it differs from a cooperative because benefits are shared with a broader community as well as with the members who invested in it. In this new organization, the previous board group became the Portland Works Committee and started to negotiate loans with two sources: the Architectural Heritage Found and the Key Fund for social enterprises.

Through the sale of the shares from June 2011 to January 2012, the group had managed to earn £115,000 to buy the building, a first step towards the goal of £200,000. A figure that would have allowed them to start to negotiate a deal. A new media campaign spread its mission nationally, and the shares sales took off again. From the first semester of 2012, the group started a negotiation with the owner, reaching an agreement on a purchase organized in three years, offering a fair price for both parties. At the end of 2012, the group decided to pay the final in cash by raising another £ 100,000 of share and bonds offered to the shareholders. The agreement was finally completed on the last day of February 2013. In December 2013 the group received a national award by the Heritage Alliance for the effort, and the goal achieved to safeguard the English heritage.

Portland Works committee was able to raise £250,000 over 18 months with more than 500 shareholders, a testament to the strength of feeling local and determination to keep the building as a place for 'makers' in the 21st century.

Today Portland Works is led by a board composed of twelve elected directors with full responsibility for the affair of the organization. They are supported by a salaried manager and more than 25 volunteers who take on a wide range of tasks from administration and events planning, to hands-on renovation work. The team is also supported by two permanent members of staff that manage the day-to-day operations.

A crucial element that the committee had to reorganize after purchasing the building was the reorganization of rents. Previously these were arranged arbitrarily without precise guidelines and unjustified price differences between different businesses. The committee wanted to maintain the rent low to favour the located businesses, reorganizing the rents based on the square meters occupied by the single tenants. They opted for an initial transitional period to allow the unexpected cost to be amortized to arrive today at the same parameter between old and new tenants. Today rents are divided according to the square meters occupied for an average cost of £ 2.5 per square meter per month to which a small variation is added if space exceeds 90 square meters. To this sum is added a fixed cost for space management.

4.4.3d Social organization

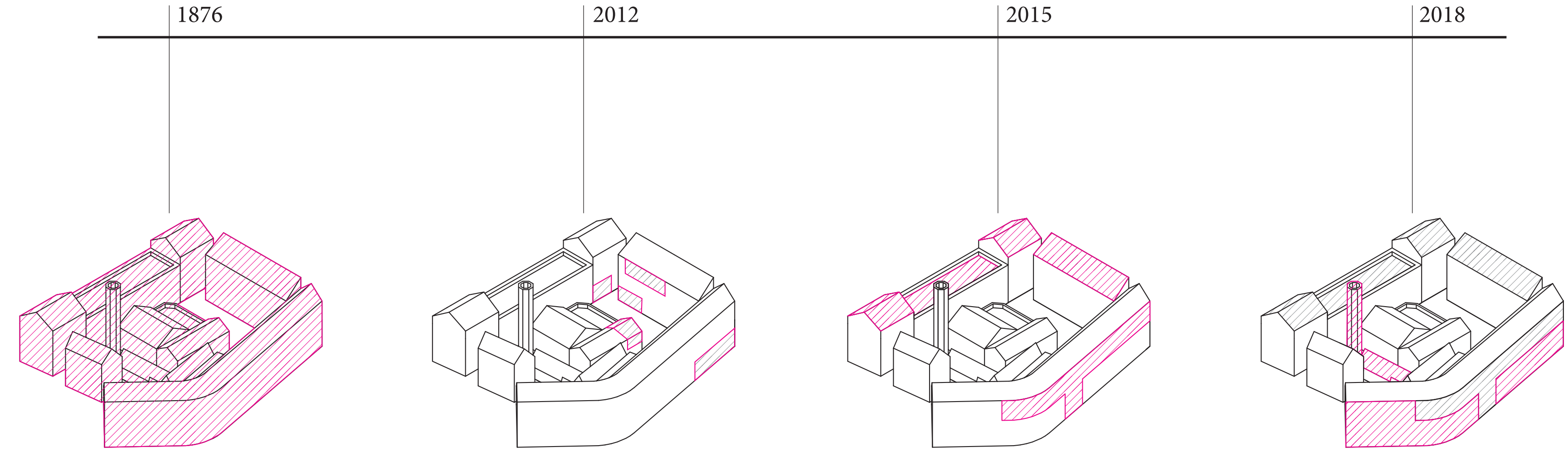
Portland Work was born as a Community Benefit Society, with the specific purpose of safeguarding the companies located within it and sharing the social and cultural value that the place possesses with the whole resident community. The ambitious goal of buying the building for its protection has been achieved by the committee thanks to the help and support of a local and international community made up of more than five hundred people, who are today shareholders of the building. At an organisational level, the presence of at least 10% of the members is required to make a committee meeting possible. This requirement has created logistical and organisational problems in recent years, sometimes slowing down the decision-making process due to the lack of a minimum number of members present at the meeting. (Donna Bate, Interview 25/10/2019)

At the same time, however, Portland Works is not only constituted by its shareholders but also by the crucial work made up by the volunteers. Different groups deal with communication, company organization, resource and rent management, public and private events and once a week about the building renovations for a total number of seventy people, including forty regular. Today Portland Works houses 32 tenants occupying almost all the spaces available within the complex. Among them, many activities carry on the traditional local metal industry as knife-makers and silver platers, but the place also accommodates woodworkers, artists, social enterprises and creative craftspeople. After the start of the restructuring, the older tenants were joined by new business such as Bailey of Sheffield, a jewellery manufacturer, who wanted a place inside the building for the cultural and historical value it has. New tenants, in particular, perceive the place as an essential value for their business and want to be part of the transformation that is taking place by supporting the work of the committee in the management of spaces. (Bailey of Sheffield, interview 28/10/2019, Hackerspace 28/10/2019)

Furthermore, Portland Works is also a place open to the external public. The Society organises public open days several times per year, and these have grown into more prominent events, as the renowned cutlery and craft fairs in 2014 and 2015 each bringing in around 400 people.

4.4.3b

Portland Works | **time strategy transformation** | architectural strategy



The building after its construction in 1876 was totally used for the production of cutlery and steel objects

Over the years tenants have changed and the spaces have been used for different productions, some have remained empty, others only partially used

The restructuring operations initially concerned the vital parts including roofs and energy systems

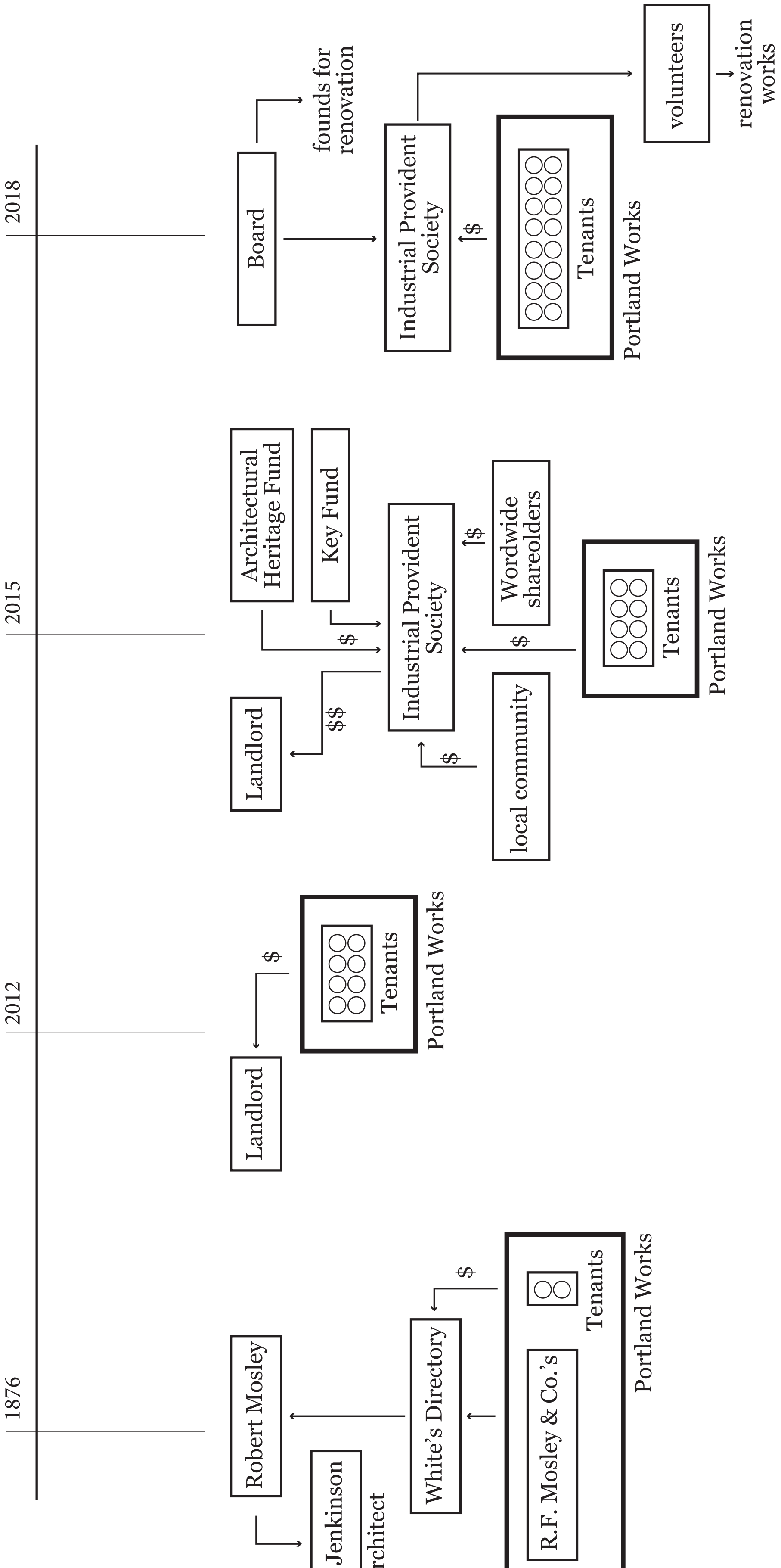
Reorganization of internal and external spaces thanks to the help of volunteers and assignment of empty spaces to new tenants

Small artisanal production system

The building was poorly maintained

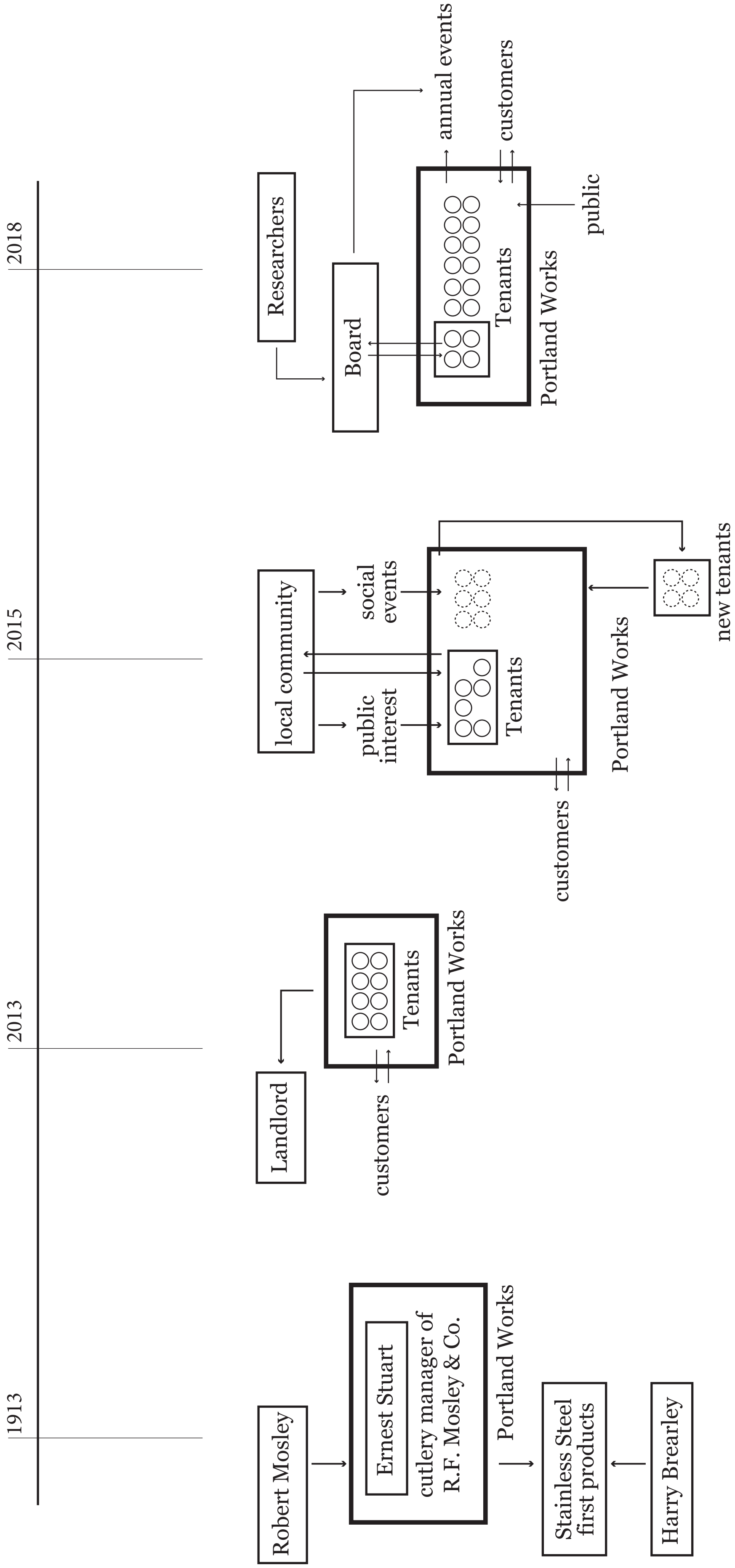
Renovation of the vital part of the building

Renovation of the monumental and external areas of the building



4.4.4c

Sectie-C | **time strategy transformation** | management strategy



4.4.4d

Sectie-C | **time strategy transformation** | tenants relations

4.5 Case study: Les Ateliers de Renens

4.5.1 Renens an industrial infrastructure

Renens is a municipality in the Canton Vaud, Switzerland. From the 31 August 2006, It is part of the district of Ouest Lausannois and a suburb of the city of Lausanne. Renens is the fourth largest city of the canton, surrounded by the municipalities of Jouxtens-Mézery, Prilly, Lausanne, Chavannes-près-Renens, Ecublens and Crissier. It is located on a south-west facing terrain with an altitude between 398 and 490 meters, and it is characterized by a multi-ethnic population with over 50% of foreigners out of the total of its resident inhabitants[1]. Renens covers an area of 295 ha with 278 ha, 93.9% of the total land, covered by built-up areas. Within this percentage, industrial buildings made up 13.9% of the total area, housing and public buildings made up 41.6%, while transportation infrastructure made up 28.7%. The remaining 15% is divided between green areas, sports infrastructures and agriculture fields. The city is crossed by two major roads, by the railways and the M1 line of the Lausanne metro which terminates at Renens railway station, connecting Renens to Lausanne more directly, as well as offering some longer-distance trains.

The city developed to meet the demand of industries and the related population growth, which led to the rapid urbanization of the territory. The driving force of the development of the urban fabric of the city of Renens has been the realization of the Morges-Renens-Yverdon railway line in 1855, expanded until Lausanne in the following year. In 1875, the western Swiss company decided to build a marshalling yard in Renens, which possessed a more favourable territory for logistics operation than Lausanne. The yard was inaugurated in 1876, and its construction had two significant effects on the city. First, the creation of new jobs in the area. The new yard created jobs directly related to the railway and logistic operations but also in other sectors, attracting a non-native population. The second effect was the localization of new industries in the Renens territory near the railway, benefiting from the large not urbanized spaces in the outskirts of Lausanne and the privileged access to the leading transport network. The development of the sorting yard played a crucial role in the municipality of Renens, as an inductive element that generated the industrialization of the city.

Over time, the marshalling yard played an increasingly important role, especially after the purchase by the Swiss Federal Railways in 1903. The operations increased and consequently the number of employees: the number of operations went from 20 in 1876 to 112 in 1907, with 377 employees. (Biermann, 1907: 98-105). This increase in jobs attracts a new population to Renens made up of artisans, architects, bricklayers, industrialists, workers, coming from the region or from abroad. The demographic explosion that derives from this worker demand causes Renens to

1 The demographic report refer to the 2018 Swiss Confederation's statistical surveys

change from the status of the village to that of the city. In the late 1950s, Renens reached 10.000 inhabitants, which corresponds to the threshold to define the city status in Switzerland. The large areas available and their relative low rental costs, together with the proximity to the energetic centre of Lausanne has been the critical element favouring the development of the industrial and construction sectors in Renens. Until 1911 new buildings and settlements multiplied quickly, thanks to the available land without following a general plan. The lack of an urban plan in this phase of urban development may explain the coexistence of industries and housing, particularly in the city centre.

The railway line also caused some disadvantages. The first problem was the creation of a second centre, not related to the structure of the village of Renens, but around the station, creating a polarization of the urban development of the city. The second was the physical break between the north and south part of the town. In about 2 kilometres of tracks that cross Renens, there are only two intersections that connect the two sides. Two other crossing possibilities exist nearby, but they are located in the territories of Prilly and Crissier.

The development of transport infrastructure powerfully drove the development of Renens. Subsequently to the railway line, two other elements have certainly played a crucial role in the urban and economic development of Renens: the first has been the proximity of the main communication routes which are the cantonal road and the Lausanne ring road constructed at a later date. The second has been the proximity to the municipality of Lausanne. Renens' development has been strongly influenced by the urban and economic growth of Lausanne and today there is no longer a real separation between the centre of Lausanne and the centre of Renens. The Lausanne's expansion determined the annexation of Renens in its conurbation.

However, in 1967, a reversal trend occurred in the industrial sector, moving from the urban territory of Renens towards the outskirts, allowing the localization of activities related to the tertiary sector. This choice originates from the impossibility of companies to expand within the urban area and the problematic coexistence with the resident population. This phenomenon has been more visible in the last thirty years, mainly in the south area of the railway line. The area, initially dedicated to industrial activities, has been partially transformed into a mixed urban area with the inclusion of housing, school and sports infrastructure with compatible industrial activities.

On a demographic level, the population of Renens has continuously increased between the 1950s to the 1970s. Starting from 1975, the total number of foreigners residents decreased for the first time since the end of the Second World War due to the economic crisis and the relative increase in layoffs, especially among the less safeguarded foreign population.

Since the 1990s the city has seen significant jobs increase in the service sector. This phenomenon involved the entire metropolitan area of Lausanne, supported by the role assumed by the knowledge economy and by the university, as a sector of excellence in the field of research and development. Today this inclination of the local economy is evident as shown by 2018 statistics, with the 122 people employed in the primary economy 6.349 people employed in the secondary sector, and 115.628 people employed in the tertiary sector, of which 6.122 employees operating in ICT and media industries[2].

4.5.2 Renens today and its problematic development

Today Renens is no longer as interesting for the location of industries as it was in the first half of the twentieth century, and the relocation of part of the industries to the periphery in the late 1960s is an example of this process. The city is still an attractive place for those businesses that can easily coexist with other functions or for activities with high technological content related to research and development, whose installation does not require large areas and can be easily adapted to the built environment constraints. This transformation of the industrial tissue is also visible in the general plan of the city, which intended to limit the development of large industrial areas to make way for more mixed neighbourhoods. A strategy of the municipality to improve the quality of life and inclusion in a territory which is strongly affected by an infrastructure that physically separates the city into two parts.

Even if industrial areas evolved significantly, often in favour of services, it is necessary to underline that today the productive asset still plays a significant role in Renens, both for the city's economy that for the jobs it creates on the territory. For this reason, the municipality started a discussion on the industrial future of the city. On one side, it promoted the reuse of existing spaces for small and medium-sized businesses linked to the territory, such as the case of Atelier de Renens, which consists of a cluster of small manufacturing and creative enterprises. On the other side, it favoured the localization of technological and digital industries, taking advantage of proximity to the École Polytechnique fédérale de Lausanne (EPFL) and its research infrastructures, offering a location to spin-off companies that did not find a place inside the university incubators.

4.5.3 Case study: Les Atelier de Renens

4.5.3a History of the place

The building of Les Atelier de Renens is located in Rue Chemin du Closel 5 in the north-east part of the city on the border with the municipality of Lausanne and directly connected with the adjacent railway infrastructure.

2 The number of Employees in the primary, secondary and tertiary sectors of the city of Renens refers to 2018 Swiss Confederation's statistical surveys

The building designed by Jean-Marc Lamunière was built in 1962 to house the production and offices of two companies in the printing sector. In essence, the Mayer & Soutter SA founded in Renens in 1957, operating in binding and related services, and the IRL-Imprimeries Réunies Lausanne SA specialized in printing operations, in particular newspapers, magazines and periodicals. These companies were part of the significant graphic arts and typography cluster, an important sector for the local economy.

At the end of the 19th century, the industrialization of the Canton Vaud encouraged the development of the graphic arts sector. Local businesses needed packaging for products, advertising material and catalogues and these requests contributed to the construction of a highly competitive industry in the Lausanne area, specialized in the field of books and printing, thanks also to the limited repercussions of the Second War World on the productive apparatus. The advantage of the Lausanne publishing industry was the coexistence of the entire production chain in the same geographical area, from inks production to the final binding. Sometimes the different companies were located in the same building as happened in the 1950s for the Central Imprimerie. The great proximity of different companies permits to control all the phases, from printing to volume binding and broaching, reducing production times and making the system more efficient and competitive (Junod, 1948: 193). In 1952, the Skira editions, widely distributed abroad and recognized for their high printing quality, so much so that it was customary to call an art book an "a Skira book" (Corsini, 1993: 157), had their book made in the workshops of the Imprimies Réunies company in Lausanne (Corsini, 1993: 156). This type of highly illustrated product contributed to Lausanne's reputation as a centre of excellence for the printing industry in the 1950s and 1960s. Although it is readily accepted that a photography book is the result of the work of a photographer, author and publisher, it is necessary to remember that printing, with its technical skills, actively contributes to the aesthetic choices and quality of the final product. In particular, in the 1950s and 1960s, each actor in the production chain brought their knowledge and know-how into a continuous exchange for the realization of the product. A book was not the product of a person but the result of collective work. In the case of the photography book, which requires a particular reflection on the layout, the arrangement of the images, but also a precise knowledge of inks, papers and machines, this importance of the collective is particularly advanced.

In Lausanne, from the immediate post-war period to the early 1970s, various printers shared the photography book market, including the Imprimerie Centrale, Imprimerie Populaires / Héliographia, Imprimerie Réunies and Jean Genoud. This balance was interrupted when during the 1970s the rotogravure printing method was gradually replaced by offset printing, which changed the sector significantly both for the know-how required and for the production machinery. Initially, the new technique was of lower quality, but it was more profitable and offered more freedom and advantages in layout operations (Martin, 1998: 79). Already in the mid-1970s, the success of photo book printing in Switzerland was under threat. The rise in the price of paper, the stable high value of the currency and the technical progress of other European countries put small Swiss printers at risk. The crisis in the Swiss printing sector worsened in the following decades until the sector almost wholly disappeared from the Lausanne area.

The set up of the new building for the production of Mayer & Soutter SA and Imprimeries Réunies is to be inserted within this industrial panorama. In 1962 the printing industry was still in a period of growth, and the two companies needed a new production building with modern characteristics to housing production machinery, offices and a large warehouse area that could contain the copper cylinders for rotogravure printing. The complex is made up of three buildings which used to house the workshops, the warehouses and the boiler room. The two main buildings consist of three floors, separated by the railway line. The buildings are characterized by a structure consisting of double external steel frames with a large span that supports a suspended roof, recalling the industrial classism and the constructive rigour of the architecture of Mies van der Rohe. The facades are prefabricated, composed of aluminium and glass panels. The plan is set on the square module, which also defines the composition of the rhythmic and regular facades (Marchand et al., 2012: 280).

Fifty years later, in 2012, the Imprimeries Réunies company, which was still occupying the whole ten thousand square meters of the building, had a big crisis and it had to plan the closure of the plant and the lay off of all one hundred and thirty-five workers working inside. At the time, the company owned two plants, one in a location in German-speaking Switzerland, the other in Renens. To overcome the crisis, the Renens plant had to be closed in order to downsize the operations in a single plant and overcome the crisis.

At the time, the managers of the company asked for help from the city of Renens and the Canton Vaud to maintain the plant at work and continue the production. They were convinced that there was still a market for the company and that they could find new customers to continue the business. The company was the last one rotative printing plant in the whole French-speaking Switzerland, and with the closure of the company, in addition to the loss of a large number of jobs, excellent local know-how would also be lost. The municipality of Renens organized a meeting with the owner not to close the site and find an agreement to keep the jobs threatened by the plant closure. After a period of negotiations, an agreement was reached which however provided for the sale of both the business and the building. The managers would not be able to deal with the purchase alone. Therefore the city of Renens and the Canton of Vaud took an active part in the sale. The managers took over the business and the machinery; the building was bought by the city of Renens while the land became a property of the Canton Vaud. (Nicolas Servageon, interview 01/04/2019)

The managers took over the company, reducing the number of employees from one hundred thirty-three to sixty-nine and downsizing the business from ten thousand square meters of the entire building to five thousand. The building was bought by a real estate company which the city owns for 60%. The sale process of the property ended in 2014.

The city started to think about what to do with the building and to look for possible companies interested in occupying a part of it. After a series of meetings with firms, including a company that worked in healthcare and wanted to convert the building into an ambulance parking lot, the municipality decided to experiment with a different model based on open innovation, creating a co-creation space. The first project that was hosted in the building was a project in collaboration with the university for the creation of a small maker space, a laboratory open to all, especially to the resident community, based on open innovation. The city supported the project, and for a year and a half, seven hundred square meters of the building were granted free of charge for the organization of the maker space. This space, open to the public, had the purpose of making the building known to the local public and sponsoring its rent.

The municipality realized the potential that space and a mentality based on the idea of open innovation could have in the development of the place and this concept became the fil rouge for the recovery of the area: the evaluation of the activities that would take place in the building would not be based on the type of business but on the mentality and attitude. The UniverCité project was born together with the help of the Inartis foundation, and after a year and a half, a relevant number of start-up began to rent a space inside the building and to work in a collaborative environment. The activities of the UniverCité and the spaces rented by the Inartis foundation have been important elements for success of Les Atelier de Renens, reaching the interest of other activities as Mass Challenge which decided to rent the entire third floor, some watchmakers who have rented a space for their production workshops and a brewery, the Nébuleuse which occupied a large part of the building to install its production line. From this cluster of stable activities, Les Atelier began to have a daily flow of people who frequented the building for working, to meet customers or to visit it, building a real site based on open innovation, sharing and above all on making. After the entry of several start-ups and companies that needed to develop prototypes to analyze and study the development of a product, the makerspace was moved to the ground floor and expanded.

At the same time, at the end of the summer of 2015, the renewed Imprimeries Réunies Lausanne plus (IRL+) company went bankrupt. In March, the new managers had signed a ten-year lease contract with the owner, but it was impossible for them to continue the production. Les Atelier de Renens found itself with another five thousand empty square meters that compromised the entire real estate operation.

The strategy adopted up to then planned to rent space to small businesses looking for space at a low rental cost in order to enter the market and grow. It is known that the mortality rate of small businesses is very high, especially in the first years of entering the market, and in the same way, there was a very high risk that the leased spaces would remain empty making it challenging to manage the project. For this reason, the presence of a major player as IRL+ was necessary to create balance and flexibility in the management of the building. After the bankruptcy of the IRL+, the managers were contacted by the Nord Thin Ply Technologies, a company specialized in the design and processing of carbon, which was looking for a place to establish the company's new headquarters close to EPFL and other companies in the innovation sector.

Les Atelier de Renens also started to collaborate with the école spécialisée de Suisse Occidentale (Hes-so) hosting inside the building a master called Innokick that combe the skills and competences of students coming from different fields to develop an interdisciplinary project.

At the beginning of 2018, all the available spaces inside the building were occupied contributing to the success of the creation of a work and production space based on open innovation with only 10% of the available space for office use only.

Later in the same year, the brewery built a new production line that now occupies one of the three buildings, while the old line is now used by another company called Urban Kombucha and which produces an alcohol-free fermented drink. The company needed the same technology already implemented by Neboulose, and when it moved, they took the first infrastructure into use. Together with the new production line, the Tap Room was also opened, a bar located on the first floor with a terrace overlooking the railway line open to all. The Tap Room has become a meeting place not only for staff working inside but also among external users.

The opening of Les Atelier de Renens not only led to the redevelopment of an important building for local history and to the creation of jobs in a territory that was suffering from the relocation of the activities or their closure but also built a point starting point for the redevelopment and reuse of adjacent buildings. In fact, the renovations will lead to the reuse of an adjacent building that is part of the complex, for a total area of six thousand square meters by a private entity which, however, has commissioned the Les Atelier de Renens foundation for the choice of tenants. Another building will instead be built to house mixed functions: offices, laboratories and service areas.

4.5.3b Architectural development

Les Atelier de Renens is part of the diversified work of the architect Jean-Marc Lamunière on the Swiss territory. His academic studies, international influences and the evolution of his architectural design are the main elements for an analysis of the compositional approach and structural layout that the building of Les Atelier de Renens possesses. These characteristics strongly affect the organization of spaces and the importance of this building in the local culture, going beyond the specific function and the activities it hosts.

Jean-Marc Lamunière was born in Rome but grew up in Geneva and was one of the crucial figures on the Swiss architectural scene of the second half of the 20th century (Meier, 2007: 4). His mother, Fiera Mirandoli was part of the Tuscan upper middle class, graduated in mathematics and an Italian teacher in Geneva, while his father, Henri Lamunière, was a jeweller and member of a Huguenot protestant family. His cultural ties with Italy led him to begin his studies in 1946 at the Higher

School of Architecture in Florence, then directed by Professor Giovanni Michelucci, but his training is marked by different influences from different backgrounds such as the period spent in the office of Daniel Girardet, a disciple of Auguste Perret, the meeting with Frank Lloyd Wright, and the passion for the De Stijl movement and the discovery of the works of Mondrian and Calder (Marchand & Lamunière, 2007: 32-33).

After completing his studies, Jean-Marc Lamunière returned to Switzerland where he created his own studio with several partners. His first projects were mainly private commissions for the construction of houses and villas between 1953 and 1954. In parallel, the architect also develops a project for a reinforced concrete residential building in Les Eaux-Vives, which was completed only in 1958. The early stages of its production are characterized by the influence of the modern movement and the use of concrete as a structural element.

The late 1950s marked the appearance of projects strongly inspired by the structural classicism of Mies van der Rohe, characterized by the use of a light material, metal, and the emergence of two new design paradigms: the transfer of the structure, so far organized inside in the spirit of the free floor, outside the building and the application of modular construction. For Jean-Marc Lamunière, reinforced concrete was an integral part of his learning of architecture and buildings, but despite this, he considers it an imperfect, poorly made material. He then moves away from this material to orient himself towards the pleasure of the combinatorial and mathematical play of metal structures and casings.

The first use of a steel structure will be implemented in the construction of an administrative and storage building: the Laines du Pingouin in 1957. The spatial and construction principles of the Laines du Pingouin project are revealed in particular by the external metal frames, the clear distinction between the supports and the facade, a cantilever at the ends of the buildings, the use of modular frames and internal free use of the space. These same principles will then be taken up in other realizations, although they responded to different programs with some flexing in the structural language. Between 1960 and 1962 Lamunière also designed the Pancosma chemical and administrative laboratories located on the edge of Geneva airport, and the Favarger chocolate and cocoa factory in Versoix with the same techniques.

The experience and techniques used in the previous projects led to the construction of the Mayer & Sautter and Imprimeries Réunies workshops and industrial depots in 1963. The project involved the construction of two rectangular three-storey buildings in Renens to house warehouses and workshops. The external structure is composed of a double steel assembled frame and truss beams with a span of 25.70 meters which support the roof. The plan is regulated by a modular square frame 1.90 meters wide which also determines the composition and proportions of the facades with the alternating rhythm a / b /a of the structure. The facades are prefabricated and consist of aluminium and glass filling panels supported by vertical stiffeners. The architectural language, as in the previous projects, is the result of the application of a structural rigour. The emerging image plays on two contrasting registers: a functional language that clearly denotes the technical program and a refined aesthetic, enhanced by the precise details duplication of the supporting elements that give a vibrating effect to the perception of the structure. Moreover, the dark paint of the structure enhances the whiteness of the facades.

The building owned by the IRL-Imprimeries Réunies Lausanne SA has undergone the addition of two volumes next to the short side of the original building, to extend the operation of the company. The first, adjacent to the building built in 1963, has a ground floor used for production and the two upper floors built to house offices. The second one, adjacent to the latter, was designed primarily for production purposes with a ground floor with a height of 5 meters for the positioning of large printing machines and a first floor dedicated to technical rooms.

All three buildings that are now part of Les Atelier de Renens have undergone no significant changes over the years, either externally or internally. In recent years, following the purchase by the municipality of the building, an adaptive reuse process has started, which has seen the transformation by sections of the building while keeping the main features intact. At the same time, the spatial image of Les Ateliers has changed a lot over time.

In the first years of recovery of the building, users had the freedom to manage the shared and private space in complete freedom, also considering the low occupancy rate. Over the years, an increase in the occupation rate led to a restyling of the private and shared parts with a more rigorous coordinated image which removed the freedom and variety that characterized the first moments of use.

4.5.3c Management and its evolution

Renens is a city characterized by the presence of many empty industrial buildings that are often bought by investors and destroyed to make way for the construction of new residential buildings. A vision that is also supported by the Canton Vaud and the municipality of Lausanne due to the shortage of houses in the area. (Nicolas Servageon, interview 01/04/2019) In 2012 the municipality of Renens was starting a project for turning industrial zones into residential. However, the internal discussion moved on the importance of secondary jobs within the urban tissue and the importance of providing space for industries nearby residential areas to decrease the extended distance from home to work, and Les Atelier de Renens is a successful example of this policy. (Nicolas Servageon, interview 01/04/2019)

Following the announcement of the closure of the IRS, the Canton and the City allowed former executives to resume activity under the new IRL+ entity by granting a deposit supported by a back-deposit. CACIB SA, whose shareholders are the City of Renens (60%) and SICOL (40%) bought the building to allow the former owner to vacate completely[3].

As the IRL+ company occupied only half of the building, the municipality began to conceive an effective tool for the administration of the rest of the building. The management was assigned to the Fondation des Ateliers de la Ville de Renens, created in 2007 as part of the Lausanne Cantonal Art School (ECAL) located in the former IRIL workshop, a pantyhose and stockings factory, in Renens.

The Fondation des Ateliers de la Ville de Renen with the support of Inartis, a non-profit foundation whose mission is to promote innovation, particularly in the technological and life sciences fields, decided to rent the premises of the building to innovative companies to develop a new type of work, between science and design, based on collaboration and interdisciplinarity. The two foundations established the UniverCité project to host makers, designers, engineers, doctoral students, start-ups in three different environments: a co-making space, a workshop equipped with machines and tools for rapid prototyping and small batches production; the ateliers, single rooms that could be rented by companies or by individuals as a venue for their activities, and an accelerator where startups can find the necessary supports to enter the market[4].

Part of the building is directly managed by the Inartis foundation, which follows the development of the UniverCité project. The project started with the realization of the co-making space occupying an area of seven hundred square meters supported with the funds of the municipality. The management of the space was entrusted to an external group to encourage interaction with the local community. In addition, the Inartis foundation started to rent the individual ateliers, and in 2016 the Mass Challenge accelerator decided to locate in the building occupying the thousand square meters of the third floor. The success of this first step of building rehabilitation, supported by the network and partners involved, attracted different occupants and supported promising initiatives. Some areas of the buildings, external to the UniverCité project, were rented by watchmakers, artisan and start-ups. Between them, there was also a brewery, La Nébuleuse, which invested four million Swiss francs for the installation of a production plant inside the building. Companies that rent a space can request a short-term contract of a minimum of one year and do not have to pay any lease guarantee.

After the bankruptcy of the IRL + company in 2015, some vacant spaces have been directly rented to the Nord Thin Ply Technologies, a company specialized in carbon design and processing. The company started to occupy eight hundred square meters at the end of 2016 to set up offices and the R&D department, subsequently expanding into another two hundred square meters, for a total surface area of one

3 the bankruptcy of the company and the sale of the building to the municipality were documented by the newspaper Lematin (28 August 2012), Letemps (6 June 2015) and on the official website of Les Atelier de Renens

4 Université brings together producers, designers, engineers, doctoral candidates, start-ups through projects aimed at developing innovative projects related to the industrial field.

thousand square meters located on the ground floor.

The foundation receives a large number of rental requests as the proximity to the EPFL makes Les atelier de Renens an attractive place to locate business after leaving the university's incubation programs. Many companies cannot afford to pay high rents for an office inside the university campus and suffer from the lack of adequate space for industrial needs. The area around the university has been developed with a focus on tertiary activities with the construction of office buildings that not always possess the required characteristics.

In addition to management of the former IRL building, Les Atelier de Renens foundation is also responsible for developing projects throughout the entire city of Renens. The first objective of the foundation is to support companies to find a working place to locate in the city, as the growth of the company creates significant values for the city itself. Nicolas Servageon, the Economic Promotion Delegate of Renens, explains that hosting business only in the early stages of development is very risky. The city has accepted the risk of this operation but wants to benefit from the success of the activity it hosts on its territory, for this reason, it is committed to helping companies to find suitable solutions to stay in the city.

Les atelier de Renens has a crucial role in these dynamics. Primarily because some companies that had been hosted in Les Atelier de Renens, once they increased in size, has been assisted by the city in finding a bigger space to settle their activities, permitting them to stay in Renens.

Secondly, the importance that Les Atelier de Renens has assumed in the area led other companies to ask the municipality to locate in Renens. These companies were not directly linked with Les Atelier activities but wanted to locate in the city to be nearby a dynamic and innovative environment. For this reason, the services of Les Atelier de Renens are strategic for the development of the entire economy of the city.

4.5.3d Social Organization

Les Atelier de Renens was born in 2014, and it has only five years of activity. In this short period, the building has changed both in terms of spatial organization and in the type of activity hosted inside, but above all in the image by which the project presented itself to the public.

Parallel to the IRL+ activities, the reactivation of the building took place through the creation of a maker space, a community and meeting place, realized with funds from the municipality of Renens and managed by an external group. This space was particularly important in the first phase of development as a pilot project for the renovation of the building. In this first phase, which lasted a year and a half, the city covered the rental and machines cost to support the growth of the internal community. The maker space was joined by other companies such as Hackuarium, a non-profit association dedicated to bio-hack, Fixme a repair shop and hack-lab and other activities under the supervision of the UniverCité project. (Juliette Lemaignen, interview 02/04/2019)

In this first phase of development, the renovation of the building took place by phases, maintaining the atmosphere and the original image of the building, both in its external and internal parts. This condition is reflected in the project itself, which lacks a coordinated image reflecting the new life of the complex. The building was a succession of empty and active space without a clear distinction; users customized doors and indications to facilitate movement within the building.

The first success of the Inartis foundation charged of the management of the UniverCité project, has been to reach an agreement with the Mass Challenge accelerator to occupy thousand square meters on the third floor of the complex. Mass Challenge used to host innovative start-ups for a period of 6 months within its dedicated spaces, promoting the interaction and development of new business models. The presence of an important institution on the national and international scene has guaranteed growth in the number of rental requests both internally, from start-ups after the mentoring period, and externally for local companies.

Another important actor who contributed to the reactivation of the building has been the Neboulose brewery. The company began the production with an investment of four million Swiss francs and only three employees. Today the company has 20 employees, a new production facility and a synergy with another company, Urban Kombucha, which uses the previous production facility. In the last year, the company has also opened the Tap Room, a bar for tasting the company's products on the first floor next to the company's office. The bar is also accessible to people coming from outside, encountering the complaints of other tenants for significant noise and unfettered access to the building. The daily difficulties of coexistence of this recreational space with other hosted activities make visible the difficulties of combining work and services, due to limitations that some occupations require, primarily related to business protection both in terms of knowledge and procedures that in terms of equipment.

The third actor who played an essential role in the economic and community stability of the building has been Nord Thin Ply Technologies. After the bankruptcy of the IRL + company in 2015, the entry of a new major tenant created more stability. In addition, the company has started to collaborate with the watchmakers located in the building for the creation of a carbon watch line which, after its success, required to increase the rented space by two hundred square meters to implement its development.

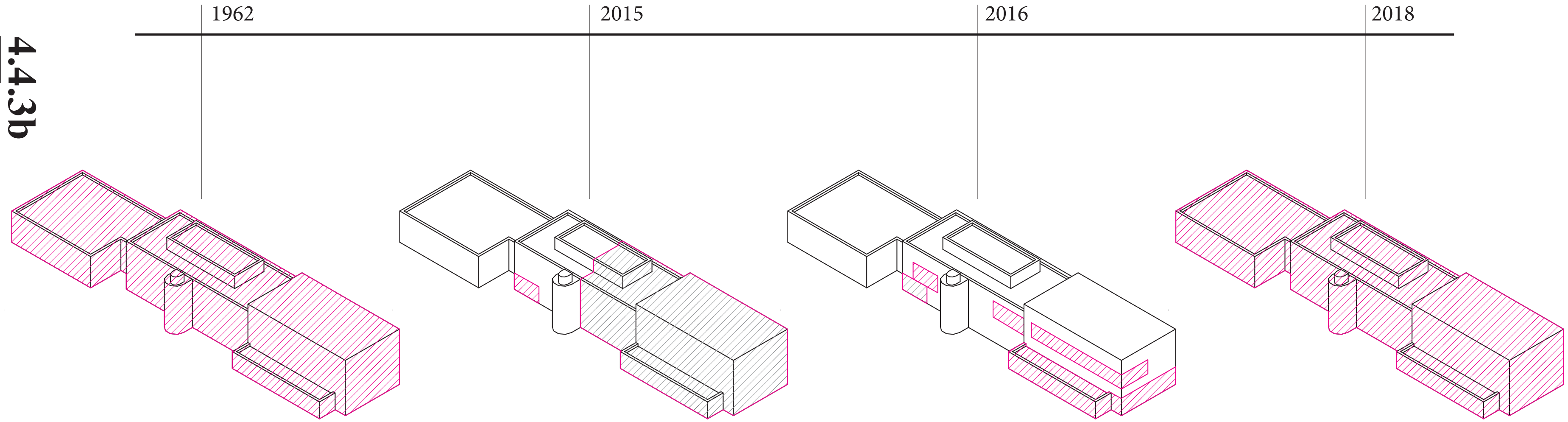
The fast-changing reality of Les Atelier de Renens highlights the evolution of industrial space dedicated to innovation and technologies. The project born as a co-creation and collaborative space, hosting open labs and communities activities accessible to anyone, following the ideal of open innovation and co-creation as supportive instruments for the reactivation of the building. With the advance of the project, however, this ideal changed. Unlike other cases analyzed, the building management organization chart has not changed substantially over time, what has instead changed significantly are the type of activities hosted inside. Following the distinction made by Cohendet et all in their studies about the anatomy of the creative city, the case of Renens represents the progressive transition from a place dedicated to an “underground movement”, considered as creative, artistic and cultural activities taking place outside any formal organization or institution based on production, exploitation or diffusion, to the support of “upper ground realities”, meaning innovative firms as well as institutions, contributing to the creative process by their capacity to finance, integrate diverse types of knowledge and test new forms of creativity on the market.

This transitional phase and the increase in rental costs led to a conflict between the managers and the first group tenants, resulting in their departure, as happened for the maker space association. After a year of controversy between the managers about machines authorization and space use, the association has been invited to move, and the management passed directly to Inartis foundation. The conflict started from different ideologies. From one side, the original association of maker space shared the ideal of the maker movement, transmitting knowledge and creating a community around a common interest in making. On the other side, the target of the foundations was to subsidize a space where hosted companies could develop prototypes and their business. One point of view rejected the other, highlighting the conflict that accompanied the gradual definition of Les Atelier as a technopole. Today four companies are hosted in the makerspace, that is still open to anyone but secondary.

Today the meeting space par excellence inside the building is represented by the Mobilet Canteen located on the second floor. This place becomes the strategic meeting point between the different companies, characterizing itself as a meeting space allowing tenants to know each other and share part of their work. The canteen is managed by the Mobilet ‘Association, which promotes professional integration for young people aged 15 to 25. During twelve weeks of training, students work inside the canteen taking part in various activities which allow them to gain experience before entering technical training in the food sector.

4.4.3b

Portland Works | **time strategy transformation** | architectural strategy



The building was built to house the warehouses and production of the publishing company Imprimeries Réunies Lausanne SA

Transfer of the building to the municipality and downsizing of the publishing activity. Start of occupation of empty areas with new activities

Renovation of the interior spaces, installation of a business accelerator and entry of new activities related to the technological sector

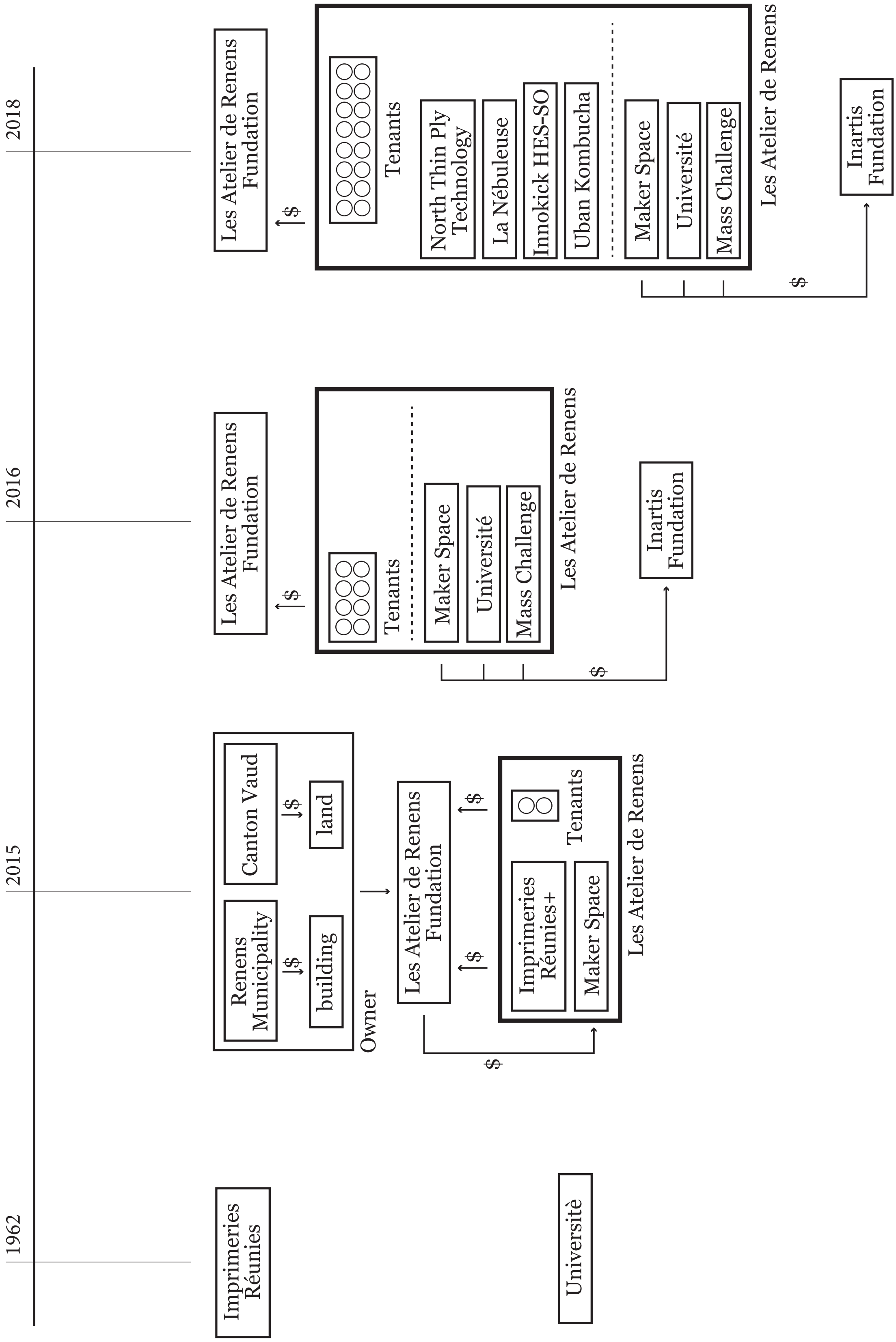
Tthe building is completely renovated in its internal parts and fully rented. It hosts activities related to the technological, craft and so-

editorial production of newspapers, magazines and books

creation of a maker-space and community space

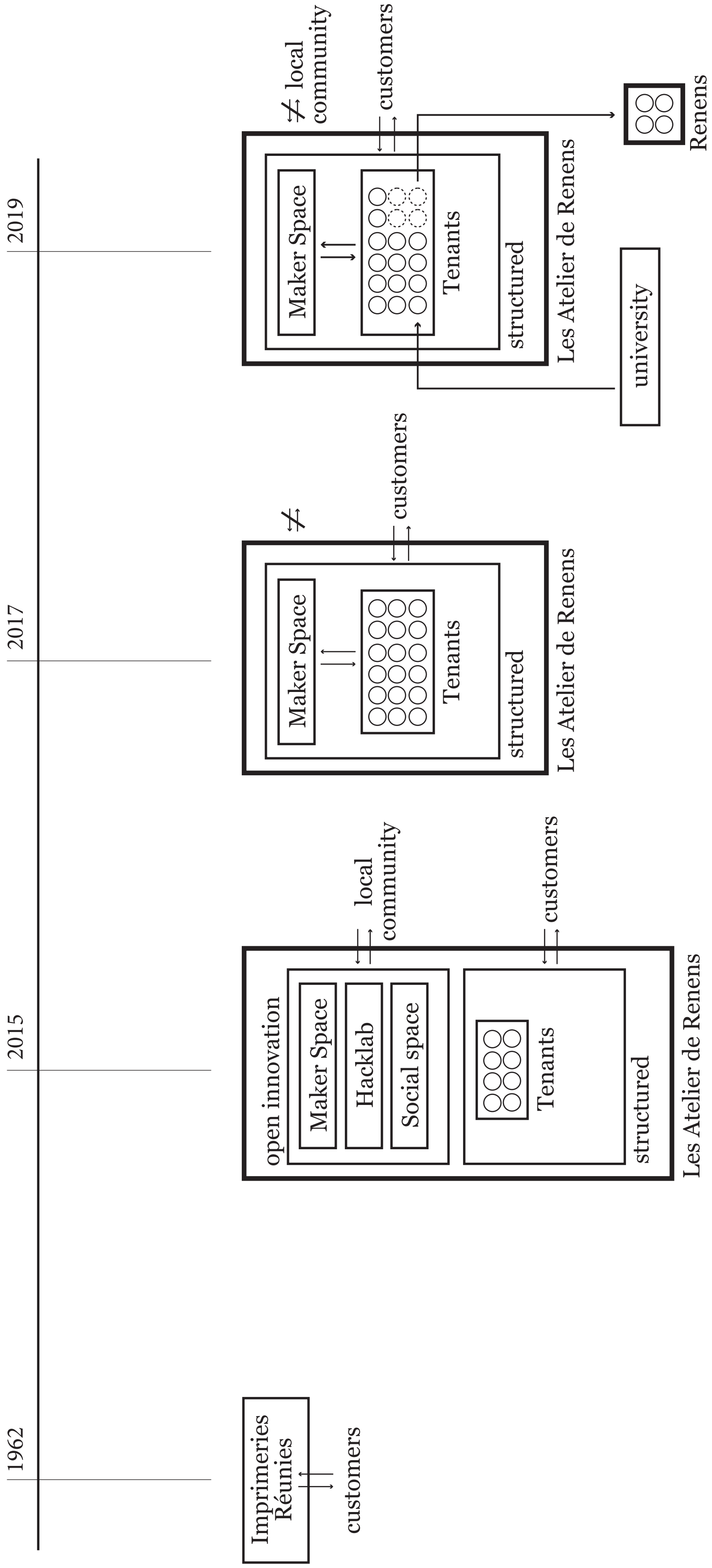
renovation of internal industrial and office space

integration with public function



4.4.4c

Sectie-C | **time strategy transformation** | management strategy



4.4.4d

Sectie-C | **time strategy transformation** | tenants relations

4.6 Comparative analysis and incubator development path

The paragraph aims to compare the selected case studies and their characteristics. For this purpose, a comparative matrix (Figure 4.6.1) describes their main features, taking into consideration the type of actors involved in their development. Keilewerf and Sectie-C are characterized by the active involvement of the final users in the process of space organization and its management. Portland Works showed the significant involvement of the public sector to support the no-profit management foundation, especially regarding maintenance funds, also defining restrictions as the building is recognized as part of the local industrial heritage. Instead, Les Atelier de Renens developed directly by the local governments, reveals a more rigid spatial organization that has limited tenants' appropriation of the place.

Regarding the spatial characteristics, the matrix reports the strategies and functions that the selected incubators host. All the cases display an inclination for the adaptive reuse of the existing structure and the creation of a new external image to convey the attention on the transformation that took place inside. In this way, the industrial space, once closed and inaccessible, shows itself as a new space, open to the outside and with new functions. Concerning the hosted functions, all case studies are characterized by the presence of light manufacturing activities and creative industries.

In the same way, the matrix compares the organization strategies indicating the owners, the management structure and the main steps that have defined their development. Development strategies have a crucial role in defining methods of interaction between internal users and the construction of a reliable network of collaboration between the companies hosted within the space and in the urban context. Co-development process of internal areas, particularly evident in Keilewerf and Sectie-C, has produced greater social cohesion between tenants and the creation of stable collaborations with reflections on the urban context. In the case of Les Atelier de Renens, the type of organization of the spaces has less favoured collaboration between the activities that base their network only on external connections. On the contrary, the business environment of Les Atelier de Renens showed a high specialization of companies relying on high technologies, specialized craft activities in the watchmaker industry and industrial food productions. The types of production hosted in Les atelier de Renens require a different logistic and spatial organization than the creative or craft activities that characterize the spaces of Keliewerf or Sectie-C, requiring more accurate management at the expense of the integration of users in the development of the incubator.

The last section of the matrix is dedicated to the relationship that the case studies established with the urban context, reporting the networks that interact with the incubator and the hosted activities. The incubators analyzed are characterized by significant collaborations with local industries and research centres. Collaborations are especially evident in Sectie-C, which combines the prototyping and design developed within the complex with high technology of the local industry to implement production. At the same time, the analysis shows the link between the metal works hosted at Portland Works and the local steel industry, or the collaboration between research centres in EPFL and the technology companies hosted in the nearby building of the Les Atelier de Renens.

The case studies have shown that the development of an incubator requires high managerial skills, the support of the public system, the creation of an internal and external network for the growth of companies and the incubator itself, the elaboration of a vision on different levels: from the single activity to the urban context. Case studies show how building local know-how regarding incubator construction involves experimentation, errors and feedback as well as time and investment. This know-how is a precious value on a local scale for urban planning and economic and social policies. Case studies show how the know-how acquired in their development led to the creation of new production spaces and incubators within the urban context or collaborations with other industrial centres, expanding the context of interaction.

Even if case studies showed essential differences in actors involved in their development, the study retraced common development path which has been individuated as structural in the development of incubators. Figure 4.6.2 shows, through a simplification of the complex network of interaction within the incubator, the common phases that characterize the development of this place. The scheme has been organized following the three elements of analysis: space, processes and users, placing them in relation to each other. Some elements of this process are not present or are present only in part in the process of development of the selected cases, but the study considered important to report the all the stages of the entire process as a tool for understanding and analyzing the incubator.

Case studies com

	Space		Proc
	spatial strategies	functions	management
Secite-C	- industrial complex - adaptive reuse of buildings - external space redevelopment - new public front	- design - light manufacturing - service - art - events	- private owner - venture and rent manager - board of directors - building managers - tenants fundation
Keilewerf	- industrial buildings - adaptive reuse of buildings - new external image - temporary public structure	- design - light manufacturing - building materials store - training	- public owner - no-profit management org. - boards of directors - building managers
Portland Works	- industrial building - renovation of internal spaces - new external sign	- desing - light manufacturing - service - art	- no-profit owner (fundation) - boards of directors - building managers - volunteers organization
Les Atelier de Renens	- industrial building - continuity in use - internal new divisions - new external sign	- design - light manufacturing - service - high technologies	- public owner - boards of directors - private fundation managers

Figure 4.6.1 case studies comparative matrix.

nparative matrix

cess	Users		
redevelopment approach (steps)	internal network	urban network	
- 1st: tenants occuation - 2nd: informal co-design - 3rd: renovation by the owner - 4th: use of outdoor spaces - 5th: shared redevelopment vision	- thriving community - working collaboration - tenants fundation - shared development vision - events	- local industries - design university - city design culture and events - neighborhood redevelopment - development of new building	
- 1st: tenants occupation - 2nd: informal co-design - 3rd: redesign and extension - 4th: public financement	- thriving community - working collaboration - training activities	- neighborhood redevelopment - public events - development of new building	
- 1st: bought by the foundation - 2nd: structure renovation - 3rd: fundraising campaign - 4th: redevelopment by volunteers	- working collaboration - tenants fundation - foster traditional techniques	- local industries - heritage and tradition - public founds	
- 1st: bought by the city - 2nd: free space for activities -3rd: fundation management - 4th: internal renovation -5th: high tech focus	- backward community - shared canteen	- university - public founds - city development asset - development of collaboration	

Incubator deve

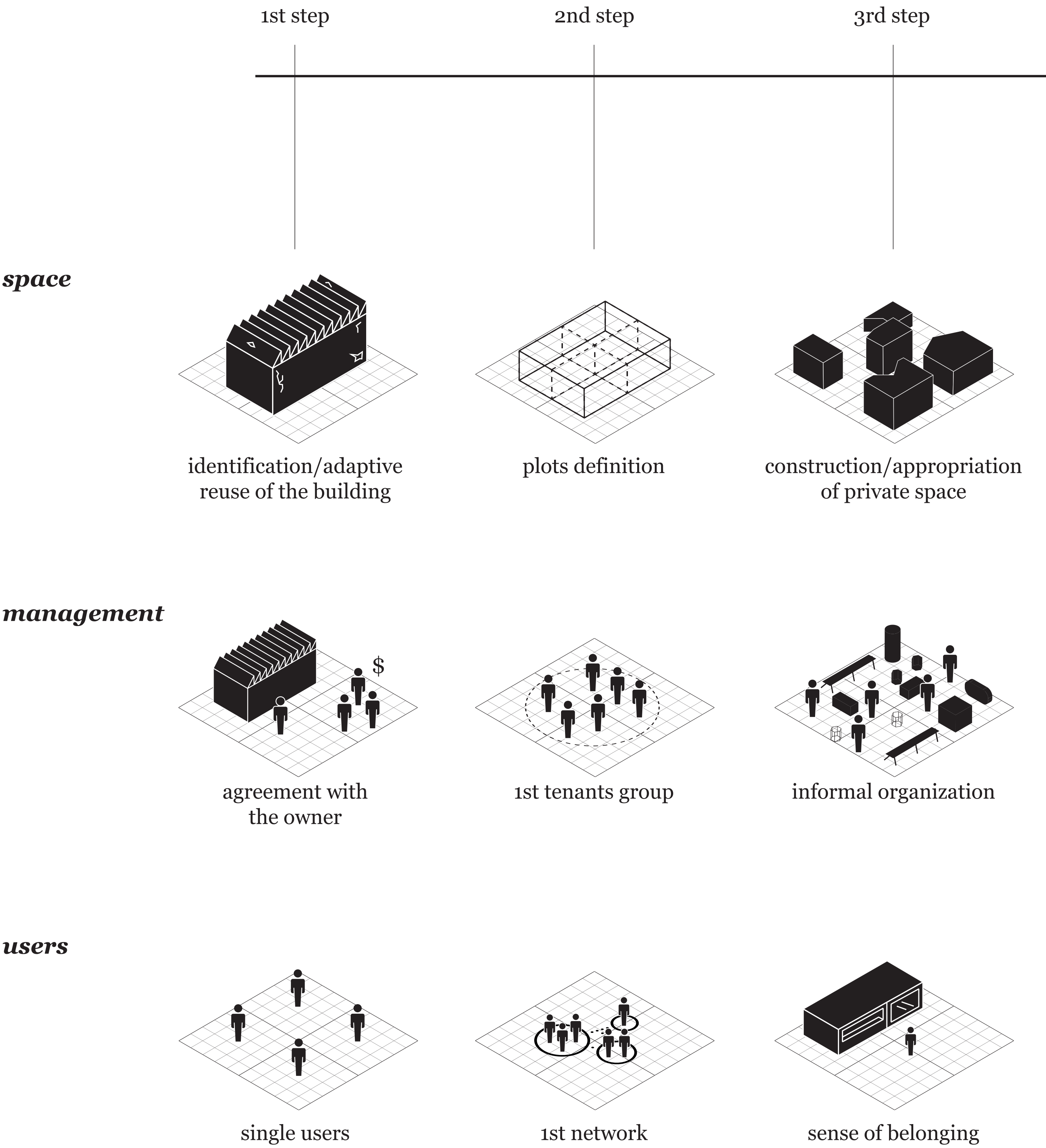


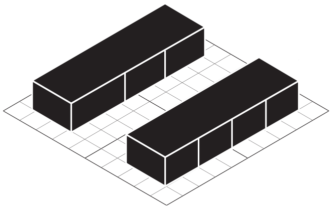
Figure 4.6.2 Incubator development path

elopment path

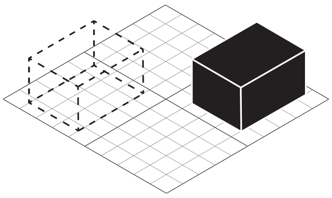
4th step

5th step

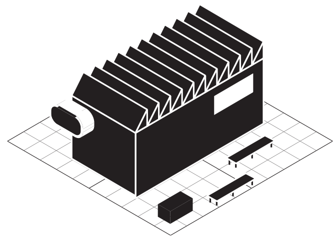
6th step



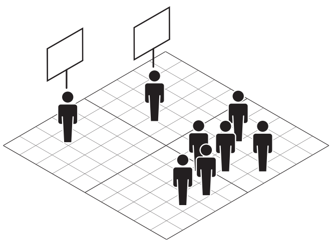
feedback and
re-design



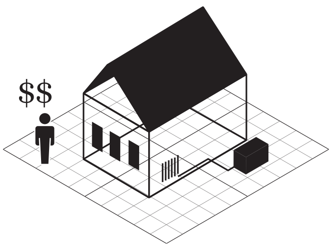
activities internal
movements



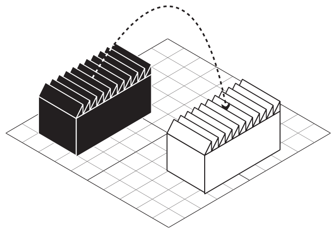
new external image
urban redevelopment



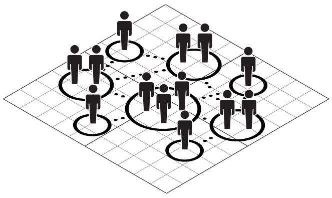
definition of
rules



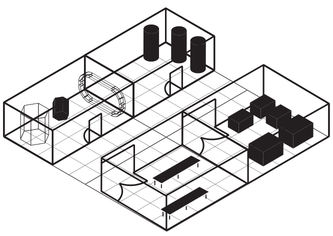
maintenance



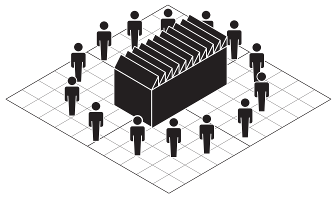
development of know-how/
opening of new spaces



developing community/
expading network



different level of
making / mixed activities



common vision

4.7 Architecture and the incubator model

Architecture as a discipline and as a research tool represents the central element of the thesis.

Architectural research, dealing with complex contemporary objects, is increasingly supported by other tools and sources of investigation to describe the rapid changes and transformation occurring in the urban realm. The heterogeneous nature of a building, its intricate network of events e relationships, has been described by Latour and Yaneva's in *"Give me a gun and I will make all buildings move"* (Latour & Yaneva, 2008) with a consequent reflection on the concept of Movement as a crucial question for research in architecture (Chapter 3). Their critical analysis deal with the obstacle for architecture to go beyond the statical image of a building, to represent the changes occurring after its construction, the act of living performed by users, or how external events impact on building functions. The thesis does not provide an answer to this complex question, nor does it try to find a new tool for the discipline; the attempt has been to highlight the *Movement*, the transformation of the building, through the evolution of spatial, managerial and social strategies related to the case studies examinated.

Historically, the theme of industrial architecture has been addressed through the analysis of the most significant projects, which marked the diachronic evolution of the genre, pioneers of a constant technical development characterizing this building type. For example, Raffaele Raja (Raja, 1983), Gillian Darley (Darley, 2003), but also Jeannette Kuo (Kuo, 2016), who introduced a fascinating argumentation on the use of the section in the analysis of industrial buildings, based their study on the great examples of present and past industrial architecture. Gillian Darley herself in the conclusions of her book "*Factory*" where she traces the genesis and evolution of the factory declares,*"The imagery of the modern factory - however we define it - is essentially hermetic, with no references given or even hinted at"* (Darley, 2003: 210)

The analysis started from a different assumption, considering the factory not in its singularity, as a history based on single architectural projects, but in its evolution, in its being a cross-cultural phenomenon, where to a standardization of forms and construction techniques corresponds a multitude of different uses, contexts and users. Assuming the same point of view as Howard Davis in his reseach about the shop-house, the production space is not definable as a singular architectural type, but as an exhibition of common ideas.

The study of the incubator shows the same criticalities encountered in the research of a unique type for the modern factory. Site-specific development of forms and concepts produced a great variety and overlapped definitions which become a significant obstacle in scholars' systematic analysis of the phenomenon (Chapter 2). Like the factory, the incubator remains an object of difficult interpretation, hermetic. In order to handle with this criticalities encountered in defining the incubator model, the field research has pointed out the common patterns, the evolution of spatial and managerial strategies, revealing the common elements and how this model interacts with other functions of the urban environment. These elements have been identified by interpreting the *movement* of the building, comparing the spatial analysis with actors involved, patterns of uses and the site-specific context in which case studies are located.

The architectural research of this chapter followed the approach that Venturi described in the introduction of *"Learning from Las Vegas"*, about the need for architects to learn from the existing landscape, from the analysis of what seems obvious, common, to identify the emerging lexicon of current architectural practices. The case studies examined diverge from the popular idea of the incubator, mainly characterized by buildings or areas of buildings that host brilliant start-ups or small businesses operating in the ICT economy, basically proposing a fresh look to the modern office. They retrace the original idea of the incubator (Chapter 2), as a response to an industrial crisis in developed countries, by activating a local development process to provide affordable space to SMe. At the same time, recovering part of the large stock of abandoned industrial buildings and enabling regeneration processes in urban industrial areas.

The immersive study developed trough case studies analysis over the three years of research, has highlighted peculiar characteristics of the incubator which move a reflection on their role in contemporary architecture and for the culture of the city.

4.7.1 The neo-cottage and the hybrid nature of the incubator

The first element identified by the critical analysis concerns the concept of the neo-cottage industry and the hybrid nature of the incubator model.

The idea behind the cottage industry is a production space that has always existed in any human culture. In fact, production was born within the domestic context and then gradually moved away, when tools and technologies required a specially equipped place. The cottage industry, the most common form of production, was still strongly present at the beginning of the twentieth century, as Prince indicates when he described the industrial ecosystem of New York in its research on the modern factory in 1914 (Price, 1914), and it is still present today (Luckman, 2015).

However, the cottage industry takes on a fundamental role in the seventeenth and eighteenth centuries, as the "antagonist" of a regulated system represented by medieval guilds. The cottage industry, not subject to the rigid control of the guilds has been the fuse from which the industrial revolution flared up. Many reasons made the events of the Industrial Revolution possible, but the cottage industry made possible the accomulation of capital and the training of labour force for the nascent class of entrepreneurs and industrialists and the improvement of the first forms of the factory system, as cotton mills or weaving sheds (Chapter 2). Consequently, the production system of the modern factory almost completely absorbed the cottage industry, while the remaining realities were instead banned from the modern city by functional plans of the twentieth-century city.

Today, the term neo-cottage proposes a revival of this production model, adapted to support a change in scale and in technology of production systems, *“smaller-scale spaces that are flexible and dynamic”* (Rappaport, 2014: 237) designed and adapted to accommodate *“innovative small-scale production, moving from Just-in-Time to real-time on-demand”* (Rappaport, 2014: 443). The original idea of the neo-cottage derives from the advent of the “*electronic cottage*” and the reflections posed in the 80s by Toffler and John Naisbitt about the disruptive role of the internet in the transformation of work and the shift to telecommuting. In her comprehensive analysis of the “*Vertical Urban Factory”*, Nina Rappaport takes back idea of the neo-cottage to describe the new trend in urban production, where technologies as the 3D printer, CNC machines and CAD-CAM computers are transforming light manufacturing. In contrast to massive factories, small-batch production is raising again in urban workshops, competing on the market thanks to a high flexibility in terms of production and labour as well as the low initial investment cost and the support of digital platforms. The theme of the workshop and the spatial typology of the neo-cottage were also identified within the selected case studies, describable in their minimum unit, occupied by the single tenant, like contemporary forms of a cottage industry, with some important differences. Individual production units are not in direct contact with the domestic environment, as the definition of cottage industry implies, but instead, they are organized in clusters, occupying large urban industrial buildings.

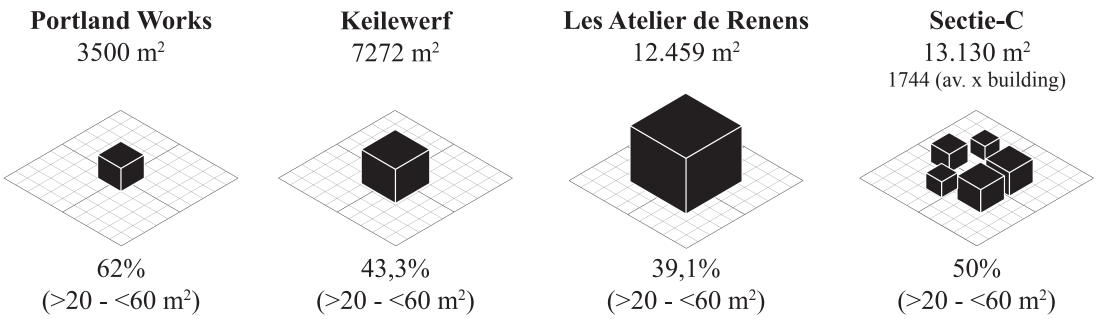


Figure 4.7.1 The figure highlights the percentage of lots with an area between twenty and 60 square meters in each case study. The graph shows how the size of the lots increases as the surface of the building increases. In the case of Les Atelier de Renens, 46% of the lots have an area larger than 100 square meters. In Keilewerf, the higher percentage is 39% of the lots having an area between 60 and 100 square meters. In the case of Secite-C, the size of the individual buildings affects the size of the lots, despite having a total area of 13,130 square meters, the individual buildings have small dimensions between 3500 and 320 square meters.

These production units, described in the functional typologies analysis (Appendix ch. 4), present common patters in the different case analyzed. The first relates to workshops size, most of the leased plots have a size between twenty and sixty square meters (Figure 4.6.1), where machines, tools, worktables and storage space are organized following a strictly functional layout, allowing logistic movements and the organization of different types of processing techniques simultaneously. At the same time these production units are frequently divided into two different spaces: the space used for production, the workshop, often directly accessible from the external common area which sometimes becomes a real additional workspace according to needs, and the office, a quiet and more closed place, where users can retire to develop a new product, new concepts or work digitally. This type of workspace is visible in all selected cases. The research has identified how this type of workspace is frequent if not necessary for manufacturing and creative activities that are located inside incubators. Figure 4.6.2 shows this relationship between workshop and office by reporting an exemplary case within Keilewerf, making visible the relationship that exists between workshop, office and the shared space.

At the same time, the analyzed production units showed another significant difference compared to the traditional cottage industry: their tendency to be organized in clusters. In addition to the use of the common space as an additional workspace, the organization of working unit in the same physical place allows the creation of shared work areas, equipped with machines that would constitute a too high cost for the single activity, that through sharing becomes accessible. Furthermore, the field research and the interviews carried out highlighted how this spatial proximity organization allows the emergence of a real working community that collaborate in large projects or through subcontracting contracts, creating a virtuous process of collective growth[5].

The characteristics of these individual production units, their clustering in what we have defined as the incubator, conveys a second reflection on the transformation and trend of new urban production. The incubator, born as a strategy to redevelop abandoned industrial areas and provide affordable working space to a light urban and peri-urban manufacturing, today is increasingly subjected to hybridization with other functions. Hybridization is a strategic aspect for incubators, from both

5 In Keilewerf, the organization of the internal space considered the creation of open areas, rented temporarily by companies for large-scale projects, for collaborations with other companies and sharing expensive machines. In Sectie-C, shared machine space has been the strategic element for space organization. A strategy initially adopted by the Collaboration O collective and subsequently applied to other buildings. Tenants have described the sharing of machines and workspace as enabling social relation and sharing knowledge. In Les Atelier de Renens, the maker space on the ground floor has been initially created as a meeting place between the activities located in the building and the local community. Now it has lost part of its function, remaining a place of work and sharing between companies. In Portland Works, activities related to to the metal and cutlery industry has established internal and external collaboration, especially with the Sheffield University keeping the cutlery industry tradition alive. The building still maintains active the foundry for semi-finished metal products, as well as cutlery, engraving and plating workshops while new business set in to be part of the community, as a jewelry company “Baileyof Sheffield” and “SquarePegs” manufacturer of school supplies, and share strategic knowledge between old and new companies in the sector.

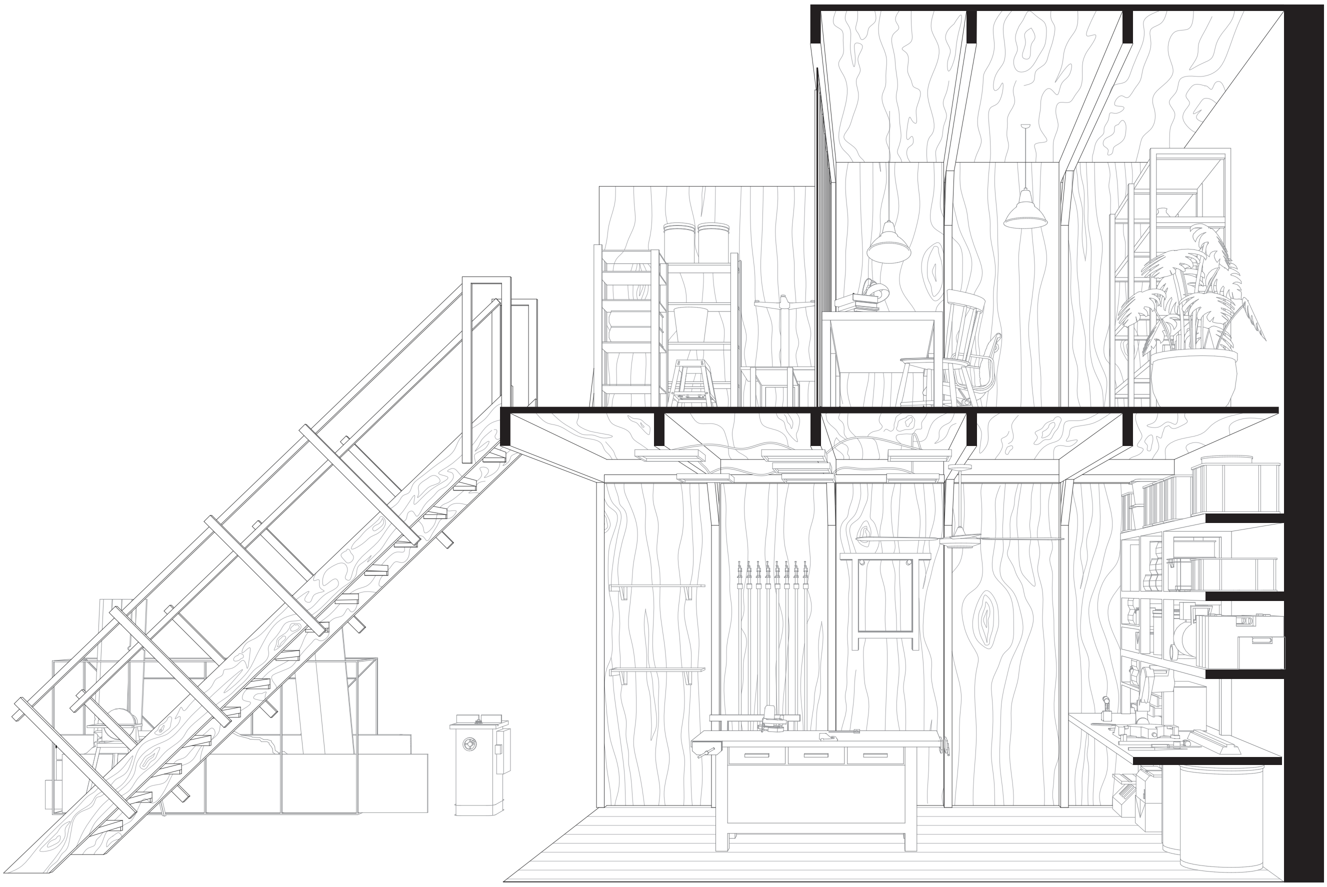
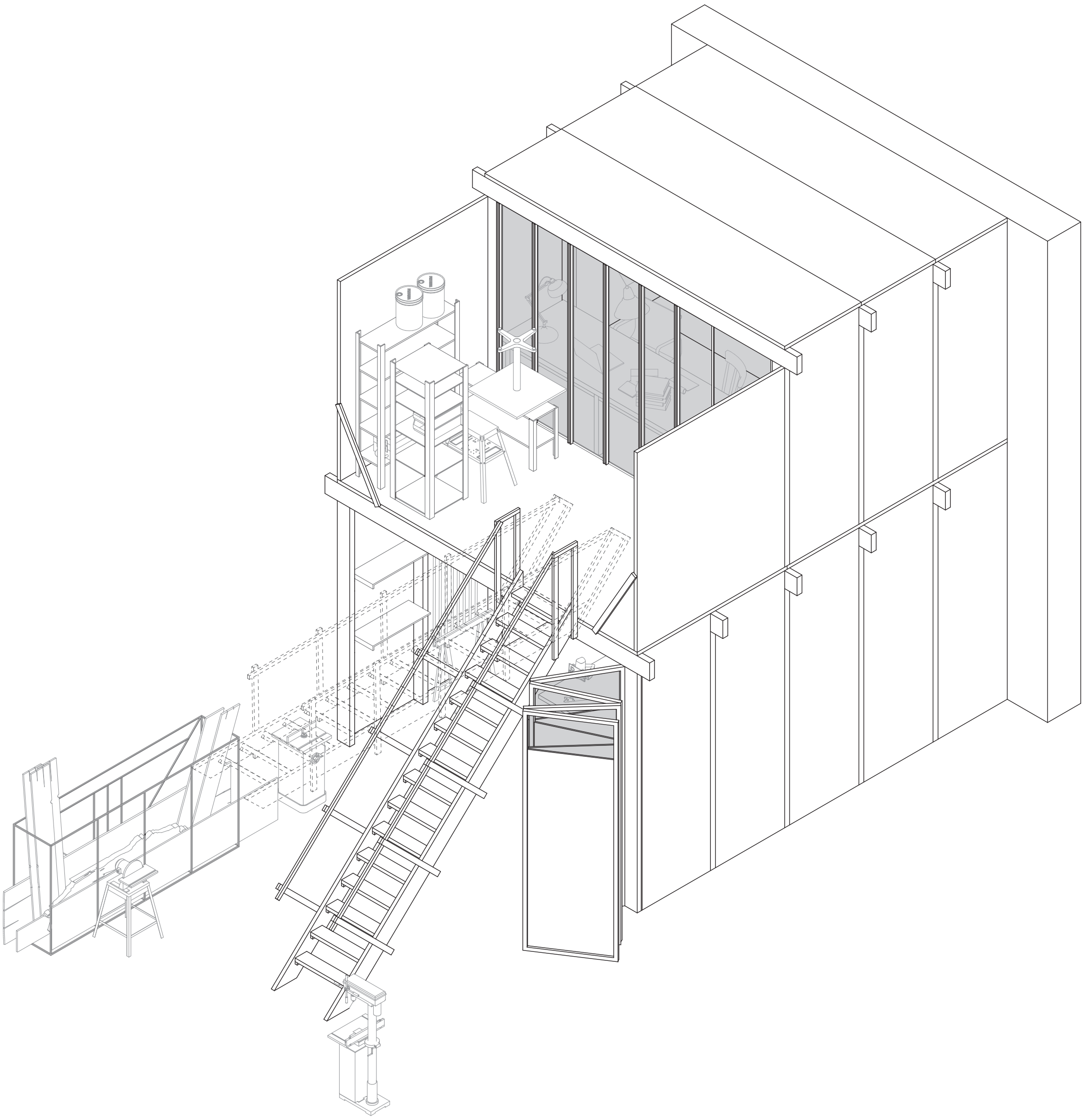
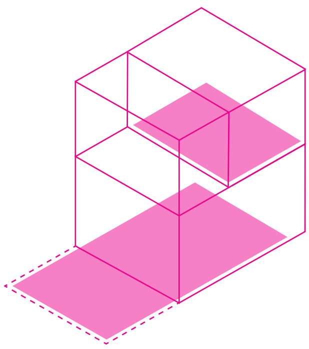


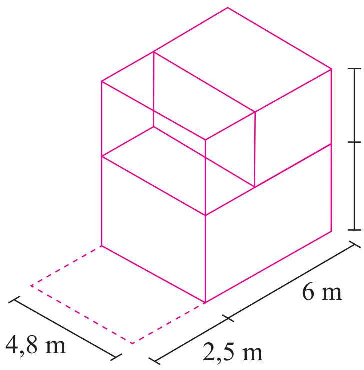
Figure 4.7.2 graphical representation of a work unit present at Keilewerf 1. The drawings show how the workspace is divided into two distinct parts. The first is the workshop on the ground floor which expands to occupy the common area according to the need and the type of production. The office space, located on the first floor, is accessible by a staircase operated by a pulley which determines its position without hindering work on the ground floor.

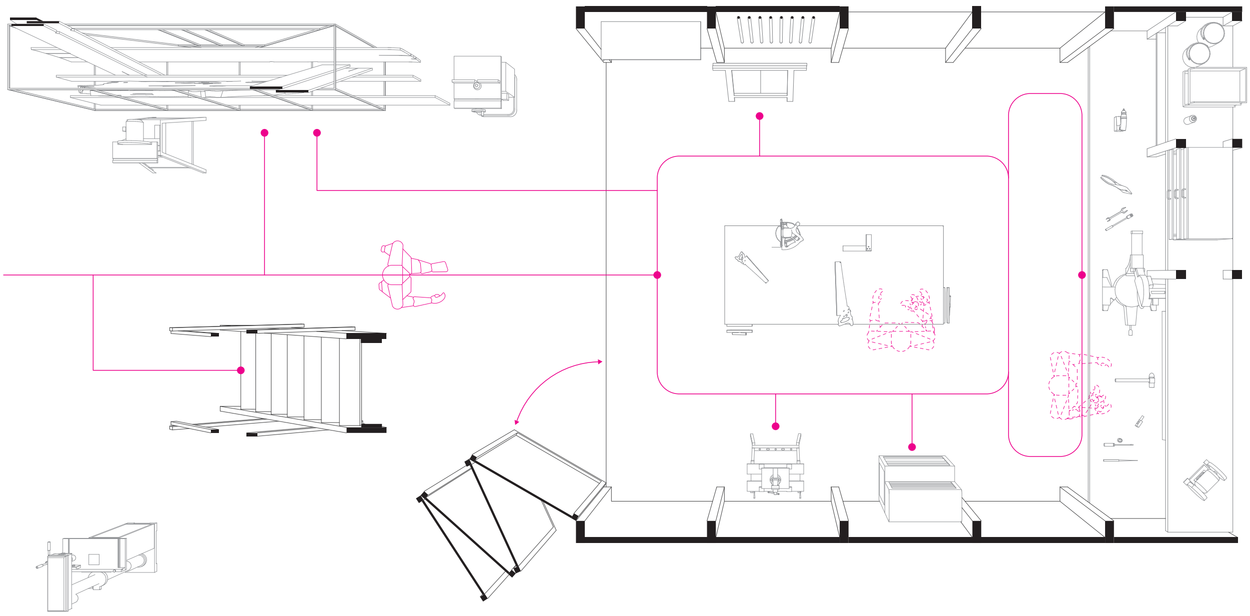


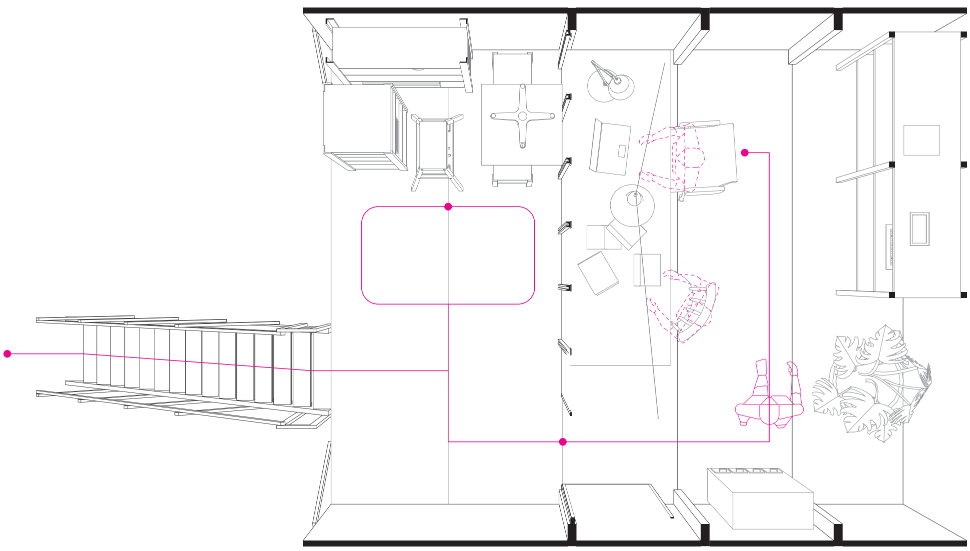


Office space
16 mq

Workshop
40 mq







a managerial and spatial point of view. Combining multiple functions, it allows managing the risk of companies short terms leases more easily, diversifying the internal economy and making companies visible to possible external customers. Spatially, it allows to strategically organized the avaiable space to host the most suitable function, proposing innovative spatial solution. For example, the construction of the covered walkway and the bar at the entrance to the Sectie-C complex created a new relationship with the surrounding area and a new image of the factory, while reusing the former control booth at the entrance to the factory as a bar opened to the neighbourhood and a meeting point for clients.

This phenomenon leads to a reflection on the nature of the incubator as intrinsically a hybrid model, as a spatial strategy, born from a need of affordable industrial space and favourable circumstances, assuming site-specific characteristics and modelling itself to be able to adapt to a different contexts. At the same time, it highlights the possible compatibility of urban manufacturing with other functions, as more traditional working activities, sale and services, events and art spaces or even public functions, confirming the trend of urban manufacturing to be positively influenced by other function of the urban environment (Chapter 1).

As the case studies, other international examples show how urban manufacturing, especially new born companies, can take advantages from being co-located with other function inside the incubator, building synergies and innovative spatial solution. The incubator is increasingly associated with public activities, with areas made available to the local community, or connected to spaces for art and events, as well as temporary forms of residence. Keilewerf's analysis has highlighted how the creation of a sales area, managed by Buurman, at the entrance to the building acted as a receptive and interaction point for the external public, providing at the same time strategic support for building material supply during the realisation or customisation of tenants working space. In Portland Works, recognised as a community space, the board decided to realised shared meeting room and a conference room to organise internal meetings, rentable on request by external organisations or local residents. The transformation of the industrial complex of Sectie-C in a diffuse exhibition space during the Dutch Design Week is an example of how its ordinary functions can be placed side by side, even if only temporarily, to artistic and cultural events, becoming the stage where tenants work is displayed to the public.

Alongside these examples, the incubator model has developed the most appealing hybridisations with research and educational activities. Both on European territory and on a global scale, several examples can be cited for the development of a successful model combining working, research and educational space. The result is a stimulating, dynamic space where learning takes place not only through traditional teachings but also through practical lessons.The incubator model links three fundamental aspects for the development of the factory of the future: education, research and manufacturing, making visible the advantages and adaptability of urban manufacturing.

4.7.2 Craft and contemporary architecture

The spatial analysis and the research carried on the incubator and new forms of urban industry allows making a critical reflection on the relationship that exists today between Architecture and Craft, and how this relationship is developed in the selected case studies.

Catharine Rossi, in an article published in Architectural Review in February 2017, proposes a reflection on the current state of Craft, on its relationship with the consumer economy and how making is linked to architectural practice. In her article, she emphasizes the necessary debate regarding the meaning of Craft today and the values of authenticity, of material and immaterial quality which resided in this term, in contrast to the culture of mass-produced objects and consumerism.

Catharine, through the words of craft writers and critics, define our times as a *post-craft era*, where Craft is no longer marginal but mainstream, where its intrinsic values are conveyed by the market to exploit its potential within a new dialectic of selling products. This is particularly evident in processed foods, as craft beers or coffee roaster, owned by multinational, which share this new Craft's fashionability to sell their products. This process is what Jenni Sorkin defines as *"craftlike"* in a article contained in *"Nation Building: Craft and Contemporary American Culture"*, where the most profound values in Craft become only a process, a performance capable of capitalizing the interest given to the world of making into consumer commodities. This concept has a critical implication also in the sphere of architecture. This craftlike imaginary takes on a physical shape, creating a visual expression, a material language that leads to a serialization, to the construction of a style able to convey an idea of "false genuine" craftsmanship in the mind of the consumer. Through this new image and spatial identity restaurants, bars, shops, sales place in general but also working space as co-working or offices, are subject to this new brand identity, transmiting a temporary value to the customer, an experience reduced at the slightest act of consumption, but capable of being attractive.

At the same time, there is the necessity for a new definition of Craft, taking into account digital technologies that today constitute an essential aspect of the world of making. The inclusion of Crafts in the "creative industries" in 2013 is a proof of the need of a more inclusive definition of the term, in a historic moment in which the culture of making has taken on international proportions and new forms of craftsmanship are re-occupying urban spaces with the coexistence of traditional and new experimental techniques. The case analyzed showed different approaches to Craft. For example, Portland Works is characterized by companies related to the cutlery industry and stainless steel production, a tradition that has been going on since the construction of the building, promoting traditional techniques while keeping alive local knowledge. On the contrary, Sectie-C and the city of Eindhoven, took advantage from the presence of spin-off technology companies connected to Philips to develop prototypes and small batch productions, revealing an idea of craft as research, experimentation and collaboration between different field of knowledge.

As for the case of Sheffield and Eindhoven, craft represents a cultural aspect of societies and places. It is at the same time part of the traditions of a place and representative of new practices, life-styles and techniques. Using the words of Catharine Rossi *"If making is universal, cultures of making are culturally constituted"* (Rossi, 2017). As Sennett declared in his book about the Craftsman, while art has a unique subject, in craftsmanship the subject is collective, composed by different participants both in the practical act of making and in the cultural process of its essence, enabling a meaningful relationship with the material (Sennett, 2008).

The analysis of the case studies has shown how the production of the single object is part of a broad cultural process that involves different subjects and actors, from the craftsman or company hosted within the incubator, to the material supplier, sub-contractor, close tenants contacted for suggestions or feedback, up to the final customer. In this context, the incubator enables a more agile relation between actors in the process of making, provinding a space for physical relation and cross-collaboration which are at the base of a successful process of local innovation[6]. The incubator act as a physical node in the network of local competences, connecting different field of knowledge and skills.

The vast literature on Craft culture and the fieldwork carried on case studies highlighted how the act of making requires the development of skills, which need a long period of training and active engagement with the material to be properly mastered. As Ingold declares *"even if the maker has a form in mind, it is not this form that creates the work. It is the engagement with materials. And it is therefore to this engagement that we must attend if we are to understand how things are made"* (Ingold, 2013: 22). Material and skills play a fundamental role in craft culture, and this does not only happen in objects creation but also in architectural practice. Materials perform a role in making buildings exactly as architects do.

As architecture need to develop rapid, precise and fashionable responses to a constantly changing market, the architect has lost the approach to making. It all reduced to choosing between a potentially infinite number of products, showing different finishes as the only elements to deal with. A concern that had already been raised in the field of architecture, among all by Koolhaas in *Junkspace*. The standardization of the construction process has always accompanied the practice of architecture. However, supply chain and market products are today the only possible resources for conventional architecture with a loss in experimentation and cultural differences that craftsmanship has perpetuated over time. In this sense, the Koolhaas' generic city of is a city that loses its craft traditions by developing a standardized culture of the city.

---

6 Lee Fleming and Jasjit Singh pointed out in the paper *"Lone Inventors as Source of Breakthroughs: Myth or Reality?"* how collaboration is a critical asset for breakthrough innovation. Their discussion, based on a study of U.S patents, suggested the importance of collaboration in comparison to a stand-alone inventor or designer. They conclude that collaboration reduces the probability of very poor outcomes, due to more rigorous selection processes, while simultaneously increasing the probability of extremely successful outcomes, due to greater recombinant opportunity in creative search. (Singh & Fleming, 2009)

Regarding the standardization of architecture, Mario Carpo describes how new digital technologies, unlike mechanical production, are rarely based on matrices, with the possibility of producing series of variations without additional costs (Carpo, 2017) (Chapter 1). New digital technologies allow a new approach to making, opening up new possibilities for small businesses, as well as to develop different solution in the field of architecture than those already on the market, while developing essential know-how for the profession.

Part of the research carried out on case studies has made possible to analyze the relationship that exists between craftsmanship, production and architecture, addressed through interviews with professionals in the field of architecture, who decided to locate their business within the incubators analyzed, in order to be able to exploit the knowledge and collaborate with the vast community of craftsmen.

These conversations highlighted how the reality of the incubator represents a production ecosystem capable of responding promptly to design problems promoting customized solutions through the interaction of different artisans within the ecosystem. The incubator is a place where dialogue with other designers and craftspeople allows to develop solutions or new possibilities through a continuous feedback loop which often leads to a better design than the previous one. At the same time, developing a process that changes personal sensitivity to aesthetics, technical details and how thing can be made. Architects involved in these places admitted a change in their perspectives by entering these communities and being able to experiment themselves with machinery and tools, bringing their design skills to a higher level of consciousness.

The internal network permits to find a customizable solution which can compete with market products, finding the right and cheaper solution for its production; opening the door to opportunities hardly achievable in other contexts due to the effort and time that such solutions would necessitate. At the same time, the internal network is connected to external suppliers and producer permitting fast exchange based on common trust as part of the same network. The more extensive and reliable the internal network is, the more industries are interested in collaborating with these realities, cooperating to find solutions that are not immediate and already accessible to customized requests. In these realities, making is a real option for architectural practice.

A new approach to making based to a physical common ground of experimentation can unlock the potential of architecture.

4.7.3 Learning from the factory: architecture and spatial freedom

As described in the previous paragraph, Craft is experiencing a new revival following a renewed international interest in making. This return of Craft relates to an economic and social system exploiting the values and ideals of quality and uniqueness regarding crafted objects, inherited from Morris and the Art and Crafts movement in contrast to the upcoming mass culture. As for Art described by Benjamin (Benjamin, 1969), today, Craft is living its age of mechanical reproduction.

At the same time, Craft has much more to do with the physical act of building, shaping matter, an act of knowledge and learning, as Sennet (Sennett, 2008), Ingold (Ingold, 2013) or Flusser (Flusser, 2014) argued. The act of Making is intrinsically related to Architecture. It is the most concrete part of a process that begins with ideation and ends with its use in time. Architecture today is influenced by a renewed attention to Craft, which poses a question about how architecture is dealing with the act of Making in opposition to a catalogue of prepackaged products to choose the "most appropriate" solution.

The analysis of case studies showed how Making is not only related to the work of individual tenants, but it also becomes a fundamental element in the organization of the space itself, in its construction, in its aesthetic and functional image. Case studies showed an alternative way through the combination of architects' knowledge with a network of highly skilled professionals capable of establishing a qualitative process of making based on direct confrontation and planning. The result is a peculiar architectural approach, proposing creative solutions which combine domestic, working space and other functions with a high degree of freedom in spatial organization. In some cases (Sectie-C, Keilewerf) each tenant took part in space organization, taking care of building their workspace and common areas, in other (Portland Works, Les Atelier de Renens) it has been subject to a more standard organization without limiting the customization of the individual rented space.

Questioning the architecture of the case studies, their symbols and forms, made visible how Making is directly employed in space creation and in its atmosphere, characterized by direct involvement of the final users in internal and external construction, enabling a process of space appropriation and the realization of innovative spatial solutions in the architectural scene. In this regard, the research examined these spaces with the same theoretical approach of Venturi on Las Vegas (Venturi & Brown, 1977), convinced that *"common architecture"*, like the one presented by case studies, could be a stimulus for contemporary debate about architectural form and aesthetics. The research questioned what condition enabled this process to happen, recognizing in the space of the modern factory and in its structural characters, the crucial infrastructure which allowed the freedom of uses and architectural forms shown in the cases analyzed.

The modern factory, an object which had an exponential distribution on the global territory, is defined by simple as strictly functional principles, essentially representing the idea of the Typical Plan: *"A plan stripped of all its qualities and* *reduced to a calculated relationship between discrete standardized elements: an empty surface able to host whatever program and on which life could be simply performed"* (Marullo, 2013). Many things have changed since the model factory has been theorized and realized in many variants by Albert Kahn. Today, the factory is less and less part of our urban culture. It has been removed from urban life and the city reprogrammed as a landscape for consumption, in which work, if not outsourced, has been converted into a service. The factory moved into industrial complexes outside the city, in the periphery of industrial districts, in the free areas along international logistics routes (Easterling, 2016). The transformation of the urban factory took place: no longer a production space but only the space of the Typical plan. As Marullo describes, an empty surface capable of hosting any program.

In spatial terms, the urban factory of today has something fundamentally different from the modern factory. The wall, the fence that skirted the factory, dividing it from the rest of human activities (Gregotti, 1996) disappears, it becomes a passage, permeable, porous, fluid, flexible, accessible, for everyone. The felling of its fence is what made the factory something else, a reusable object, exploiting the potential of its rigid scheme to assume any aspect and function. The theme of reuse is central to the transformation of the contemporary factory.

The practice of reuse can be referred to as the way of dealing with architecture in our time. It does not mean that buildings reuse appeared in our contemporaneity, it has been the most prevailing way over centuries, but in contrast with the constructive force of the last century, of the post-war reconstruction, the conservation and reuse of our built heritage certainly becomes one of the main themes in the debate and the practice of architecture. The factory is the place that has been invested most of all by reuse projects. Illegality and squatting practice soon gave way to institutionalized actions for the conversion of industrial buildings into apartments, theatres, art spaces, events, shows, libraries or public buildings (Cantacuzino, 1975; 1989), defining their new image: post-industrial, post-work. Instrumental use of the poetics of the "as found" (Alison Smithson & Peter Smithson, 1990), in which the aesthetic of the industrial space takes the place of the collective memory of work. In this sense, the reuse of the modern factory is central in the aesthetic and spatial culture of our time, filling the great void left by the industrial city. The case studies show in the reuse of the factory, in its new aesthetics and form, a cultural transformation of the workspace and new values attributed to the urban factory.

Today, the abandoned factory has become an alienated object, inserted in a social context to which is denied the possibility of accessing the specific culture of its iconography (Caruso, 2009). These places lose their collective memory which resided in action, movement, in the use of the place (Choay, 1996), in the unstoppable productive force which resided within its walls, preserving only part of it, the memory of forms, a material memory.

Material memory is subject to reuse. What remains, the material form of the building is reduced to a structure (or an infrastructure as in Price's Potteries

Figure 4.7.3 Keilewerf 1 warehouse before the renovation. Source: Keilewerf commuity

Figure 4.7.4 Keilewerf 1 warehouse after the renovation. Source: Keilewerf commuity Source: photo of the author, 2017

Figure 4.7.5 The interiors of Mercato Metropolitano Newington Causeway St., Elephant and Castle, London. Source: photo of the author, 2019

Figure 4.7.6 The interiors of Keilewerf 1. Source: photo of the author, 2018

Figure 4.7.7 showing the articulated architectural language used in the realization of the individual lots. The photos show how architecture results from the combination of a co-design of the space and the style and character of the individual. Source: photo of the author, 2018

Figure 4.7.8 showing the articulated architectural language used in the realization of the individual lots. The photos show how architecture results from the combination of a co-design of the space and the style and character of the individual. Source: photo of the author, 2018

Thinkbelt Project) for generating new uses, new users and functions. In that sense, the novelty expressed in the silver factory of Warhol, or by the Westbelt community (Dahl, 2014), was slowly replaced by a reuse diktat of real estate market operations (Zukin, 2014), losing the enchantment present in Cantacuzino's gaze in "Re-architecture: Old Buildings / new Uses".

The birth and development of the incubator model take distance from such transformation, at least in a first phase. In his book, Cantacuzino made no mention about reuse projects for new production purposes, a proof of the low appeal of this kind of model in the architectural debate (Campbell & Allen, 1987). The incubators (Chapter 2) established a different approach, characterized by a light renovation and a functional continuity, which did not require a massive conversion of the building to be adaptable to the new use, preserving continuity with its collective memory.

Without a function and losing part of its memory, what remains of the abandoned factory is its typical plan, its structure, its potential of being transformed. From this point of view, the factory is synonymous of freedom. A freedom of uses, forms and combinations that industrial space, reduced to a regular matrix, makes possible. In this sense, the case studies analyzed show an aesthetic and functional language in the use of space that reflects the freedom promoted by the factory scheme. A condition where forms are chosen through negotiation with contemporary uses and needs, inside a world of shapes and technologies inscribed in the Craft culture.

Contrary to what Marullo argued in his analysis of the factory as a coercive and regulatory tool for the mass within a precise and measured social system, "by individuating his own potential into a productive form of life" (Marullo, 2013: 257), the selected case studies show how the internal community has been able to transform the space based on communal needs. The freedom of the typical plan has been employed to accommodate personal workspaces with an inclusive organization of common areas, responding to the necessities of the whole community. It is the results of personal expression and common compromises which gave shape to a tangible, material architecture that, although its constant mutation, make accessible the interpretation of its traces, the overlap of different pieces in time, the discontinuities of an ongoing verbal discussion to maintain the freedom of creating and modifying the space. In this informal process, these places preserve visible signs of an ongoing operation of space creation; contradictions and overlaps become active parts, as memory traces, in its aesthetics and atmosphere. A natural process of adaptation and use of the space that, as the strips in Las Vegas, contains a complex relation of parts to constitute an singular landscape rising new characters and aesthetics of a contemporary architecture.

Returning to the role of Craft in our contemporary culture, it is possible to see how analogies, images, symbols of the architecture that these places show, have already been absorbed by architectural culture, especially in its interior forms. Construction materials such as plywood, or MDF, polycarbonate panels, luggage racks are combined with more noble materials in the furnishings of houses, shops, offices. Screws and joints are left visible on the rough finish of the furniture, to recall

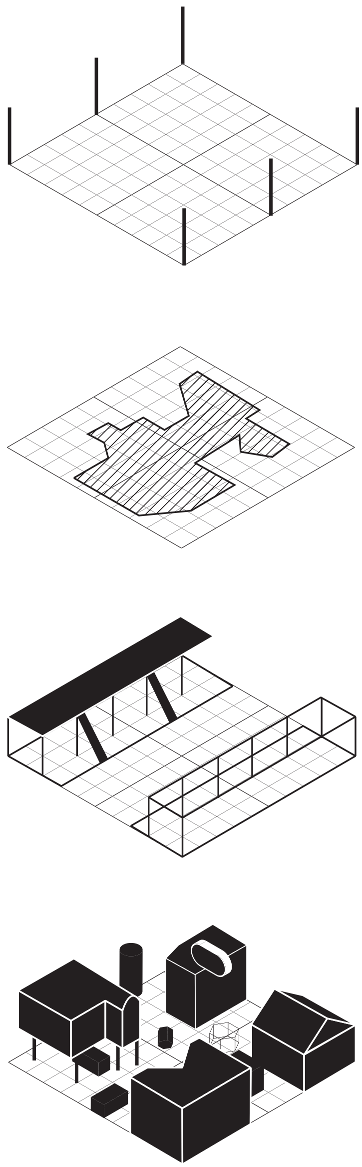


Figure 4.7.9 characters of spatial organization

a DIY aesthetic consisting of overlaps of unusual materials, lights and furnishings made from plastic or recycled wood combined with cheap Ikea furniture. A mix where the extrovert, the bizarre object is combined with a multi-coloured curtain, in which the structure of an industrial greenhouse hosts a bar whose furnishings are made by downloading a digital file from OpenDesk, cut by a CNC machine and delivered on-site ready to be assembled. It is already part of our culture. A new reuse and making culture aesthetic.

At the same time, however, the case studies showed something different. They derive from an authentic process, the result of a self-construction process by the end-user, designed to accommodate their own way of living, working and being together. The result is the definition of a fluid space, where workspaces, machines and materials are juxtaposed with offices and ateliers with large transparent acetate windows opened on the common central machine shop. Domestic and workspace have no boundaries; from the machine area staircases can lead to a mezzanine where a kitchen is equipped with all necessities or to a relax area, furnished as a small living room or a music room, where instruments are juxtaposed to work desk nearby some indoor plants, in a sequence of different scenarios.

A dense, material space. A lived space, where the freedom to explore architecture has never stopped.

Bibliography

Beauchamp, V.A. (2002) ‘The workshops of the cutlery and tableware industry in Sheffield’, in J. Symonds (ed.), The historical archaeology of the Sheffield cutlery and tableware industry 1750-1990. Sheffield: ARCUS, Studies in Historical Archaeology 1, 53-107.

Belford, P. (2001). ‘Work, space and power in an English industrial slum: the Crofts, Sheffield, 1750-1850. in A. Mayne and T. Murray (eds), The archaeology of urban landscapes: Explorations in slumland. Cambridge: Cambridge University Press, 107-117.

Berg, M. (1994) The age of manufactures 1700-1820: Industry, innovation and work in Britain. London: New York, Routledge.

Binfield, C., & Hey, D. (Eds.). (1997). Mesters to masters: A history of the Company of Cutlers in Hallamshire. Oxford University Press.

Boulsover, Thomas (1705–1788), cutler. (n.d.). Oxford Dictionary of National Biography. https://doi.org/10.1093/ref:odnb/53918

Braun, E. (2008). City Marketing: Towards an Integrated Approach (EPS-2008-142-ORG). Erasmus Research Institute of Management.

British Industrial Publishing Company. (1888). The Industries of Sheffield: Business Review. British Industrial Publishing Company.

Corsini, S. (Ed.). (1993). Le Livre à Lausanne: Cinq siècles d’édition et d’imprimerie, 1493-1993. Payot.

Crafts, . (1985) British economic growth during the industrial revolution. Oxford; Clarendon.

Cushman & Wakefield. (2008). UK Cities Monitor 2008.

Dabinett, G. (1999). Technological Change and Urban Economic Development: Local Policy in Sheffield, United Kingdom (1981-1996). Journal of Urban Technology, 6(2), 87–108.

Dabinett, G. (1995). A Economic Regeneration in Sheffield. In R. Turner, The British Economy in Transition. Routledge.

Data on Rotterdam Port economy https://www.portofrotterdam.com/sites/default/

files/facts-and-figures-port-of-rotterdam.pdf consulted on 23/10/2019

Data on the word leading container ports worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports/ consulted on 22/10/2019

Economic context and number of employees by sector Swiss Confederation's statistical surveys (2019) https://www.bfs.admin.ch/bfs/it/home/statistiche/statistica-regioni/ritratti-regionali-cifre-chiave/ritratti-citta/lausanne.html Consulted on 02/09/2019

Entzinger, H., & Engbersen, G. (2014). Rotterdam, A Long-Time Port of Call and Home to Immograntsts. Washington DC: Migration Policy Institute.

ESPON (2007). British urban pattern: population data". ESPON project 1.4.3 Study on Urban Functions. European Spatial Planning Observation Network.

Frigerio, A., & Galateo, S. (2019, October). Eindhoven has devised design weekas the driving forceto revitalized the urban fabric. Solo Noi Possiamo Fare La Città. Only We Can Make the Cities., Domus(1039), 10136–11039

Frijhoff, W., Schuyt, K., & Spies, M. (2004). Dutch Culture in a European Perspective: 1950, prosperity and welfare. Van Gorcum.

Fromhold-Eisebith, M. (2012). 8. From exit to excellence: turning old industry regions into knowledge regions through triple helix processes. In Creative Knowledge Cities: Myths, Visions and Realities, 182-213.

Gemeente Rotterdam (2017b). Het verhaal van de stad, Rotterdam in Facts and Figures. http://www.verhaalvandestad.nl

Gemeente Rotterdam (2016). Rotterdam Resilience Strategy-Ready for the 21st Century, Consultation Document. http://www.resilientrotterdam.nl/wp-content/uploads/2016/05/strategy-resilient-rotterdam.pdf

Gilijamse, R., & Bonke, H. (2009). The port of Amsterdam. Seven centuries of development. Thoth.

Griffiths, S. (2017). Manufacturing Innovation as Spatial Culture: Sheffield's Cutlery Industry c.1750-1900. In I. Van Damme, B. De Munck, & A. Miles (Eds.), Cities and Creativity from the Renaissance to the Present. Routledge.

Harman, R., & Minnis, J. (2004). Pevsner Architectural Guides: Sheffield. Yale University Press.

Havermans, D., Appel-Meulenbroek, R., & Smeets, J. (2008). Rebranding the City – The Case of Eindhoven. In Corporations and Cities: Envsioning Corporate Real Estate in the Urban Future (pp. 1–12).

Huang, W.-J. (2013). Spatial Planning and High-tech Development: A comparative study of Eindhoven city-region, the Netherlands and Hsinchu City-region, Taiwan. TU Delft.

Junod, J. (1948) . De l'Imprimerie Vincent à l'Imprimerie centrale de Lausanne: cent soixante-quinze ans de tradition typographique. Imprimerie Centrale

Korenberg, G., & Haans, F. (2015). Zuivelfabriek Friesland-Campina. Nijmegen: Monumenten Advies Bureau. Consulted on 15/11/2019

Maarse, G. (2016). Rotterdam: First Class Second City. Een zoektocht naar de Rotter- damse identiteit. Erasmus Magazine.

Marchand, B., & Lamunière, J.-M. (2007). Jean-Marc Lamunière: Regards sur son œuvre. Infolio.

Maldonado, A. F., & Romein, A. (2009). The reinvention of Eindhoven: From Industrial Town in decline to capital city of a technology and design region. In City Futures in a Globalising World Conference, Madrid.

Martin, G. (1998). L'imprimerie. Presses universitaires de France.

McCarthy, J. (1998). Reconstruction, regeneration and re-imaging: The case of Rotterdam. Cities, 15(5), 337–344.

Meier, P. (2007). Jean-Marc-Lamunière, architecte (Fédération des architectes suisses, section Genève).

Nientied, P. (2018). Hybrid Urban Identity—The Case of Rotterdam. Current Urban Studies, 6(1), 152–173.

Oord, K. van den. 1990. De boeiende historie van Eindhoven, de Eindhovenaren en Philips. In Ach Lieve Tijd, edited by Bogaart, A. et al.,103-122. Zwolle: Waanders Uitgeverij in samenwerking met het streekarchief regio Eindhoven-Kempenland en Museum Kempenland.

Orwell, G., & Blair, E. A. (1980). Down and out in Paris and London.

Open Data on Rotterdam https://opendata.cbs.nl/statline/#/CBS/nl/

dataset/37230ned/table?ts=1578685738191 consulted on 20/10/2019

Pollard, S. (1993) ‘Labour’, in C. Binfield, R, Childs and D. Martin (eds), The history of the city of Sheffield 1843-1993. Vol. 2. Society. Sheffield: Sheffield Academic Press: 260-278.

Propris L. D. and Lazzaretti L. (2009) Measuring the decline of a Marshallian industrial district: the Birmingham Jewellery Quarter, Regional studies 43, 1135–1154.

Sandler, D. (2004) Cluster evolution, the transformation of old industrial regions and the steel industry supply chain in North East England, Regional Studies 38, 55–66.,

Schippers, H. 2007. Cityplan 1967-1970. Het modernste ontwerp voor de stad. Walburg Pers ZutphenWalburg, J. (1984). The Port of Rotterdam: Gateway to Europe. Royal van Gorcum.

Sheffield City Council’s Libraries and Archives. (2010). Sources for the Study of Park Hill and Hyde Park Flats.

Singh, J., & Fleming, L. (2009). Lone Inventors as Source of Breakthroughs: Myth or Reality?. Social Science Research Network.

Swiss Confederation’s statistical surveys (2018) https://www.pxweb.bfs.admin.ch/pxweb/de/?rxid=75d1b068-edbd-45d1-ac1e-96562c057f9c Consulted on 02/09/2019

Southall, A. W. (2000). The city in time and space (1. pbk. ed). Cambridge Univ. Press.

Taylor, S., (1993) ‘Sheffield cutlery trades 1870-1914’, in C. Binfield, R, Childs and D. Martin (eds), The history of the city of Sheffield 1843-1993. Vol. 2 Society. Sheffield: Sheffield Academic Press.

Tweedale, G. (1995) Steel City: entrepreneurship, strategy and technology in Sheffield.1743- 1993. Oxford: Clarendon Press.

Vickers, J. E. (1999). Old Sheffield town: An historical miscellany. Hallamshire Press.

Walton, M., & Lamb, J. P. (1980). Raiders over Sheffield: The story of the air raids of 12th & 15th December 1940. Sheffield City Libraries.

Wray, N., Hawkins, B., and Giles, C. (2001) One great workshop: The buildings of the Sheffield metals trades. London: English Heritage.

Sitography

"City Profile Introduction". Sheffield City Council. 31 January 2013. Archived from the original on 26/03/2017. https://web.archive.org/web/20160303235737/https://www.sheffield.gov.uk/your-city-council/sheffield-profile/introduction.html

Les IRL sont partiellement sauvées. (2012, August 28). Le Matin. https://www.lematin.ch/suisse/69-emplois-sauves-irl/story/29245830 Consulted on 14/11/2019

L'IRL ferme ses portes. (2015, July 6). Le Temps. https://www.letemps.ch/suisse/lirl-ferme-portes Consulted on 14/11/2019

Official site Les atelier de Renens http://ateliersvdr.ch/fondation/ Consulted on 14/11/2019

Sheffield city concil - Sheffield's Population https://www.sheffield.gov.uk/home/your-city-council/population-in-sheffield consulted on 25/10/2019

Sheffield 'hotbed' for investment. (2005, October 6). http://news.bbc.co.uk/2/hi/uk_news/england/south_yorkshire/4314628.stm

www.west8.com/projects/strijp_s/

www.strijp-s.nl/en/history/

www.vdlindustrialmodules.nl/en/vdl-industrial-modules/geschiedenis

Interviews

Keilewerf

Buro van Wieren - First group tenants

Lenard Vunderink - Manager

Städler Made - Tenant

Bruuman - Tenant and Shop

De Bende - First group tenants and founder

Sectie-C

Joost gehem - First group tenants

Sander Wassink - Tenant and board member

Mies Loogman - Tenant and building coordinator

Nacho Carbonell - Tenant and artist

Floor Frings - Tenant

Hanne Geenen - Sectie-C manager

Rob van der Ploeg - Founder

Portland Works

PML Silver Plating - Old Tenants

Donna Bate - Manager

Sheffield Hackspace - Tenant

Bailey of Sheffield - Tenant

Locksley Distilling - Tenant

Tietzsch Guitars - Tenant

Michael May Knives - Tenant

SquarePegs - Tenant

Les Atelier de Renens

Nicolas Servageon - Economic Promotion Delegate of Renens

Juliette Lemaignen - Manager Inartis Fundation

Bullard Technology Center (Darix Sàrl) - Tenant

Karmic Sàrl / Micropat Sa - Tenants

North Thin Ply Technology - Tenant

See your box - Tenant

Chapter 5

Case studies data analysis

5.1 The incubator: strategy for urban production ecosystem

The chapter aims to highlight, through the analysis of the data collected during the fieldwork, the business structure and the characteristics of firms located inside the selected case studies. The reported analysis is the result of a survey carried out through the use of questionnaires on a sample of firms settled inside the buildings. The information collected concerns business prior location and the challenges faced in locating the company in the city, business structure and product-level distribution, commitment in the incubator community and workers information. The objective is to identify the characteristics of the companies located in industrial incubators and their relation with the urban context.

The collected information permit to identify and verify the reasons to locate in industrial incubators, what are the advantages and what relationship exists between businesses and the urban context, providing data to support the spatial and social analysis carried out in the previous chapter. Although the internal and managerial organization of incubators are subject to rapid changes, data analysis illustrate an image, a picture of the actual state of the places.

5.1.1 Case studies data analysis: intentions, method and difficulties

Before examining the case study data analysis in detail, it is necessary to specify what objectives this study wanted to achieve and the potential of this approach for the research. The purpose of the data survey has been to obtain a qualitative result, a framework to support and verify the critical issues depicted in the literature about the Urban Manufacturing phenomenon, the transformation taking place in the labour system and portray the role assumed by the incubator in fostering business growth. The data inquiry allows interpreting the phenomenon from its specific elements, the companies and the labour force.

At the same time, the survey permitted to verify the characteristics of the case studies. The collected questionnaires are an instrument to portray and identify specific features of the incubator model while presenting valuable data to verify their relationship with the urban context. For example, the analysis takes into consideration the home location of workers in order to verify if incubators provide local work and short work/home travel. Data collected are the result of the elaboration fo aggregate data from questionnaires submitted to the companies located inside the buildings between mid-2017 and the end of 2019.

Questionnaires were distributed to all companies hosted in case studies, but a high percentage of companies preferred not to provide data on their business. The report received an average 60% response rate.

The questionnaire had an objective to investigate one of the strongest issues that push towards the return of jobs in manufacturing: the highest average salary compared to other sectors, such as services. This question was often considered too personal, sometimes almost offensive, with the result that often no answer was given. It is thus evident that the use of questionnaires is useful to collect comparable data that would be difficult to collect through other instruments but the context turns out to be very adverse to an optimal use of the tool.

time to finish: **5 min**

Keilewerf - Tenants Survey

This questionnaire aims to collect data on manufacturing, craft and creative activities carried out in industrial buildings in European cities. This survey is part of a doctoral research conducted by Emanuele Protti at the Politecnico di Torino, in Italy. All data present will be used in an aggregated manner, respecting the privacy of users.

Company

name: ....
website/social: ....
e-mail: ....

Business location

Where was located the company before moving to Keiliwerf ?

- ☐ neighborhood
- ☐ city
- ☐ region
- ☐ other:

What are the benefits of being inside Keiliwerf ?

- ☐ proximity to market
- ☐ proximity to customers
- ☐ quality of life
- ☐ other:

What are the challenges in locating the business in Rotterdam

- ☐ rental prices
- ☐ labour cost
- ☐ real estate market
- ☐ other:

Prior business location

What are the reasons that led you to leave the previous location?

- ☐ insufficient space
- ☐ rent increase
- ☐ no renewal offer
- ☐ changing land use
- ☐ poor quality of space
- ☐ other:

Keilewerf as resolved the problem? (explain how)

How long was length of lease prior to relocating to Keilewerf ?

- ☐ no loease
- ☐ month to month
- ☐ 1-2 year
- ☐ 2-5 year
- ☐ 5-10 year
- ☐ 10+ year

How many times have you changed location before ?

- ☐ no moves
- ☐ 1 move
- ☐ 2-3 moves
- ☐ 4+ moves

Figure 1 example of questionnaire p.1

Business structure

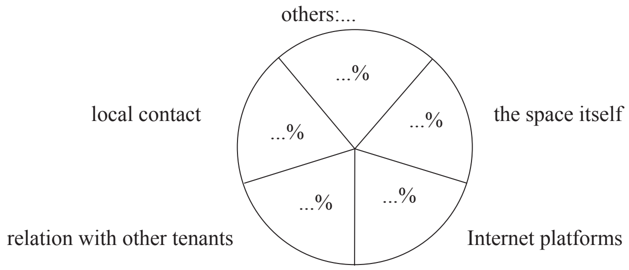
Average years in business overall — n°

Average years in business at Keilewerf — n°

Market product distribution

- ☐ neighborhood
- ☐ city
- ☐ region
- ☐ national
- ☐ international

What are the instruments for businnes development ?
(indicate percentage)



How digital platform influence your businnes ?

- ☐ online shop
- ☐ communication
- ☐ activities update
- ☐ we update our activities
- ☐ others:

Describe your work /

Indicate the most used tools or machines in your work
(min 1 - max 5)

Keilewerf community

Do you take part in the activities of Keilewerf ?

- ☐ never
- ☐ hardly ever
- ☐ sometimes
- ☐ always

Do you feel engaged in the Keilewerf community?

- ☐ never
- ☐ hardly ever
- ☐ sometimes
- ☐ always

What in the Keilewerf space layout would you change?

Figure 2 example of questionnaire p.2

Worker information

Number of workers	n°	Total
	n°	Male
	n°	Female
Workers educational level	n°	Postgraduate
	n°	Graduate
	n°	Tech school
	n°	High school
	n°	not graduate high school
Type of worker	n°	Fulltime
	n°	Part-time
	n°	Seasonal
	n°	Temporary
Averenge annual salary	....	
workers mode of trasportation	n°	Bike / Walk
	n°	Public transport
	n°	Drive

Is Keilewerf the only place of work ?

- ☐ yes
- ☐ no

If not, where you work?

- ☐ home
- ☐ cafè
- ☐ public space
- ☐ other job location
- ☐ university

Location of houses (show on the map)

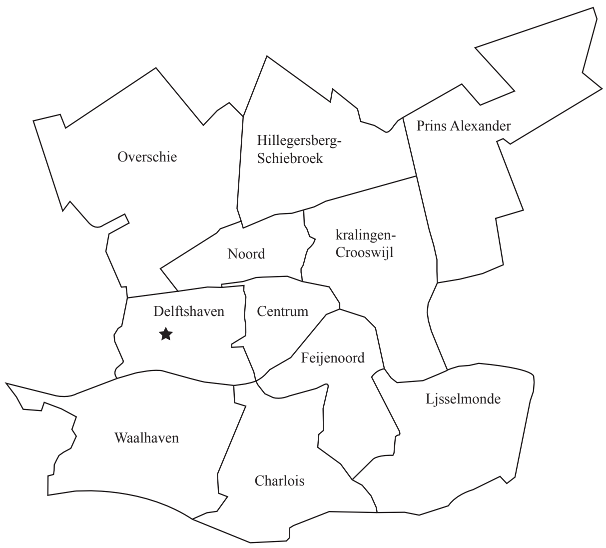


Figure 3 example of questionnaire p.3

5.2 Keikewerf data analysis

5.2.1 Business Location

The survey on Keilewerf business environment shows that a good number of activities taking place inside the two buildings, Keilewerf 1 and Keilewerf 2, located their previous activities in the neighborhood (12%) or in the city (48%). At the same time, there is a good presence of business coming from the region which underlines the effective attractiveness of the place at the local level. 18% of the reference sample started their business in Keilewerf or were based at home to contain costs at an early stage of the new business. (Figure 2.1)

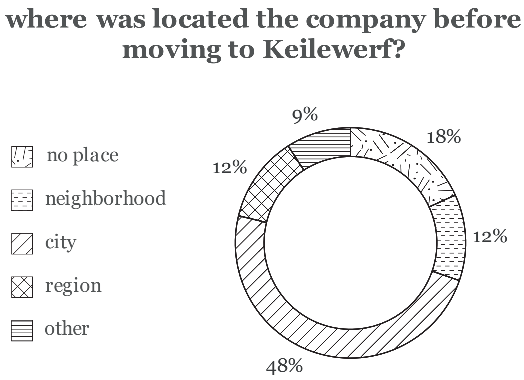


Figure 2.1 shows the location of business before moving into Keilewerf.

Keilewerf building is strategically located between the industrial area of the port of Rotterdam and the dense center of the city. Standing on a main road, accessible to heavy vehicles but also individual users from the nearby residential area, Keilewerf allows being strategically located for direct contact with customers, as shown in figure 2.7 describing the market level of distribution of activities, but also to suppliers and global supply chains.

Figure 2.2 and Figure 2.3 describe activities' benefits in locating in Keilewerf, compared with the challenges of locating a business in the city. Quality of life and proximity to the market are the most important reasons according to the reference sample. Comparing Figure 2.2 compared with the level of education and (Figure 2.16) and the type of contract (Figure 2.15), shows a correlation between the research of a good quality of life and the characteristics of workers, university education and part-time contracts required not only a working dynamism but also a variable social network that only a highly dynamic urban environment can offer. Searching for quality of life, as short home-work time travel, brings to the main constraint, detailed also in literature, of the rising rental price for industrial land inside city limits. As described by Sassen (Sassen, 2009, Winden (Winden et al., 2015) or

Leigh and Hoelzel (Leigh and Hoelzel, 2012) the redevelopment of industrial urban land for residential or service use is leading to rising rental cost for smaller activities who struggle to find a suitable and accessible place for their business.

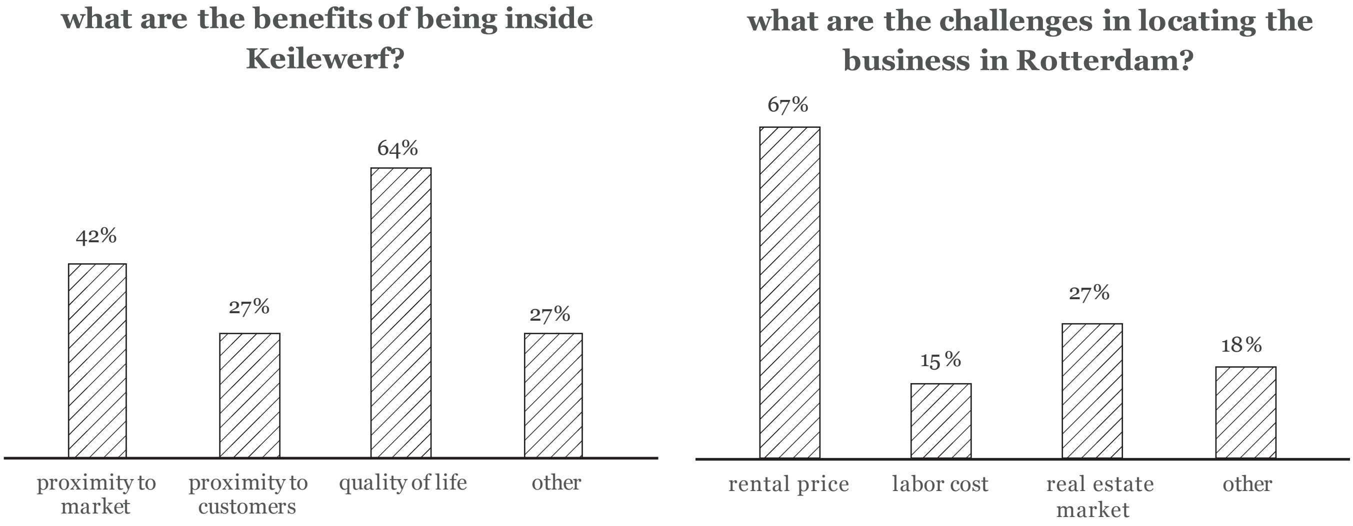


Figure 2.2: the image shows the benefits that activity has found in locating inside Keilewerf. Quality of life and proximity to the market are the most important values. 27% of other motivation is mainly attributed to social network and rental cost of Keilewerf.

Figure 2.3 shows how rental price and real estate market are the main challenges that small businesses have to exceed to locate in Rotterdam. At the same time, labor cost is not an issue for a good number of activities with one or two workers (figure 2.14), while starts to be an issue for activities employing more workers

5.2.2 Prior Business Location

The following three figures depict characters of locations and rent contracts in the city of Rotterdam thought the experience of the sample of activities considered. Spatial characters and constraints are the main reason that led to change location. At the same time, most of the activities moved only one time before locating in Keilewerf, probably in consequence of the need to restructure the business consequently to a growth in the early years, as the average market entry life is 4.6 years. Following figure 1.3, 15% of the companies have indicated an increase in rent costs. The 18% of other reasons represent a wide spectrum of answers from the desire to be closer to the city center, the search of an inspiring environment, or moving from another city.

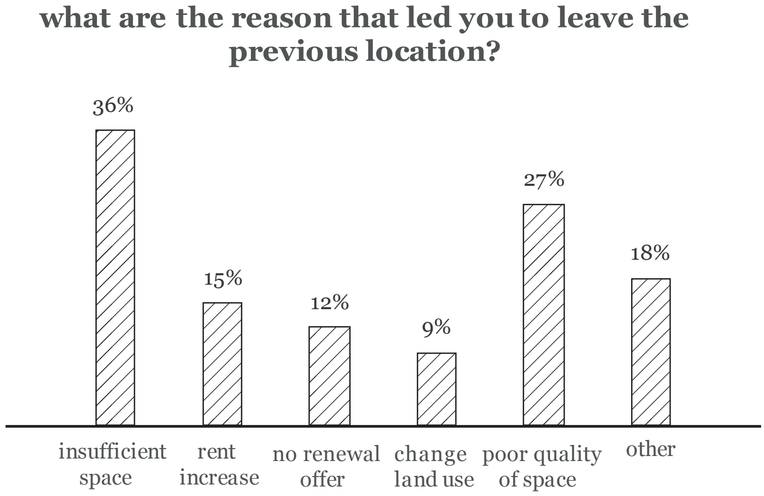
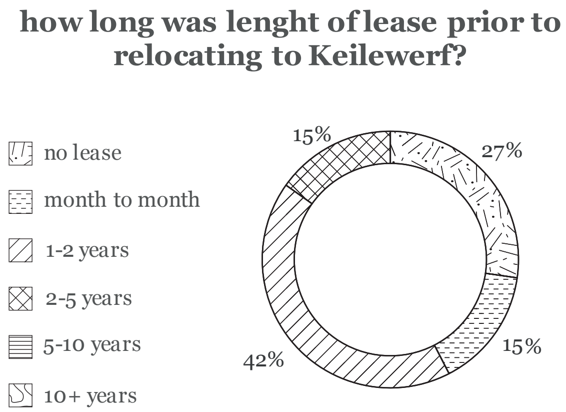


Figure 2.4: It shows the reason that led companies to leave the previous location. Insufficient space and poor space quality are the most chosen reasons. Followed by rent increase with an impact of 15% and no rent renewal. A change in land use has affected only 9% of the activities.



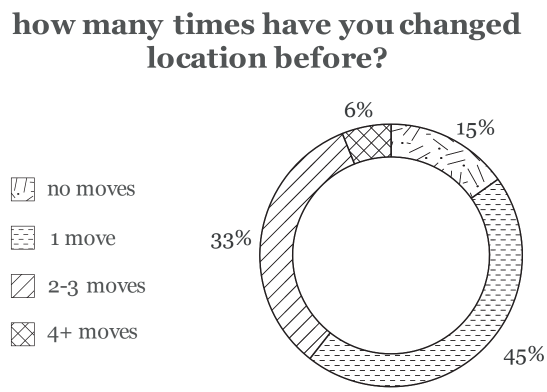


Figure 2.5 shows how long was the length of lease of activities present in Keilewerf. The prevailing type of contract is 1 or 2 years with 42% of the answers. Companies renting space from 2 to 5 years contract represents only 15% of the survey, as well as month to month contracts. Lastly, 27% represent companies without a rental contract.

Figure 2.6 shows how many locations companies changed before moving into Kalewerf buildings. 15% of companies didn't move before coming to Kelewerf, a data comparable with the 27% of business that were not paying rent in the previous location, probably using domestic or private space as working space. Instead, the majority of the activities moved one time, represented by 45%, while 33% moved from 2 to 3 times. Only 6% of the total sample has made four or more moves.has made four or more trips. This percentage represents companies with the largest number of workers and the greatest number of years of activity.

From the data reported, it is interesting to see that 15% of contract typology appear to be month by month, a contract strategy used also in Kelewerf, which allows companies to have larger economic flexibility, essential in particular for small and medium-sized companies within a market in continuous change, facing increases and contractions. The use of space and its management are again a factor of primary importance. Still with regard to spatial factors, 27% of users did not pay a rent in the previous location, traceable in the common use of private spaces such as cellars and private garages to start a business. When operational market increases or the space is no longer suitable for the performed work (figure 2.4), users are forced to locate in a new place more suitable for the request processes.

5.2.3 Business structure

The analysis of the business structures showed a prevalence of young companies (from 2 to 4 years in business) and an average of 4.6 years (figure 2.7). Focusing on Keilewerf, the analysis showed a strong presence of new activities, 30% moved inside less than one year before the survey. 21% and 24% moved inside less than two and less than three years before the survey, respectively. Moreover, the majority of the companies that moved inside less than one year before the survey are settled in Keilewerf 2: this is due to a more recent re-conversion of the building.

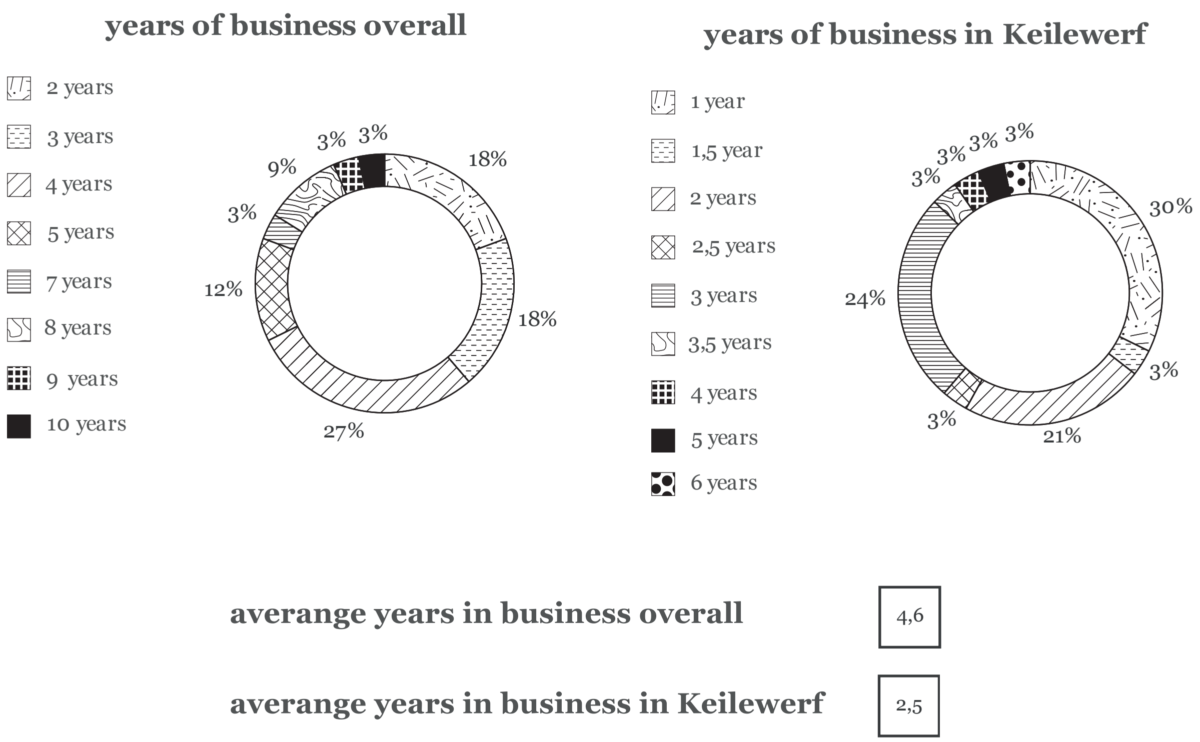
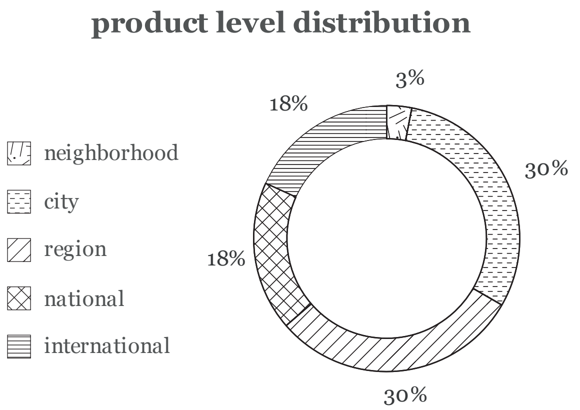


Figure 2.7- 2.8 show the years of business overall and the years of business in Keilewerf.

The level of distribution of the products is targeted to city level (30%) or regional level (30%) and showed a strong link to proximity markets especially for those activities which worked as a contractor or subcontractor into the furniture industry or in construction. (figure 2.9) At neighborhood level, the main actor is represented by the Bouw Akademie, providing training and work space to the local unemployed. The link to local markets and networks is confirmed by the role of both local network and tenant community (respectively 21% and 16%) as main driver for business development. The space itself, with a strong external image and local activities is also a driving force in business development. Internet platforms marked the highest score (30%), confirming the great contribution of digital systems within small production and sales systems.



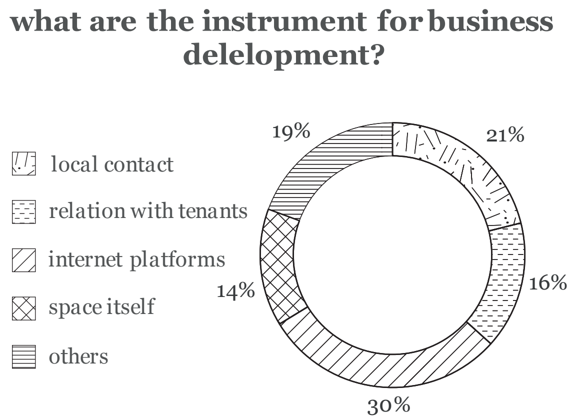


Figure 2.9 - 2.10 show the product level distribution of companies located in Keilewerf and the strategies of business development

Digital platforms are used by companies as an instrument of communication with customers and suppliers or to organize and share information about activities, products or events to enlarge digital networks and customers. At the same time, digital platforms are also sales platforms, 39% of companies in the survey declared the use of a website or social media as their main sales market. Morover, the survey showed that 70% of the communication activities were subcontracted to external agencies, further improving the local economy.

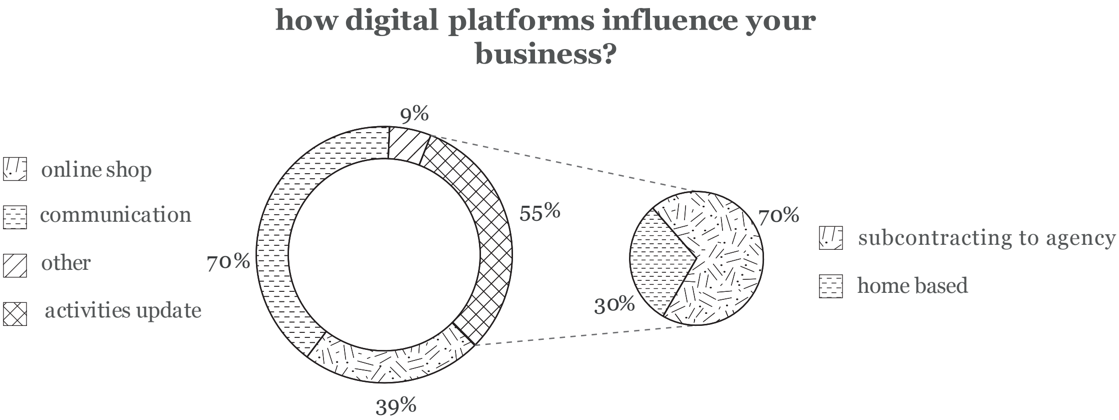
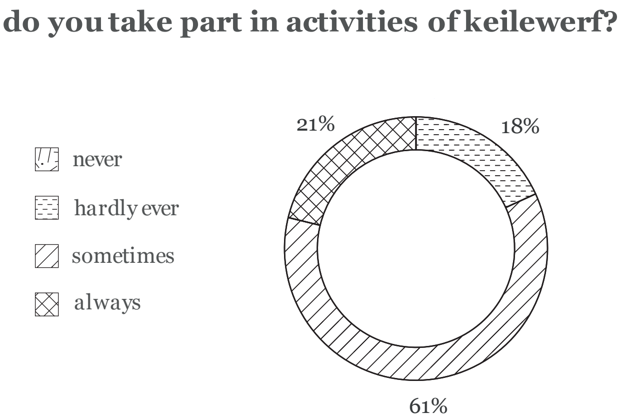


Figure 2.11 show the relation of companies located in Keilewerf with digital platform

5.2.4 Community

The high level of engagements between users is marked by the higher percentage of involvement both in common activities and events open to the public, but also in sharing spaces, machinery and knowledge. A large number of companies have identified the strong community as a key value of Keilewerf as a vibrant place for setting a business.



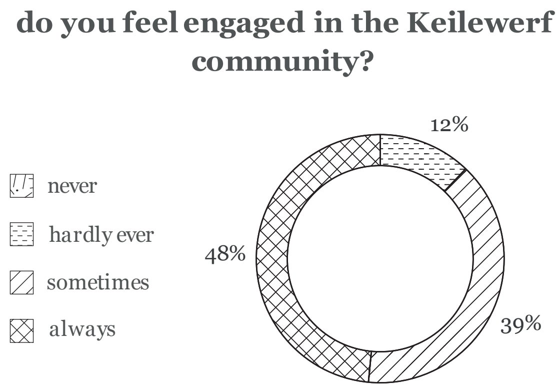
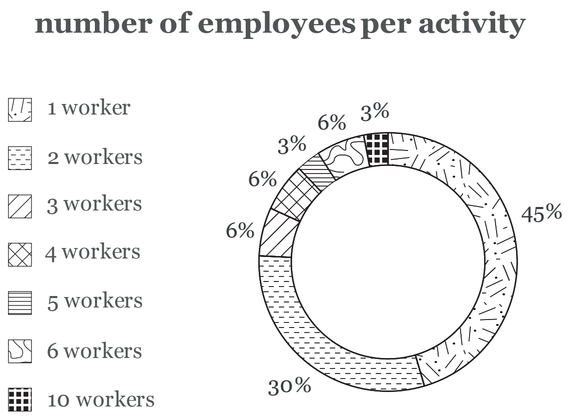


Figure 2.12 - 2.13 showed the level of engagement of users into Keilewerf community and shared activities.

5.2.5 Workers information

The survey on workers characteristics showed a great majority of business involving a single person or two people, respectively by 45% and 30%. The remaining 24% consists of activities that have between 3 and 10 employees. The activities with the largest number of employees are, Studio Joost with 10 employees with part-time work contracts, Burmaan and De Bende. The majority of Self-employed (one person business) has declared to work full-time in Keilewerf, while two people activities present most cases of part-time contracts.



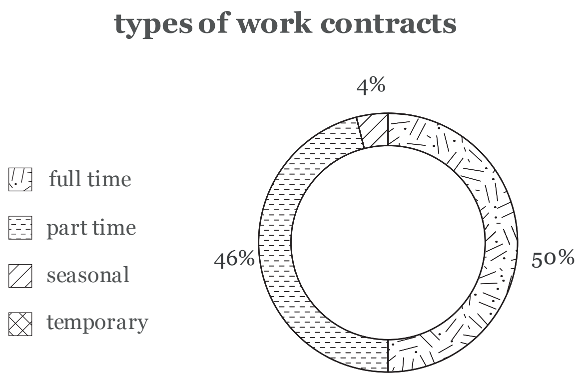


Figure 2.14 number of activities per number of employees. Figure 2.15 number of workers per typology of contracts.

The analysis on workers educational level showed a high level of education. 58% of the sample graduated from university and 33% accomplished a post-graduate diploma. Moreover, 17% completed technical school while only 7% started working after completed high school.

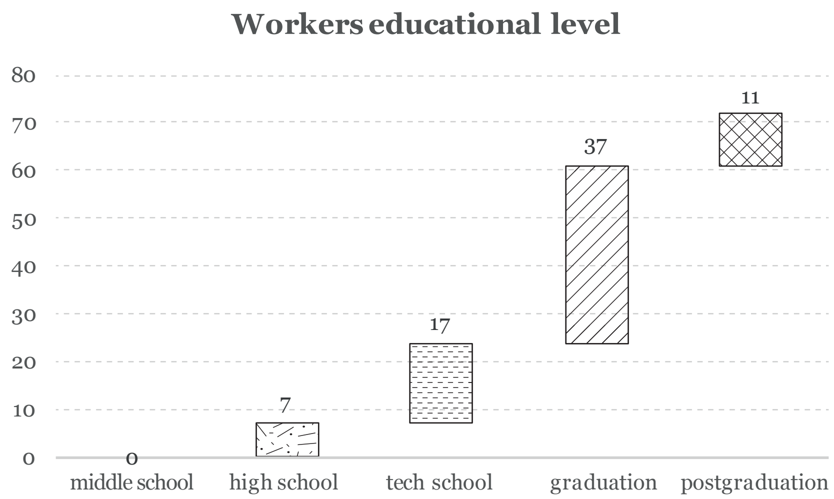


Figure 2.16 workers educational level.

Home/work means of transport

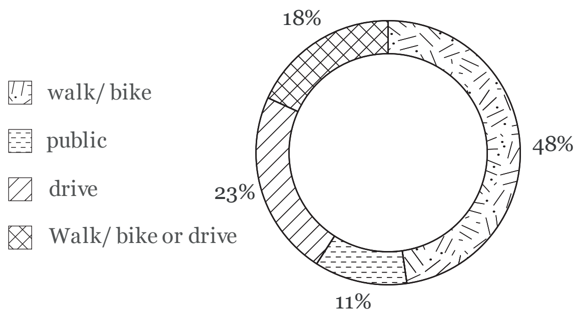


Figure 2.17 Preferred means of transportation for home-work travels. The survey showed that 70% of workers reach their workplace by foot or bicycle.. 11% of the sample used both bike/walk and car. Public transport was chosen only by 18%, while 23% prefer their private car.

Within the phenomenon of Multi-local working, the survey asked users to indicate whether Keilewerf was their only place of work and otherwise what were the other places used for this purpose. The survey showed little difference between those who use Keilewerf as the only workplace and those who do not. The survey showed little difference between those who use Keilewerf as their only workplace and those who do not, respectively 55% and 45%. Among the places designated by the chosen sample are the domestic environment with 33%, public spaces and coffee shops were chosen by 26% while 15% work at the university, probably because they are still studying or attending second-level courses. Some of the users interviewed stated that they work as assistant professor or researcher in a part-time university environment. 19% of the total number of users also owns a second job, this percentage must be compared with the percentage of part-time workers (Figure 2.14)

is Keilewerf the only place of work?

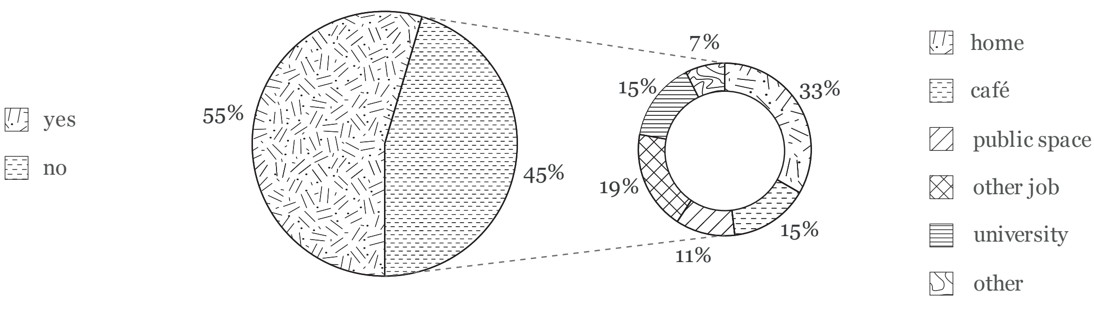
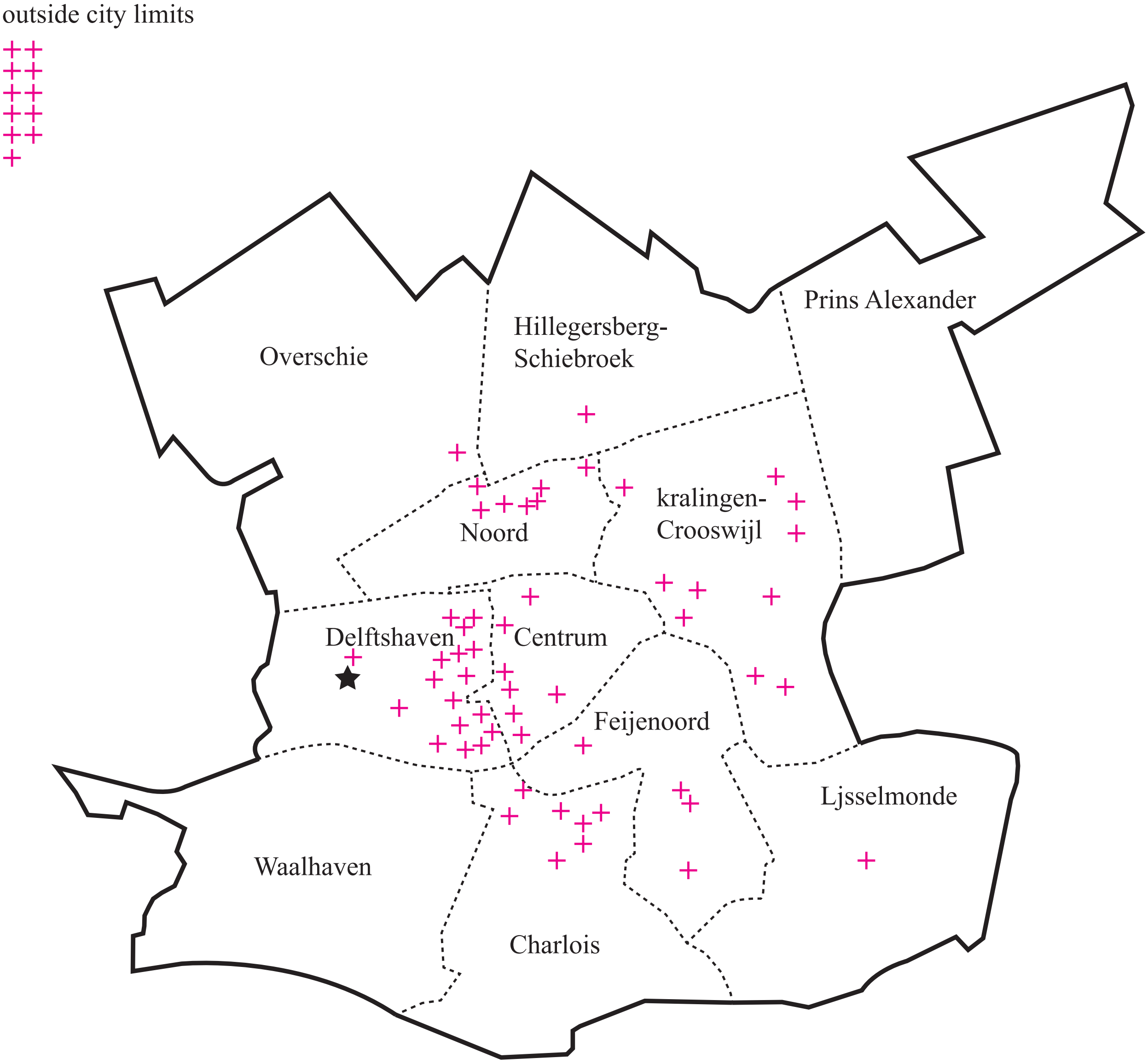


Figure 2.18 show which places are used by tenants to work

5.2.6 Home location



5.3 Sectie-C data analysis

5.3.1 Business Location

Within the economic context of Eindhoven, the companies that are today located in the Sectie-C come mainly from the local context. More than half of the total were previously located in the city (16% in the neighbourhood, 42% within the city) or from the region (13%), supporting the literature that describes Eindhoven as a place capable of attracting and creating businesses through programs such as the Brainport, the Eindhoven Design Academy, the BrabantStad urban network and other local actions. 13% of the companies were born within the Sectie-C complex. Often, these companies operated informally in the first period by employing a flexible organization without the need of a physical fix space. Many small companies or studios are born directly inside the university premises during the years of study, taking advantage of the infrastructure made available by the university body. It also explains the relationship between fig. 5.3.1 and fig. 5.3.5, in which 27% of the activities before did not pay rent moving to Sectie-C.

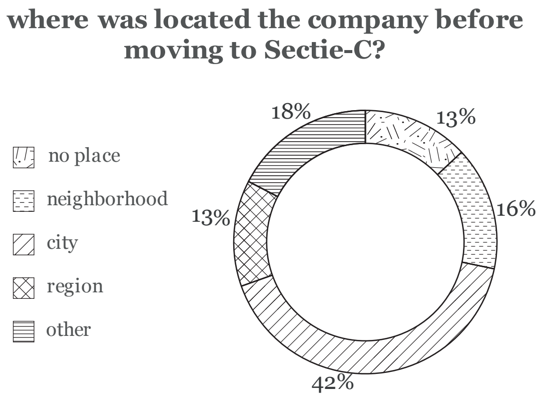
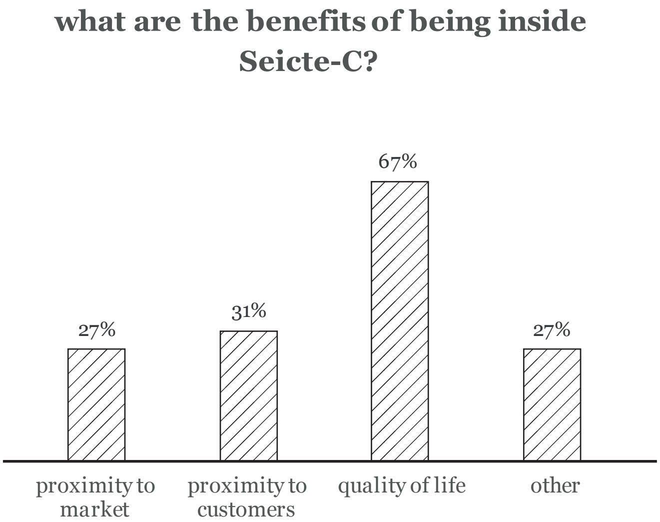


Figure 5.3.1 shows the location of the business before moving into Sectie-C.

Figure 2.2 and Figure 2.3 describe activities' benefits in locating in Sectie-C, compared with the challenges of locating a business in the city. In figure 3.2 the quality of life is considered the most relevant factor in locating within the Sectie-C complex (67%), the reasons can be observed in the organization and characteristics of the spaces and the in the high-grade of social connections. In 2018, Sectie-C community founded an association of tenants to discuss the development process of the area, the problems of the different buildings and to organize large-scale projects. This condition has given companies greater confidence in the future of the area by stimulating individual and community growth. Proximity to market (27%) and proximity to costumers (31%) are instead considered secondary factors as most companies operate on an international scale (Figure 3.9), taking advantage of the developed infrastructure and logistics networks as well as digital platforms.



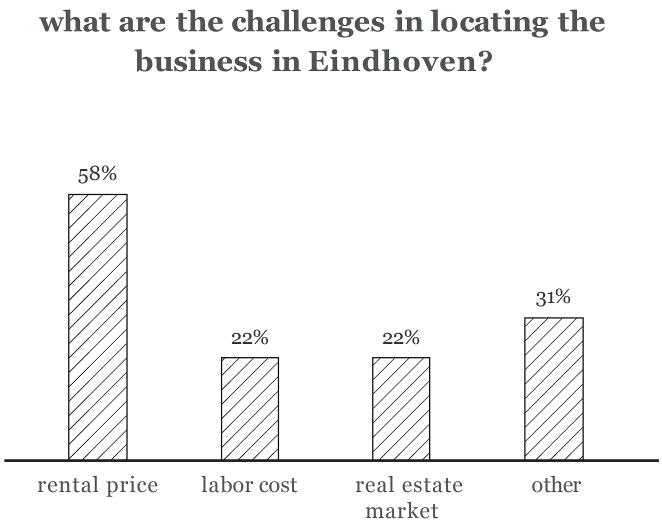


Figure 3.2: the image shows the benefits that activity has found in locating inside Sectie-C. Quality of life was indicated as the most important factor, followed by the proximity to the market (27%) and proximity to customers (31%). Others motivations are mainly related to the architectural features of the complex that respond well to production needs, and the preservation of the industrial use in the future development of the area.

Figure 3.3 shows how the rental price is the main challenges that small businesses have to face in locating their business in Rotterdam. Other motivations relate to intense competition in design and innovation sectors, housing shortage and low spatial quality of industrial buildings.

At the same time the cost of rents is indicated as the critical element to locate companies in Eindhoven (58%) as the growth of the technological, design and innovation sector, supported by urban transformations such as the re-development of the Strijp -S led to an increase in rental costs in the Eindhoven area (Figure 3.3)

5.3.2 Prior Business Location

The following images describe the motivation that led companies to move from the previous venue and the characteristics of the contracts. The motivations that led companies to change their venue has resulted in being homogeneously distributed between the different options. The lack of space is the most incisive factor (20%), corresponding to the problem of finding an industrial space satisfying the needs and growth of businesses throughout the Eindhoven territory. The increase in the cost of rents (18%), an incisive factor for the growth of a company especially in the early years on the market, is the second factor that influenced companies to move, corresponding to the high demand for these spaces in the area. Those two factors are followed by the low quality of the spaces (16%) and the decrease in rent renewals (13%). Other reasons concern situations of occupied disused industrial buildings which have been subject to redevelopment processes. (Figure 3.4)

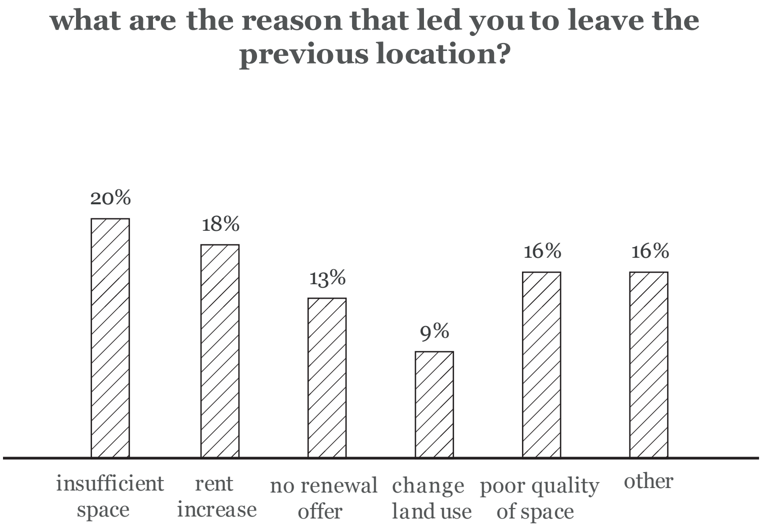
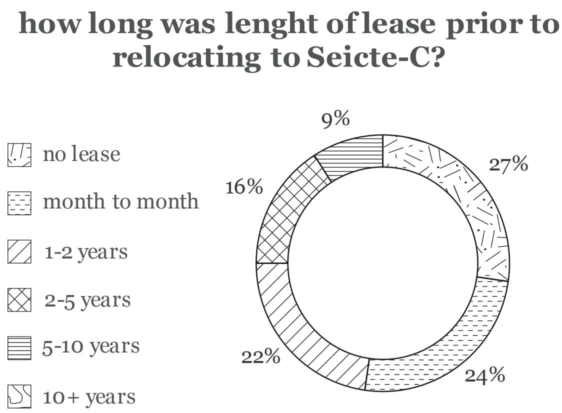


Figure 3.4: It shows the reason that led companies to leave the previous location. Insufficient space and rent increase are the most chosen reasons. Followed by poor quality of space with an impact of 16% and no rent renewal. A change in land use has affected only 9% of the activities.



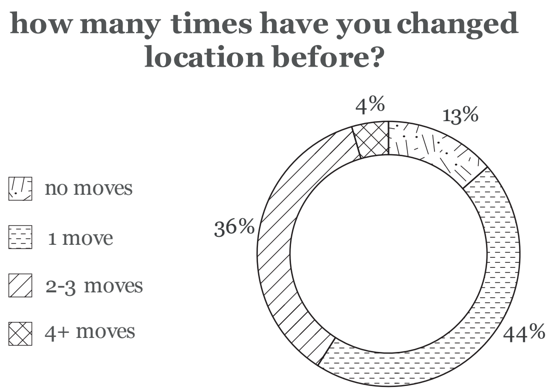


Figure 3.5: The figure shows how long was the length of lease of companies before setting the activity in Sectie-C. The most common type of contract has a minimum duration of one month, renewed month by month. The second most used contract formula provides a duration of 1 year. Instead longer durations are less common. A large number (27%) of the businesses did not pay a rent previously, a data comparable with the 13% of figure 3.6 representing companies which didn't move before establish their businnes in Sectie-C. These numbers represent companies which started their business in domestic or public facilities as university.

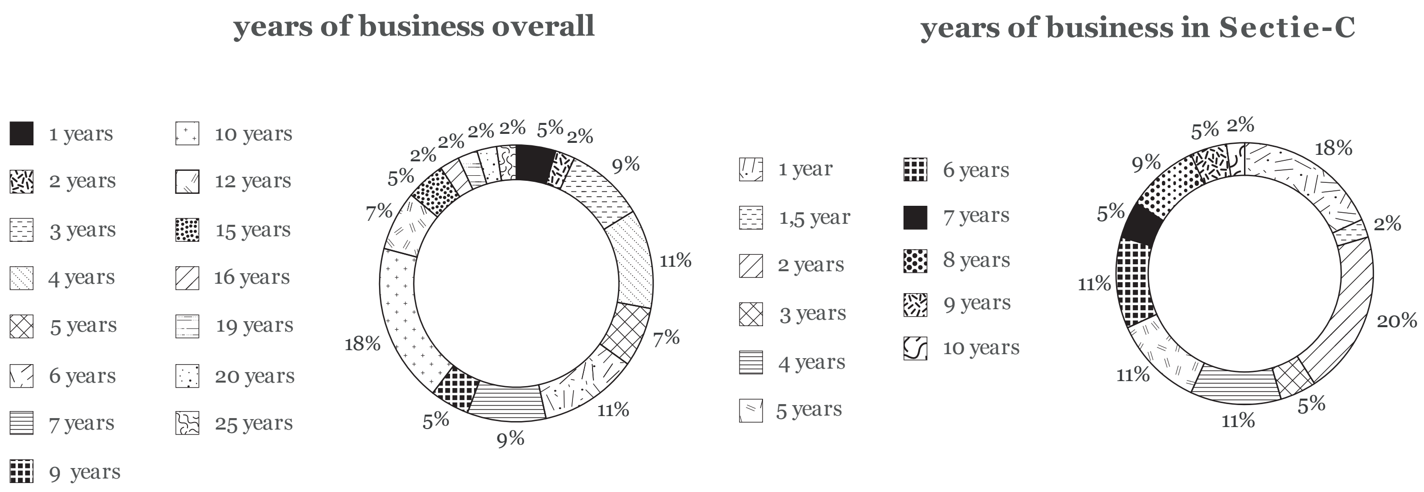
Figure 3.6 shows how many locations companies changed before moving into Sectie-C complex. 13% didn't move before coming to Sectie-C. The majority moved once, representing 44% of the analysis sample. 36% moved between two and three times and a small percentage (4%) had to change locations more than four times

The data shown in figure 3.5 describe the most frequent types of contracts in the Eindhoven area. It should be noted that the highest percentage (44%) regards types of short contracts, renewed month by month. The high flexibility that this type of contract gives the change to companies to manage their rental contract in an agile way, a fundamental factor in a highly variable market. At the same time, this type of contract produces an opposite and often underestimated effect. While high flexibility results in an advantage for the company, short contracts expose companies to a high degree of uncertainty about the rental venue with the risk of interruption of the rental contract. This situation of uncertainty leads companies not to invest in maintaining the building and in the quality of their workspace. An operation that over time can lead to necessary significant renovation works.

Instead, figure 3.6 shows how many times, companies have changed locations before renting a place within the Sectie-c complex. The graph shows that 13% have not changed places previously, representing the companies that were born within Sectie-C. 44% of the reference sample moved once. This large percentage represents small businesses, often represented by self-employed individuals, who subsequently to a growth in business needed to find a stable place to work. 36% of the companies moved 2 or 3 times, and only 4% of the total sample moved more than four times.

5.3.3 Business structure

The analysis of the business structures shows that within the Sectie-C complex, there is a balance between young and more experienced companies, already



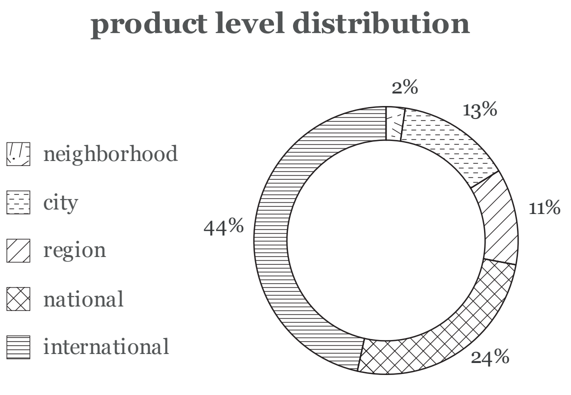
averange years in business overall 8,0

averange years in business in Seicte-C 4,1

Figure 3.7- 3.8 show the years of business overall and the years of business in Sectie-C.

established on the market. 45% of the analized sample are young companies, operating on the market from 1 to 6 years, while 55% are companies that are present on the market from 7 to 25 years. This balance between young and more stable companies is one of the key characteristics of Sectie-C. The complex is characterized by extensive collaborations between tenants as subcontracts, the supply of labour and materials or join projects. These practices are possible thanks to the wide range of skills and experiences that allows small companies to be supported in their growth and large companies to maintain a degree of innovation induced by the surrounding environment. (figure 3.7)

Analyzing the Sectie-C complex, the survey indicated that most companies have rented a space inside it for less than 5 years (56%). 11% represents the activities present for 6 years while 7% represents the first founding companies. (figure 3.8)



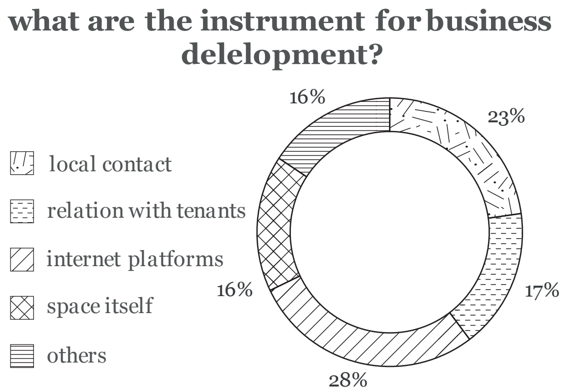


Figure 3.9- 3.10 show the product level distribution of companies located in Sectie-C and the strategies of business development

Sectie-C is a complex strongly linked to the international design network, hosting designers who interact strongly with local companies for the development of prototypes and products but who resell on a niche international market supported thanks to the digital platforms (Anderson, 2013)(see Figure 3.11). Although the sales market internationally spread, the strong collaboration between local manufacturing companies and designers still creates local value. A high percentage of firms (24%) distributes their products on a national scale or a regional scale (11%) representing large companies working on an industrial scale, covering a stable local demand. Lastly, 13% represent companies that distribute their products on an urban scale. This category represents different types of companies as graphic designers or photographers, carpenters, the laser cutting company, etc.

Figure 3.10 shows instead which tools are used for business development. Digital platforms are confirmed as the predominant tool (28%) in the development of individual companies. Like digital relationships, physical relationships also play an essential role. Relations with tenants (17%) and local contacts (23%) are crucial tools for the development of new concepts, prototypes and products (see figures 3.7 and 3.8). The physical location and architecture of Sectie-C also play an important role. Over time, from Dutch Design Week events to visits by tourists, onlookers and customers, space has taken on an increasingly important role, transforming itself into a brand and a sponsoring platform for the activities of the tenants.

By analyzing the business development tools emerged the importance of digital platforms. 80% of the companies within the reference sample have a website and social platforms to manage communication with customers and suppliers. 27% sell their products online, while 53% use digital platforms to sponsor their business and products. (Figure 3.11)

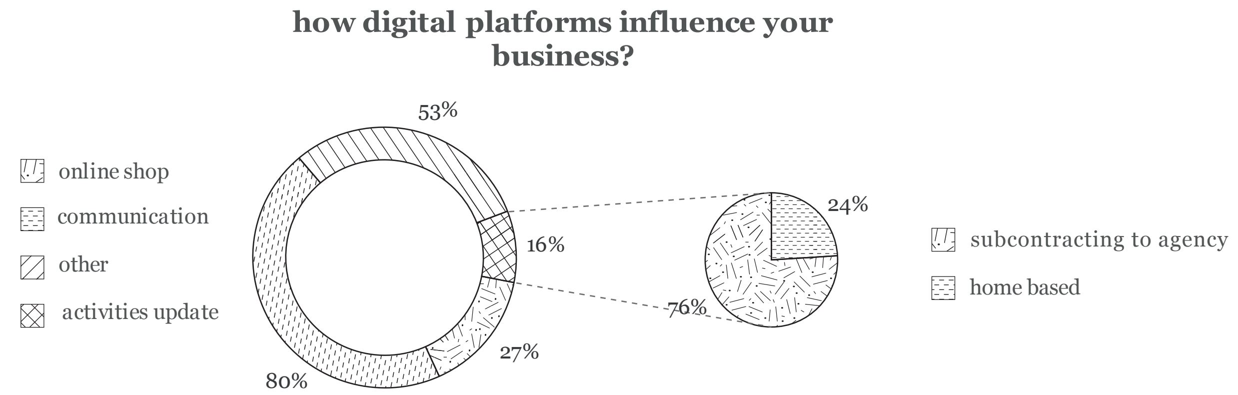
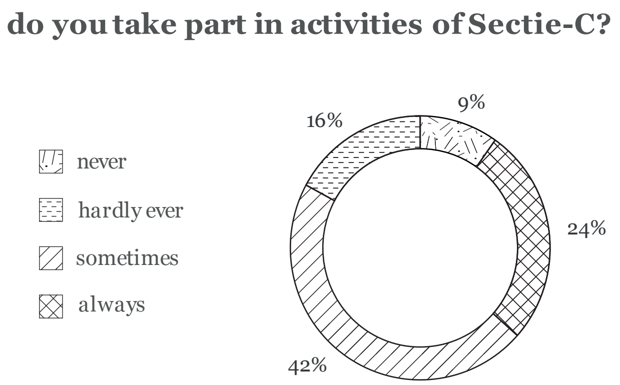


Figure 3.11 shows how digital platform influence the business of companies located in Sectie-C

5.3.4 Community



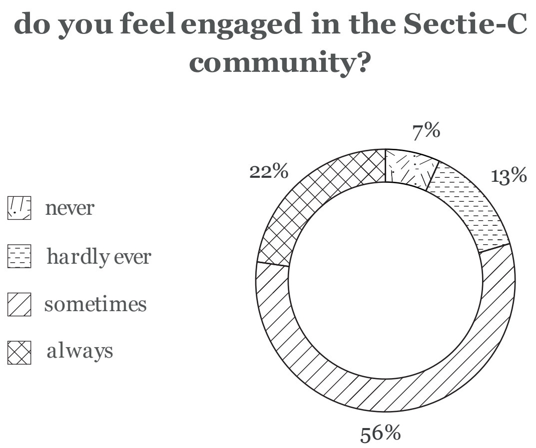
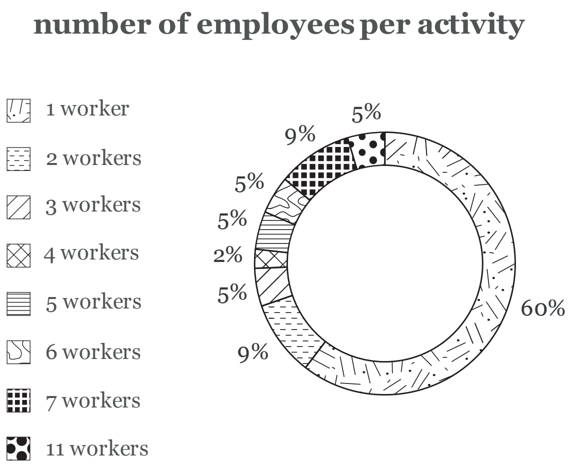


Figure 3.12-3.13 showed the level of engagement of users into Sectie-C community and shared activities.

Since 2018 the tenants hosted within the complex have founded an association and a fundation to carry out events, project and apply for funds. They also produced a vision book on the future development of the complex sharing a common vision and a sense of belonging to the place. This operation increased the level of interaction between different activities by sharing a common idea of development. In the same way, the analysis of the complex and the spatial organization highlights a high degree of sharing and interaction in the development of projects. Furthermore, the presence of different activities, small and medium-sized enterprises, with different experiences and knowledge (Figure 3.7) allowed knowledge spillover processes among users. (Figure 3.12 and 3.13)

5.3.5 Workers information

The survey on workers characteristics showed a vast majority of business involved a single person (60%) who can be associated to the high number of designers who completed their studies at the Design Academy in Eindhoven and try to enter the market by founding their own company. This also explains the level of education (Figure 3.16), showing that 31% of users possess a postgraduate diploma and 40% possess a graduated diploma. 14% of the users in the sample completed their studies in a technical school. These professional figures are for the most part included in the larger companies whose market is located at a regional level (Figure 3.9).



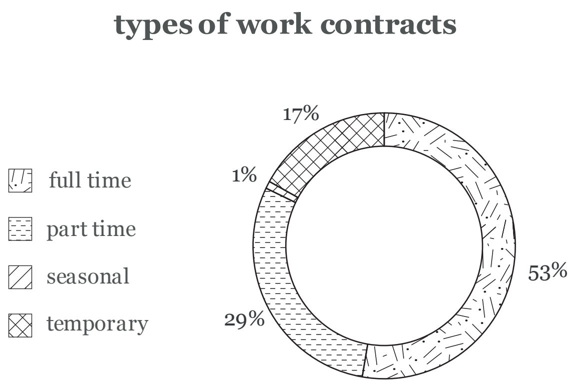


Figure 3.14 show the number of activities per number of employees.

Figure 3.15 The figure shows the number of workers per typology of contracts.

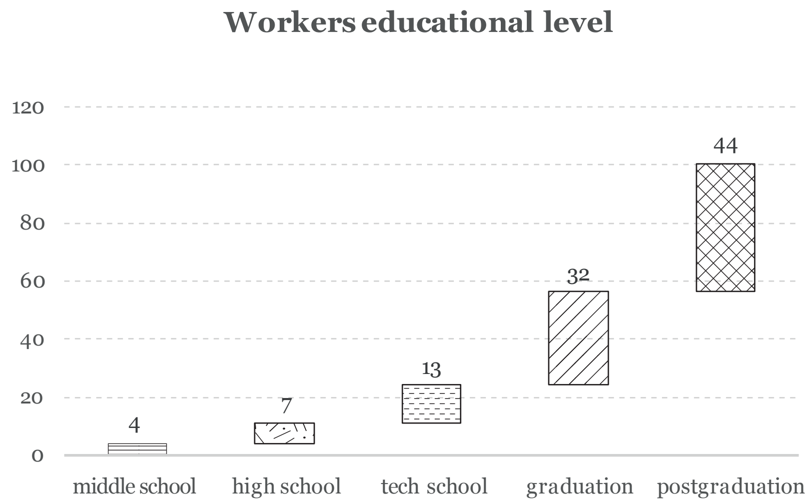


Figure 3.16 workers educational level.

Most workers have a full-time contract (53%) highlighting the high frequency of use of the complex (Figure 3.14). One-third of workers (29%) work only part-time inside the complex, comparable with the result shown in Figure 3.17 about which places outside Sectie-C are used to work. Most workers declared to reach Sectie-C by different means of transport depending on specific situation and weather. 33% prefer to use a car or bicycle. Instead, public transport is rarely used (5%) as the complex is poorly connected with the rest of the city.

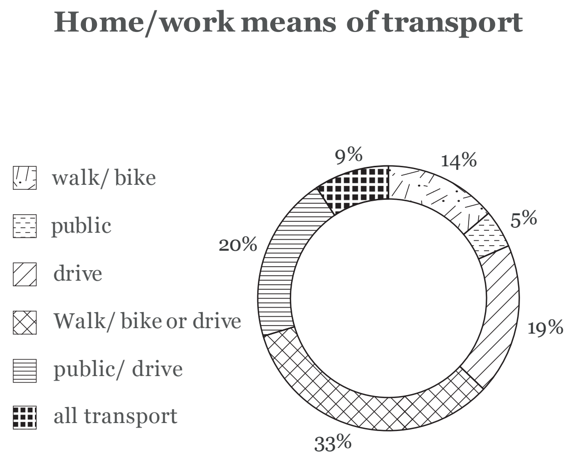


Figure 3.17 Preferred means of transportation for home-work travels. The survey showed that 33% used both personal car and bicycle, while 20% used to choose between public transport or drive. A there is a massive influx to the building using the private car (19%), and users can take advantage of private parking spaces located within the complex. Users who use only public transport are very few (5%) as the complex is not well connected to the rest of the city.

is Sectie-C the only place of work?

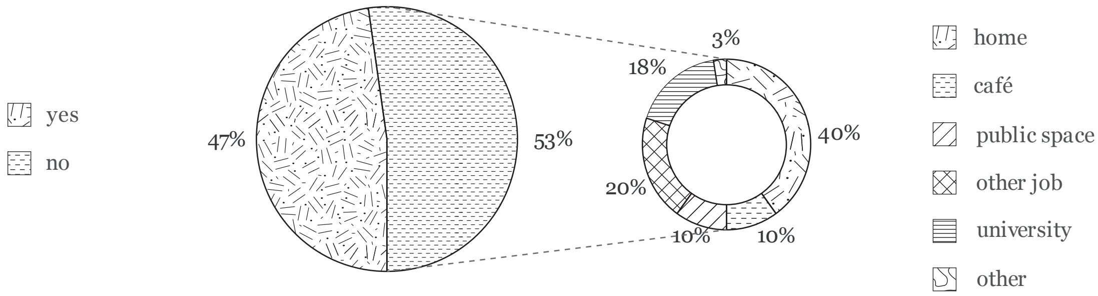
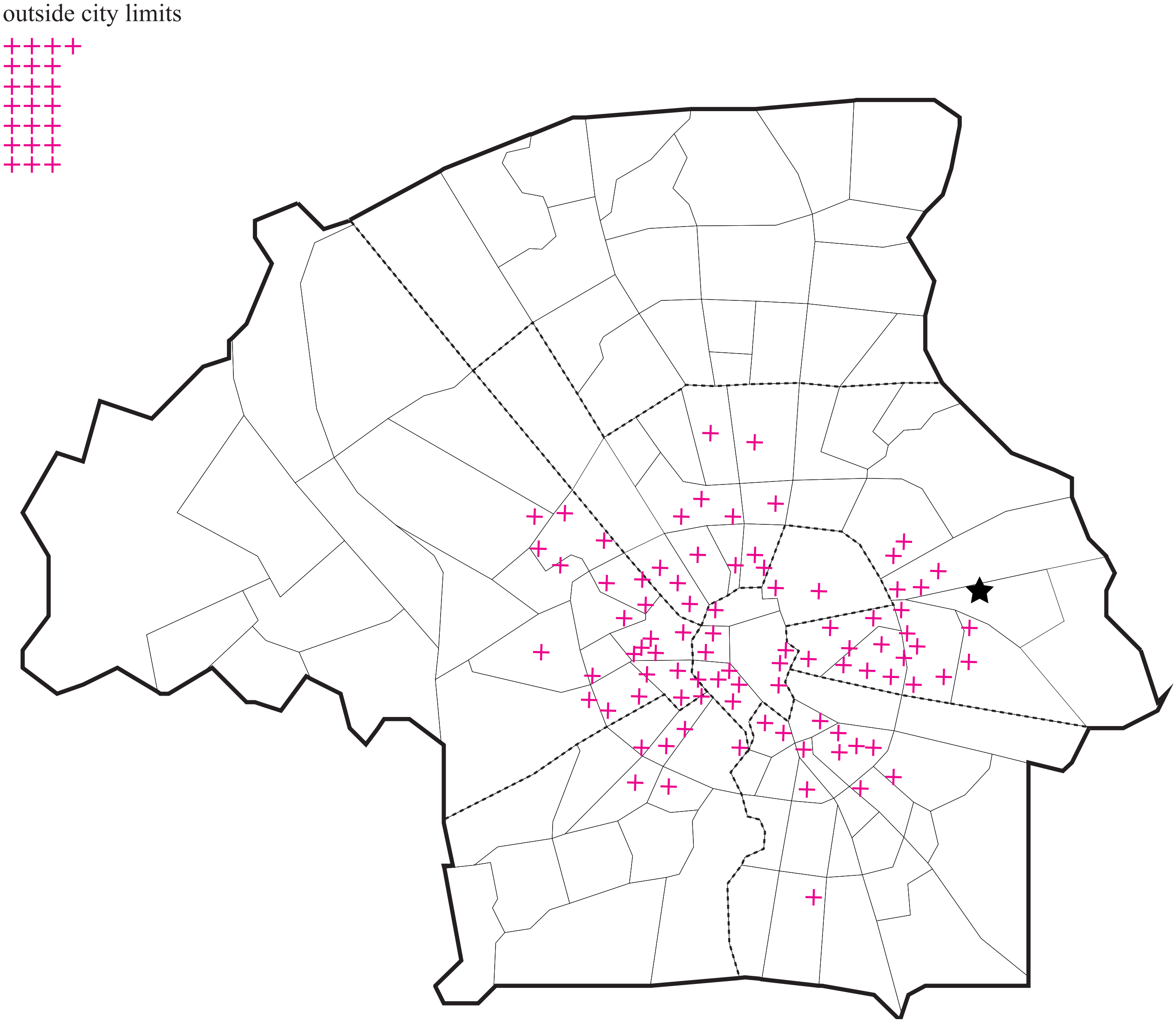


Figure 3.18 show the other places of work of the workers.

The questionnaire aimed to verify if Sectie-C was the only place of work for the users interviewed. 53% of the total number of the sample said that Sectie-C is not the only place where they worked, reinforcing the idea that digital tools and new production technologies allow users to develop products and services even in places that are not functionally organized for working activities. 40% of the total number stated that they also worked in the domestic context by strengthening the literature on the theme of multi-local working, which describes the domestic context as a place that increasingly takes on work functions. A high percentage also has another job (20%) as confirmed by the high number of part-time contracts (29%) described in Figure 3.15. Finally, 18% work inside the university as professors or as researchers and 20% used to work in public spaces or inside bars and cafés.

5.3.6 Home location



5.5 Portland Works data analysis

5.5.1 Business Location

The survey on Portland Work business environment shows that a good number of activities taking place inside the building located their previous activities in the neighborhood (22%) or in the city (48%). The neighborhood is recognized for its industrial characters. Portland Works is located n the 'John Street Triangle', today a heritage conservation area formed by an enclave of 11 surviving nineteenth-century industrial buildings. Concurrently, 13% of the businesses are coming from the region. Instead 18% of the reference sample started their business in Portland Works or were based at home to contain costs.

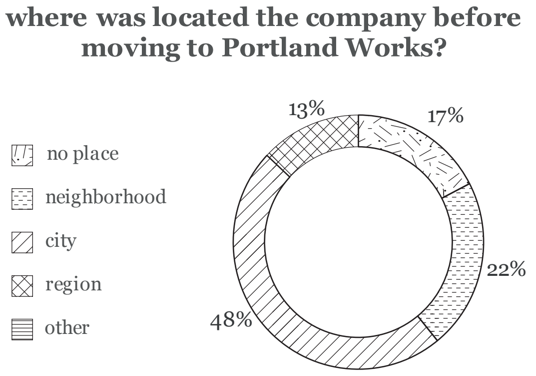
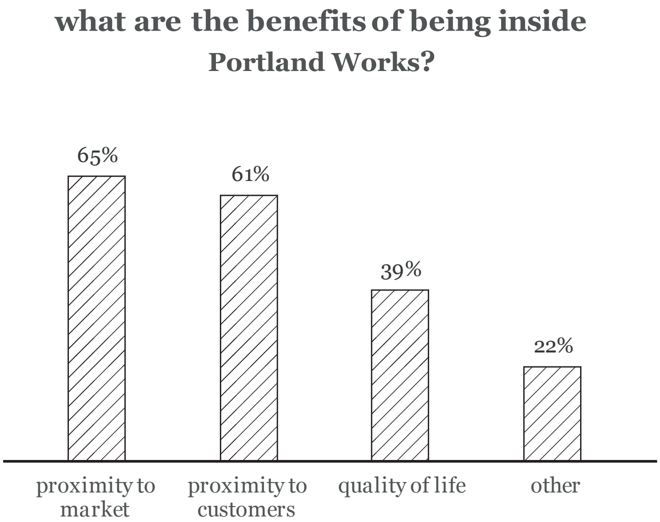


Figure 5.1 show were business were located before moving to Portland Works. 17% of business started on Portaland Works or were based home. 22% were located in the neighborhood while 48% were located in the city. Finally th3 13% came from the region.

Portland Works is home for many small businesses closely related to the local area and market. Most industries are still tied to the historical steel industry and the famous cutlery industry. For this reason, the results of the questionnaires showed that for 65% of companies the most important benefit of being located in the Portland Works building is the proximity to market (65%) and proximity to customers (61%). The quality of life reaches only 39% as the building still needs major external and internal renovation works. In addition, many of the workers do not live in the city of Sheffield but only go there to work. (Figure 5.2)

At the same time, companies interviewed indicated the cost of renting as the most significant difficulty in opening a business in Sheffield (74%). Sheffield is transforming its urban-industrial fabric to build new residences in particular related to the student sector, promoting its image as a student city leading to a vast transformation of its urban tissue and its history. An example of this transformation is visible on Kelham island, one of the most important industrial areas of the mid-



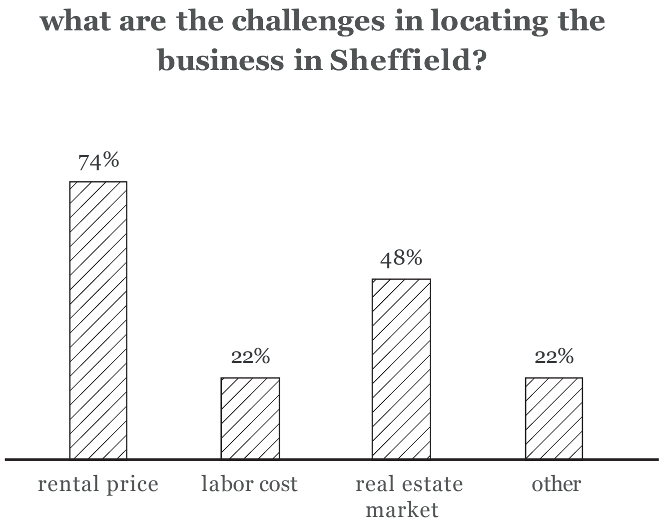


Figure 5.2: the image shows the benefits that companies found in locating their activities inside Keilewerf. Proximity to the market and customers are the most critical factors with respectively for 65% and 61%. Secondly, the quality of life with 39% has been reported as a critical aspect. Other factors were related to co-location of activities related to the cutlery industry and the will to be part of the community and the history of a remarkable industrial monument.

Figure 5.3 shows the difficulties in locating a business in Sheffield. Rental price has been chosen as the most crucial factor with 74%. Another critical factor is the real estate market, as the city is proceeding with the functionalization of most of its industrial areas. Finally, labour cost and the crisis of the local industrial sector cover 22%.

nineteenth century today transformed for residential purposes. These transformations lead to the second challenging facto which is the real estate market (48%). Finally, also the cost of skilled labour (22%) is a challenge, especially for those activities related to the artisanal production of cutlery and other metal utensils that do not attract the interest of the young population.

5.5.2 Prior Business Location

The following section describes how many changes of location the companies made, what were the reasons that caused these location changes, and what class of contract they were subject to. Figure 5.4 shows the reasons that led companies to change location. The most relevant factor was the increase in rental costs. This factor follows the previous results (Figures 4.2 and Figures 4.3) regarding the ongoing transformation of the city of Sheffield and the re-functionalization of industrial areas with a relative increase in rents in areas that still maintain their industrial function. The second factor concerns the low quality of the spaces. As Portland Works, the urban industrial fabric dates back to the early stages of the industrialization of the city and for the most part requires extensive restructuring. The insufficiency of space and the change in land use are the third factor indicated with 13%.

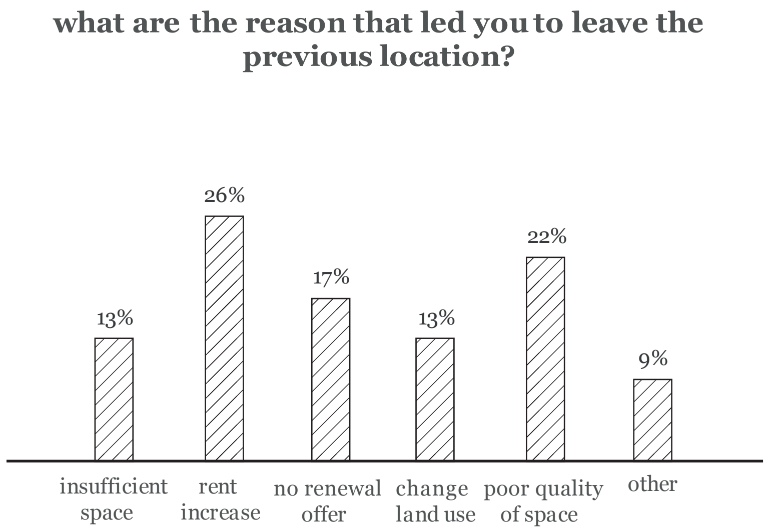
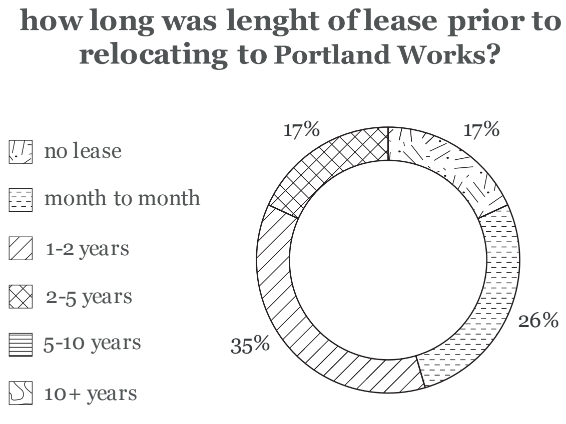


Figure 4.4: It shows the reason that led companies to leave the previous location. Rent increase has been the most critical factor (26%). The second has been the poor quality of space (22%) followed by no renovation of the lease contract (17%). Insufficient space and a change in land use has been indicated by the 13% of the sample.



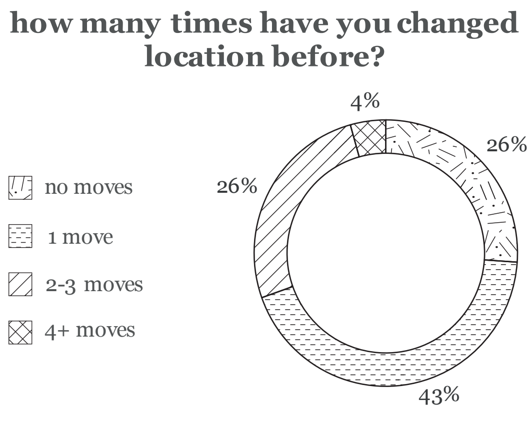


Figure 5.5: The figure shows how long was the length of lease of companies before setting the activity in Portland Works. Companies with no lease corresponded to 17%. Month to Month contract was the second most common contract typology corresponding to 26% while one to two years were the most common with 33%. Lastly, 17% of companies declared to posses from two to five years contract.

Figure 5.6 shows how many locations companies changed before moving into Portland Works. 26% did not move before. Most of the companies moved one time (43%) or between two and three times (26%). Only a small percentage moved more than four times.

Figure 5.5 and 5.6 describe the types of contracts that the companies had before locating themselves in the Portland Works building and how much travel they made. The first graph shows that the most used type of contract requires at least one or two years of rent. The second type concerns rents renewed month by month while the other categories are a minority. Most companies moved at least once before being hosted in Portland Works. A quarter of the companies interviewed moved between two and three times indicating high industrial mobility in the area.

5.5.3 Business structure

Since its construction, the Portland Works building has always housed companies and industrial functions within it. The building continued to host companies also after the change of owners in 2015 and the start of the restructuring operations. Some of the actual businesses have been located in the building for more than sixty years. For this reason, the analysis has brought to light a very varied panorama. Figure 5.7 shows that most companies have been on the market for less than ten years (55%), of which the highest percentage has been on the market for just four years. At the same time, Figure 5,8 shows that most companies are hosted in the building from for three or two years (44%). 33% of companies occupy a space inside the building from 4 to six years, while several companies are there from fifteen to sixty years (12%).

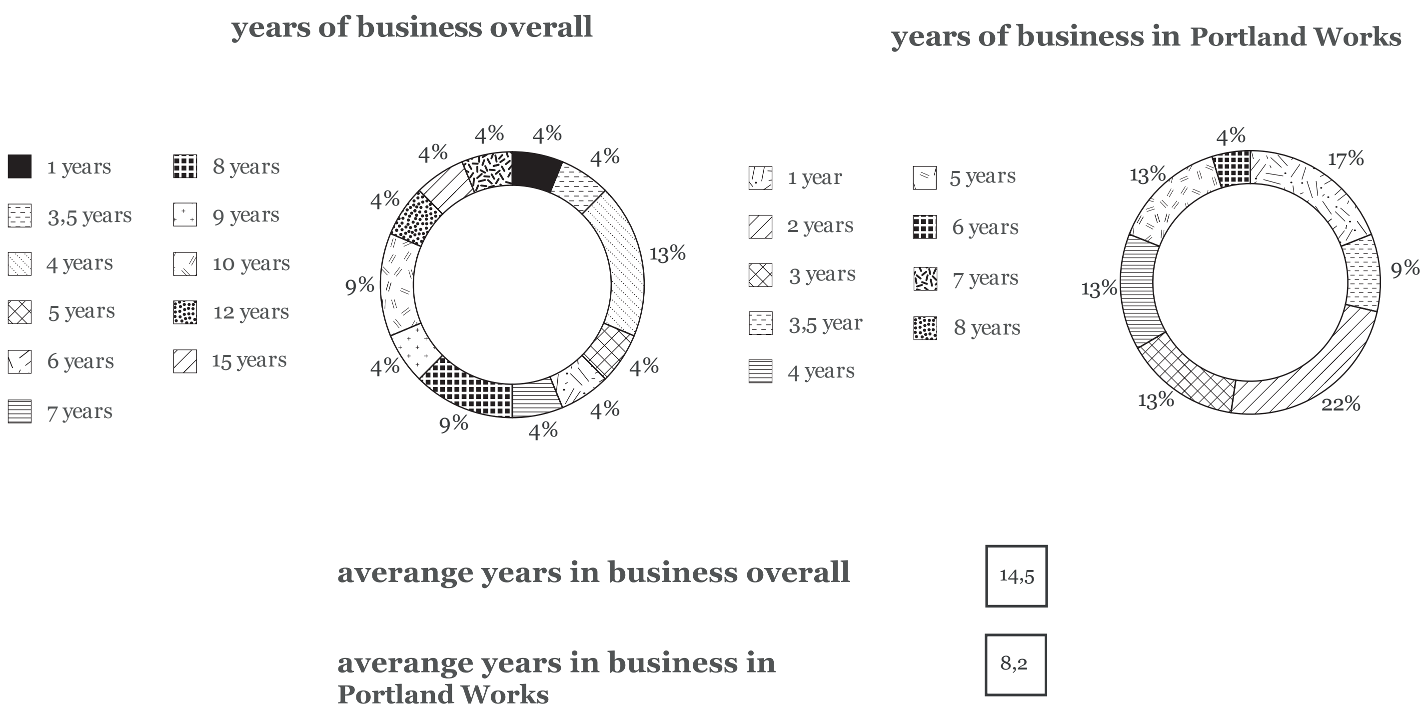
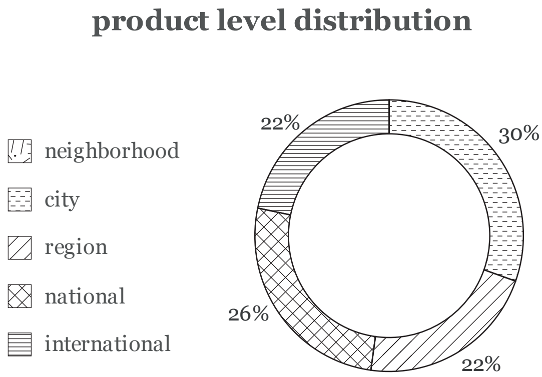


Figure 5.7- 5.8 show the years of business overall and the years of business in Portland Works.



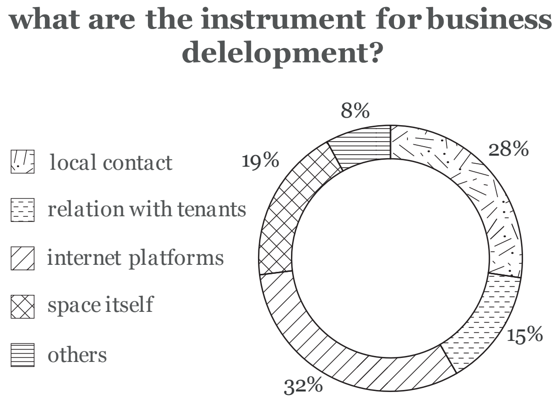


Figure 5.9- 5.10 show the product level distribution of companies located in Porland Works and the strategies of business development

The level of product distribution reflects the complex panorama of companies within the Portland Works building. 30% of companies sell their products on an urban scale. Most of them are small companies that work on a sub-contract basis for other larger companies. An example is Shaw Engravings making stamps, punches and bespoke engraving jobs for local customers. Together, there are companies that work on a regional scale (22%) such as Quality Cabinetry and Lynthorpe, both carpenters working for private clients. On the other hand, most of the younger businesses, work on a national or international scale such as Locksley Distilling, gin producers, PML Silver Plating or even Bailey of Sheffield who creates jewellery sold all over the world. This variety of business characters is also visible in the instruments used for business development. Digital platforms are the most used tool (33%), although there are many discrepancies among companies. The second most crucial element for business development are local contacts (28%), especially for companies with more years of activity on the market. Finally, the building itself is an important business tool due to its essential role in local and international

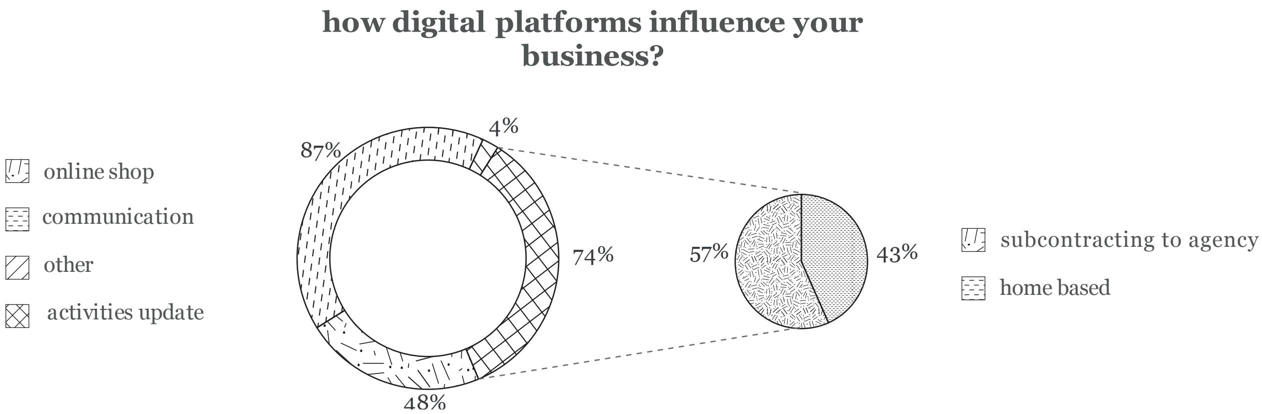


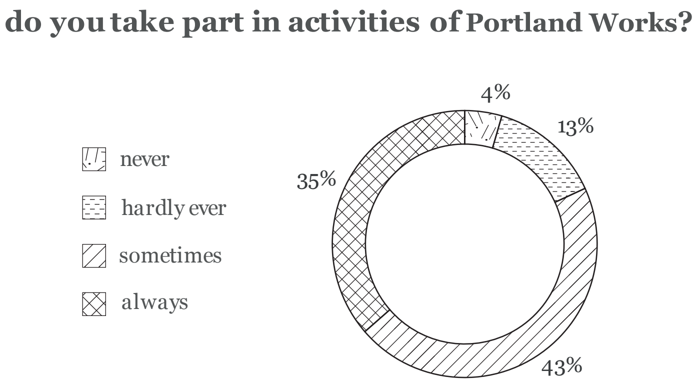
Figure 5.11 shows how digital platform influence the business of companies located in Portland Works.

history. Inside the building, stainless steel has been made for the first time, and companies like Bailey of Sheffield wanted to settle inside the building to use it as an advertising tool due to its significant historical role.

Figure 5.11 describes how digital platforms are used. Within the analysis sample, 87% of the companies use digital platforms to communicate with customers and suppliers. Only 48% of the companies have an on-line shop where they sell their products while 74% update their activities.

5.5.4 Community

The community within Portland Works is highly divided. On the one hand, there are the companies that were already present when the building was bought by a local purchasing group to save it from being transformed into a residential building. This group of companies is not very interested in taking part in community activities, including events, dinners and in the renovation of the building carried out volunteers. On the other side, some new tenants are very involved in community activities, they are part of the building administration board and help volunteers in the renovation works, in the organization events and in organizing fundraising campaigns.



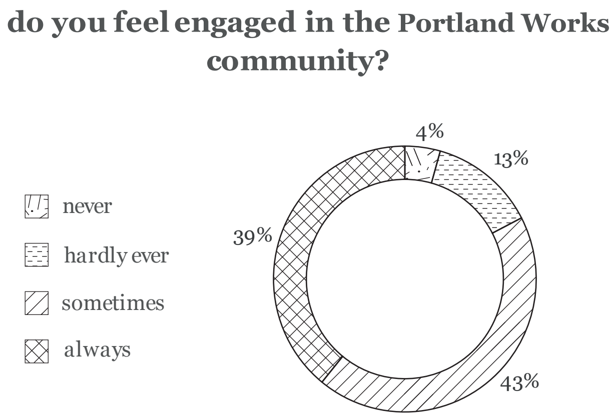
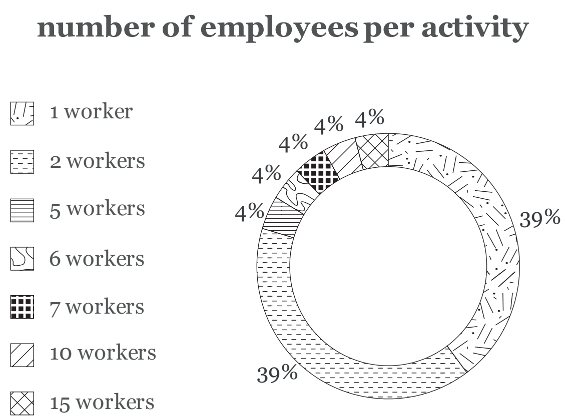


Figure 5.12 - 5.13 showed the level of engagement of users into Les Atelier de Renens community and shared activities.

5.5.5 Workers information

The analysis of the characteristics of the workers present in Portland Works showed that most companies have one or two employees (78%). There are also larger companies with between five and fifteen employees (22%). In this panorama, most of the workers have a full-time contract (65%), while 21% have a part-time but there is also a good number of users with a temporary contract (14%). The temporary contracts mainly concern Locksley Distilling, which hires workers for the bottling and distribution of the product.



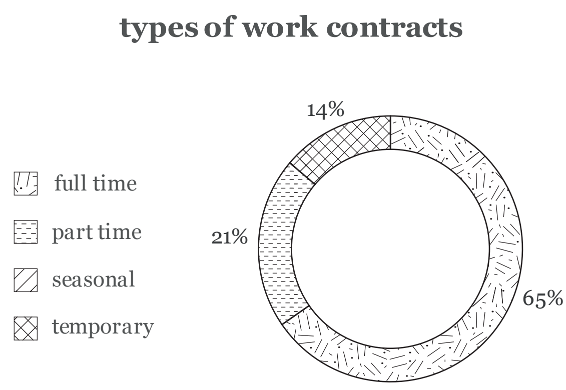


Figure 5.14 show the number of activities per number of employees.

Figure 5.15 The figure shows the number of workers per typology of contracts.

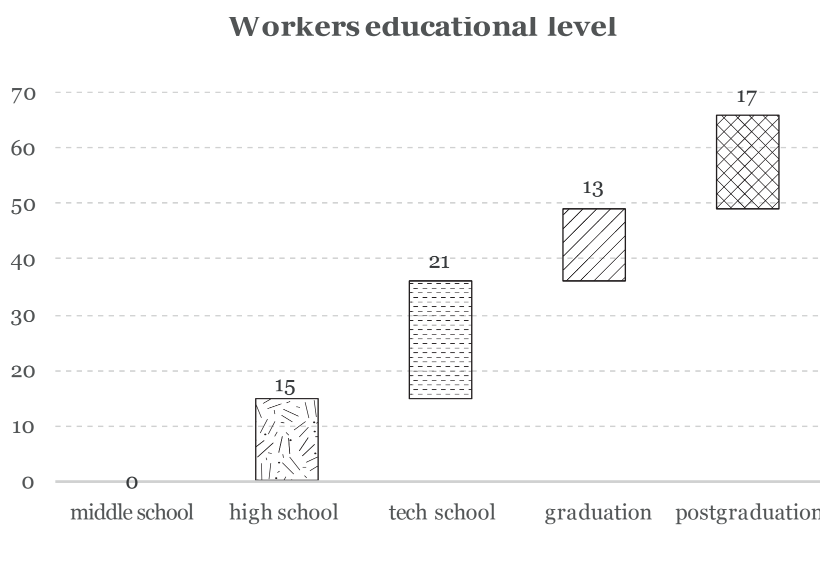


Figure 5.16 workers educational level.

Home/work means of transport

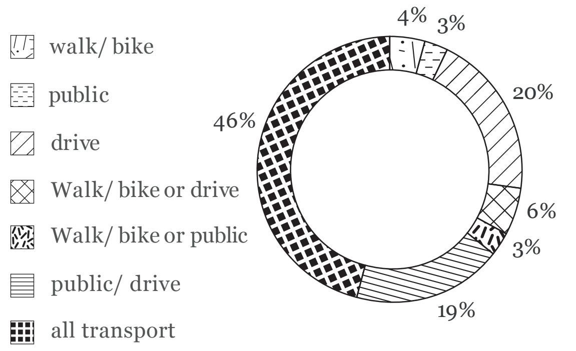


Figure 5.17 shows the preferred means of transportation for home-work travels.

The level of education is very high. Most of the users interviewed have a post-graduate diploma but there is also a good number of user with a graduate or technical diploma. Lower education is less common and is related to the oldest part of the users interviewed. Most users move by all means available. Portland Works is not well connected by public transport to the rest of the city and the proximity to the stadium causes problems for car parking spaces. Furthermore, it is not possible to park inside the building, except to unload and load goods. 46% moved with all trasport while there is a high percentage coming to Portland Works only by car. This happens because a large number of users live outside the city. The bicycle and public transport as the only means of transport are used by a very small number of users. Only 35% of workers work in another place. Most people work from home (35%) or have another job (30%).

is Portland Works the only place of work?

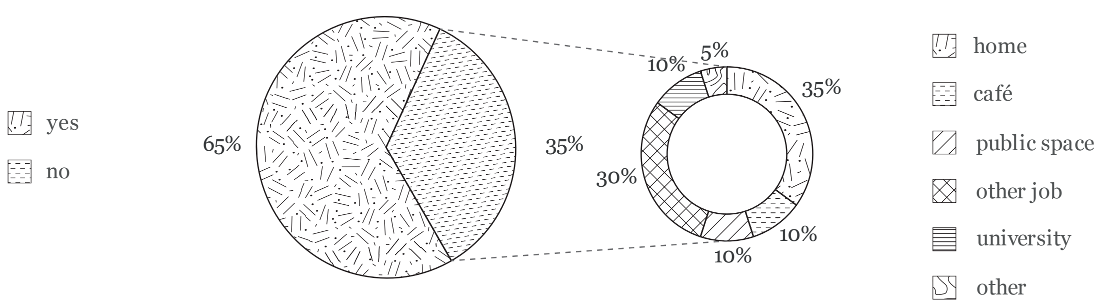
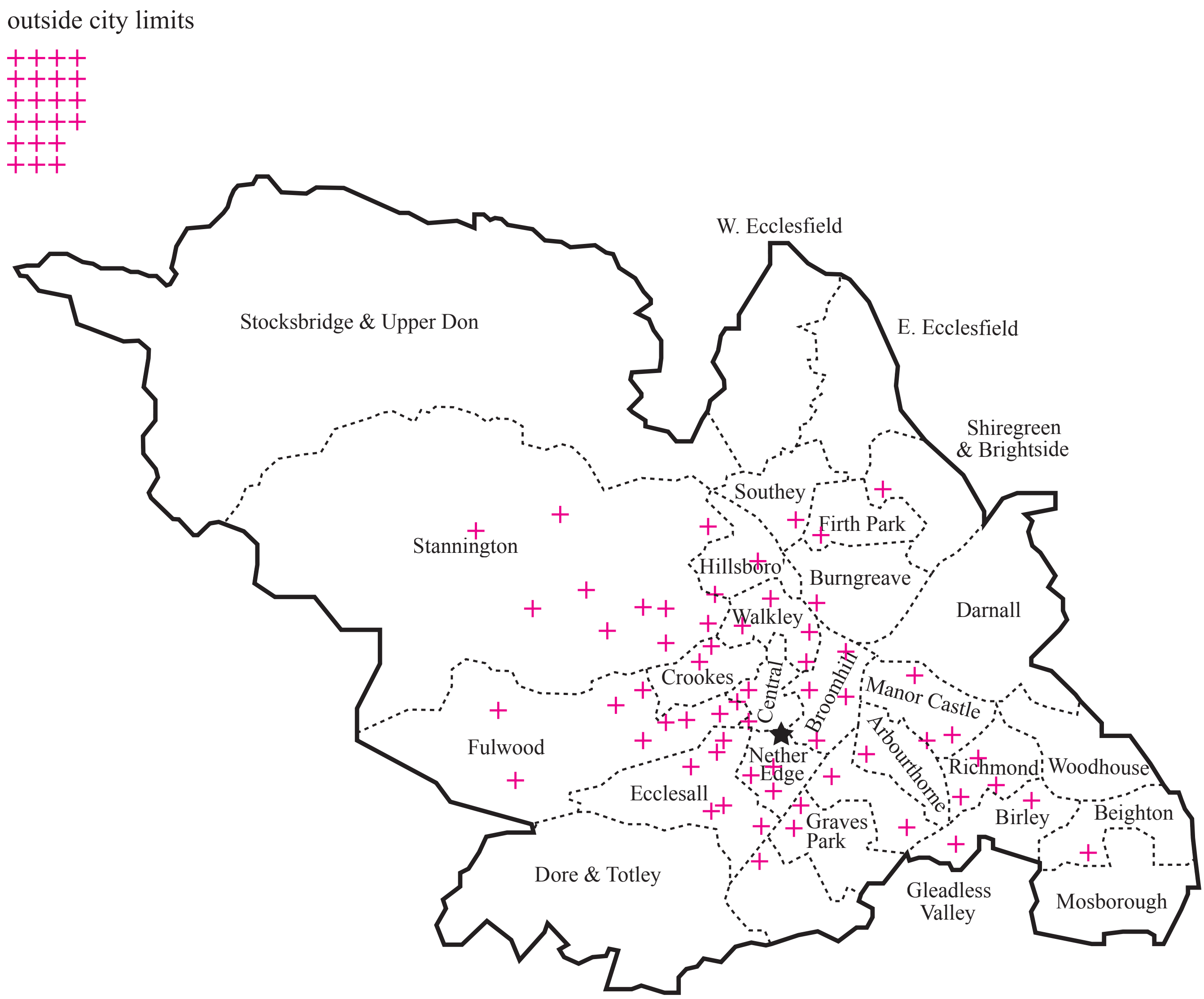


Figure 5.18 show the other places of work of the workers.

5.5.6 Home location



5.4 Les Atelier de Renens data analysis

5.4.1 Business Location

Les Atelier de Renens are characterized by the variety of companies they host. A good percentage of the companies that are now located within Les Atelier de Renens were already present within the city (25%) which is only one kilometer from the Université de Lausanne (UNIL) and two kilometers from the École polytechnique fédérale de Lausanne (EPFL). This strategic position and the low cost of rents have attracted companies in the neighborhood over time. A third of the companies (33%) come from the region. Les Atelier de Renens also hosts a high percentage of companies that come from other contexts geographical (25%) positioning itself as a reference center for technological and innocent activities that want to be located in the territory of the Canton of Vaud.

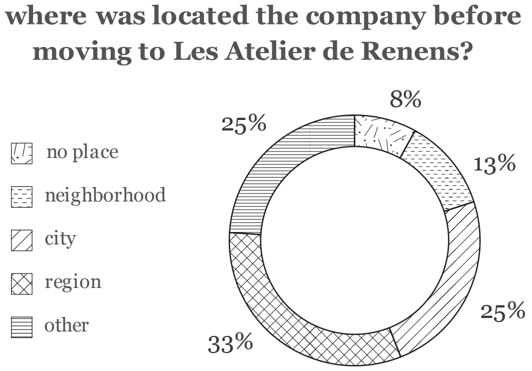
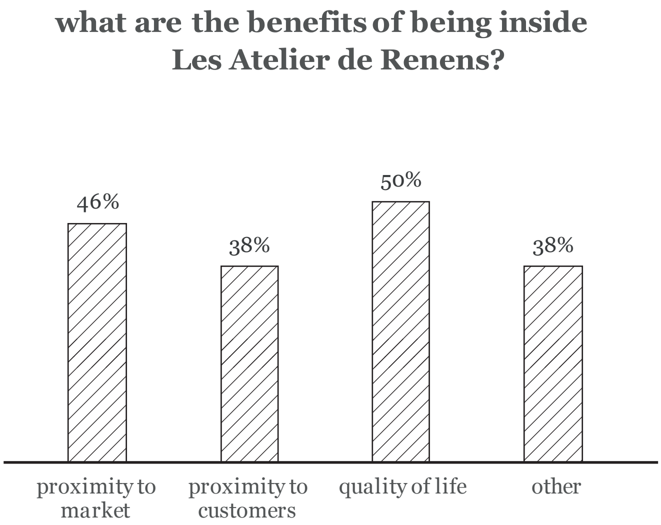


Figure 4.1 shows the location of the business before moving into Sectie-C. Businnes coming from outside the region represent the 25% of analized sample. Most of the companies where located previously in the region (33%) or in the city (25%), considering the entire metropolitan area of Lausanne to which Renens has been part since 2006. Only the 13% was settled in the neighborhood .

The sample of companies analyzed stated that the quality of life and proximity to the market are the most critical elements for locating their business in Les Atelier de Renens. Proximity to customers is a less important factor as the level of distribution of the products is mostly on an international or national scale by making use of the rail and motorway transport network for which Les Atelier de Renens is strategically positioned (Figure 3.9). At the same time, the survey showed that the cost of rents is the determining factor for companies that stabilize in Renens and Lausanne.



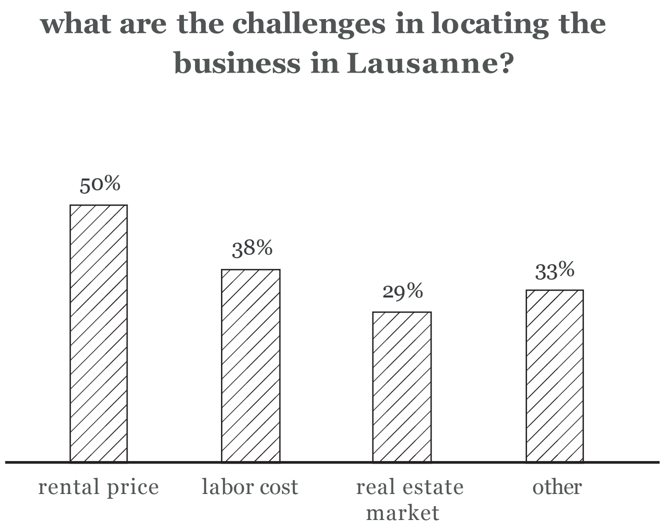


Figure 4.2: the image shows the reasons to set the business in Les Atelier de Renens. Half of the analyzed sample stated that quality of life is a determining factor in locating their business in the building, as well as proximity to market (46%). The proximity of the two university centres UNIL and EPFL make the area strategic for technology companies. Other factors such as the proximity to customers, the quality of the spaces for rent, the proximity to the main transport networks were indicated only by 38% of the interviewees.

Figure 4.3 shows the rental price is the main challenges that small businesses have to face in locating their business in Renens. Rental costs are the most significant difficulty (50%), then the labor cost (38%) and finally the real estate market (29%). Other difficulties encountered are the lack of spaces suitable for industrial and technological activities, housing shortage in the entire metropolitan area of Lausanne, the lack of funds for small companies after the initial development period within the university structures.

5.4.2 Prior Business Location

This section describes the characteristics of the previous venues of the companies that are now housed in Les Atelier de Renens. The analysis outlined that the most faced problem among companies was the low quality of the space they rented. Renens has an industrial tissue that dates back to the early twentieth century, with some extensions and subsequent additions to the Second World War. Unfortunately, most of these buildings are obsolete and dilapidate, requiring necessary restructuring actions, especially for the small industrial tissue which today is highly mixed with residential buildings. The second problem encountered by companies concerns the non-renewal of rental contracts. Following incentives by the municipality of Lausanne and the Canton Vaud for the construction of new housing units to cope with the housing shortage, some owners stopped their lease contracts to proceed with a transformation of industrial areas into housing. After the first moment of support, the municipality of Renens reversed the trend protecting industrial areas from zoning transformation. The length of the rents shows that most companies (33%) had a lease renewed every one or two years. A high percentage of companies also said that the renewal of the rent took place month by month (29%).

what are the reason that led you to leave the previous location?

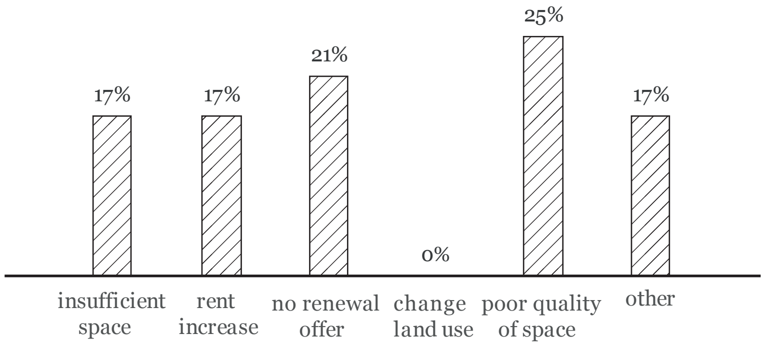
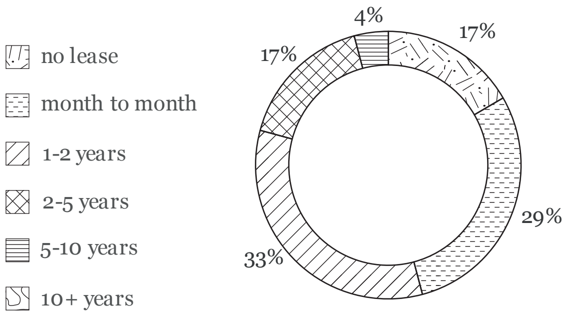


Figure 4.4: It shows the reason that led companies to leave the previous location. Poor quality of space has been the most critical factor (25%) followed by no renewal of rent contracts (21%). On the same percentage, there were insufficient space, rent increase and other reason concerning noise pollution not suitable for residential areas, building renovation, lack of specialized workforce and research in the field.

how long was lenght of lease prior to relocating to Les Atelier de Renens?



how many times have you changed location before?

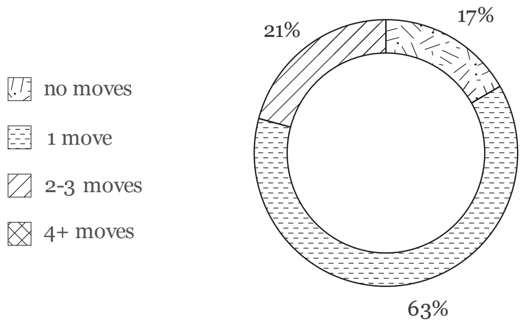


Figure 4.5: The figure shows how long was the length of lease of companies before setting the activity in Les Atelier de Renens. The most common type of contract has a minimum duration of one or two years (33%) followed by month by month renovation (29%). A good number of business had more longer contract from two to five years (17%). Instead longer contract, from five to ten years or longer were quite rare (5%). At the same time there are a good number of companies (175) which never have a contract of lease before coming to Les Atelier de Renens (17%)

Figure 4.6 shows how many locations companies changed before moving into les Atelier de Renens. 17% didn't move which correspond to the percentage of companies which didn't had a lease contract. The vast majority of companies have changed locations once (63%) while the 21% moved two or three times (21%)

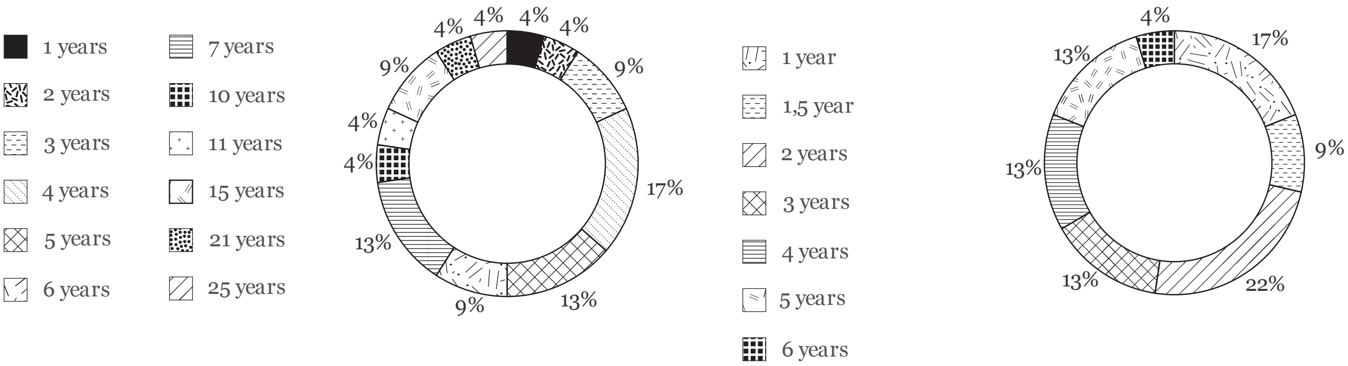
Extended rental contracts are less frequent: rents from two to five years cover only 17% of the analysis sample, while only 4% of the businesses possessed a contract between five and ten years.

Figure 4.6 show the number of changes of location of the analysis sample. Most companies only changed their office once before being hosted in Les Atelier de Renens (63%). This result compared to the number of years that companies have been on the market (Figure 3.7) demonstrates the stability of the industrial real estate market in the area. Many of the companies interviewed said they had moved within the Les Atelier de Renens complex due to the advantages in terms of space and to take advantage of the advantages of the innovative ecosystem.

5.4.3 Business structure

The ecosystem of companies that characterizes Les Atelier de Renens is very varied. There are very young companies such as those hosted within the Mass Challenge accelerator or those that have joined the Univercité project of the Inartis foundation. Most of the companies have been on the market for less than five years (47%), many of these companies are start-ups or artisans as in the case of Petermann Bédat, a company born in 2017 for the repair and production of watches.

years of business overall **years of business in Les Atelier de Renens**



averange years in business overall 7,8

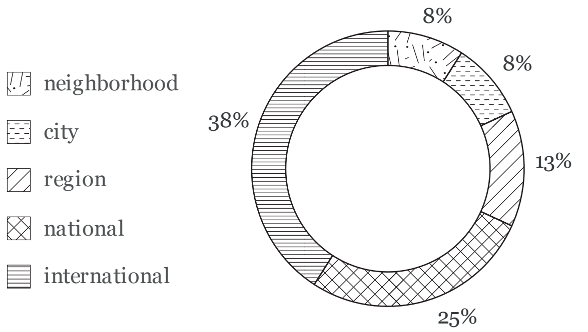
averange years in business in Les Atelier de Renens 3,1

Figure 4.7- 4.8 show the years of business overall and the years of business in Les Atelier de Renens.

26% of the activities are on the market from less than ten years, among these are for example La Nébuleuse and Urban Kombucha, two companies producing beer and non-alcoholic drinks that occupy a large part of the premises available in the complex. Finally, there are several companies with a more extended period on the market, which relocated to the building for strategic reasons. They represent the most stable group of companies in the building. An example is the North Thin Ply Technology, a leading company in the carbon processing sector that has decided to relocate its headquarters and R&D in the building.

Figure 4.8 instead describes how many years the companies have been hosted inside the Les Atelier de Renens building. In its six years of total activity, the atelier has hosted many activities for a short period, 17% of which are still located inside (5 and 6 years). The remaining share of the sample analyzed are more younger tenants, 26% are companies located in the building from four or three years, while 48% from less than two years, confirming the growing success of the project over the last years. From 2018 all areas of the building are totally rented.

product level distribution



what are the instrument for business delelopment?

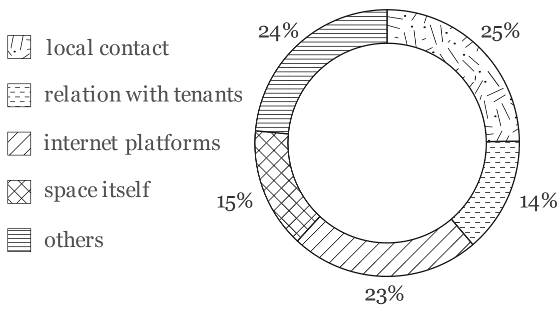


Figure 4.9- 4.10 show the product level distribution of companies located in Les Atelier de Renens and the strategies of business development

The level of distribution of the products is mainly organized on an international (38%) or national (25%) scale. Within this large percentage, there are two types of companies: the first concerns companies that sell a finished product, as Dominique Renaud which produces artisan watches with a high degree of complexity and technology, or La Nébuleuse, producing a low-tech good but exported in large quantities. On the other hand, the second group produces intermediate products or services that are used by other companies for their processes. For example, the North Thin Ply Technology and See Your Box, a company that produces a GPS tracking system for shipments. 21% of the companies produce for the regional or local market while the remaining 8% produce for the neighbourhood. Among them, there are the no-profit association Mobilet and the hackerspace-fablab Fix-me. (Figure 4.9)

Figure 4.10 describes which are the tools for business development used by the analyzed sample. The purpose of the graph is to verify if the co-location in the building and the relation with other tenants positively influence the development of individual companies. Companies declared that 25% of the business is based on local contacts, this is particularly true for companies that work on the local market (Figure 4.9) but also for young companies (Figure 4.7) who have significant relationships with research centres as the EPFL. Digital platforms are confirmed as a necessary asset for the development of companies, especially for companies that work on an international market (Figure 4.8). Other business development tools were found to be the network made available by Mass Challenge and by the Université.

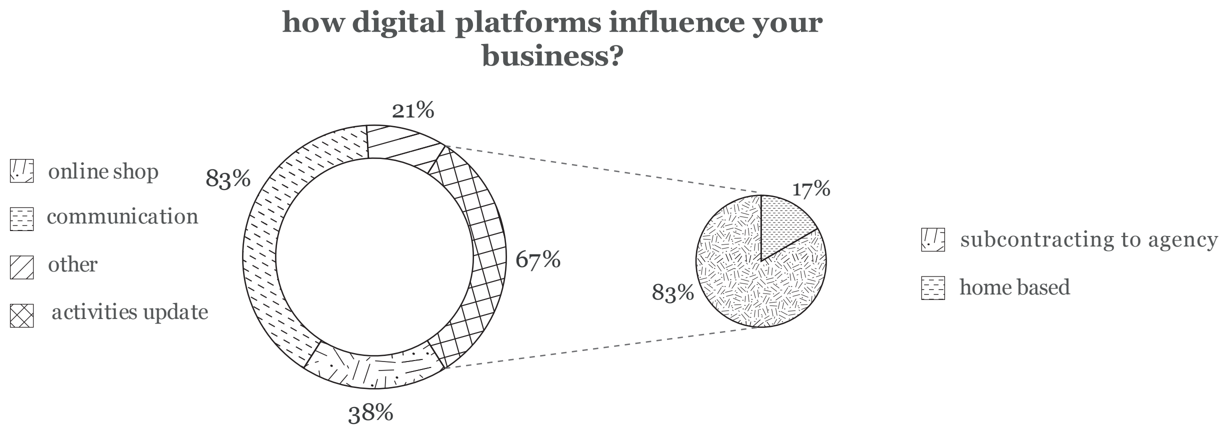


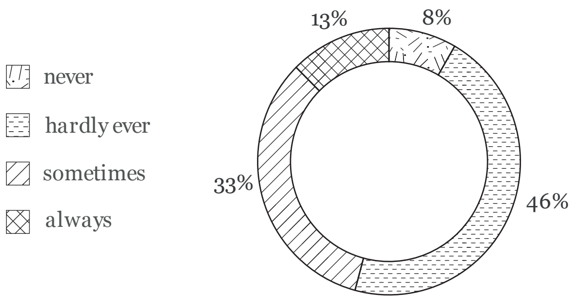
Figure 4.11 shows how digital platform influence the business of companies located in Les Atelier de Renens.

The digital tools with reference to Figure 4.10 play an essential role in the development of the companies located in Les Atelier de Renens. Only 38% of companies use digital platforms to sell their products. While digital tools are widely used to communicate with suppliers and customers (83%). 67% of the companies interviewed use digital platforms to update their activities, the release of new products or communications for their customers and followers. 83% of these operations are managed by external entities through subcontracts. It appears that most of the companies present in Les Atelier de Renens produce positive effects for the local advertising sector. (Figure 4.11)

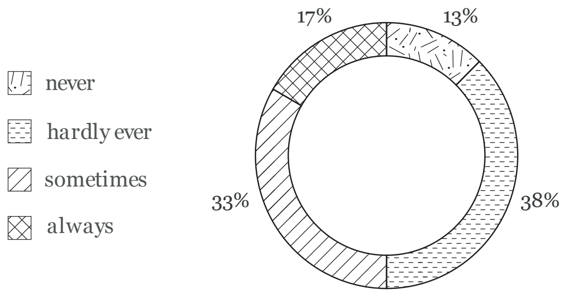
5.4.4 Community

Figures 4.14 and 4.15 describe the level of community interaction between the different companies present in Les Atelier de Renens. Graph 4.14 shows that the level of involvement in everyday public activities, 46% said they rarely take part in community activities. The level of engagement is also low, 38% said they do not feel engaged t with the Les Atelier de Renens community. These results demonstrate how the complex can be considered a successful project for the achievement of individual companies but has not invested in the creation of a community. The administration has no interest in the realization of an internal community, expressed both in the spatial layout and the management organization.

do you take part in activities of Les Atelier de Renens?



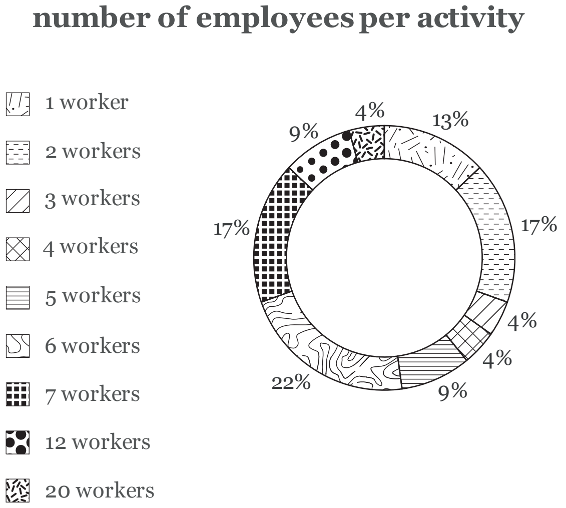
do you feel engaged in Les Atelier de Renens community?



The first period of activity of the complex has been characterized by the presence of companies such as the maker space, that were linked to the local community but over the years, the centre took on a more rigid form associated only to businesses development leaving little space for other types of activities. The only relationship space to date is the canteen on the second floor and the Tap Room bar of the La Nébuleuse brewery.

5.4.5 Workers information

The analysis of the characteristics of the workers present in Les Atelier de Renens has shown that most companies have one (13%) or two employees (17%). To these are added larger companies with six (22%) or seven (17%) employees. Finally, a minimal number of companies have between twelve and twenty employees (13%). Within this varied panorama, most workers have a full-time contract (65%). The remaining 21% work part-time and only 14% have a temporary contract. This last category includes apprentices and interns who, as in the case of watchmakers, are doing their apprenticeships to gain experience in the profession. (Figure 4.14 and Figure 4.15)



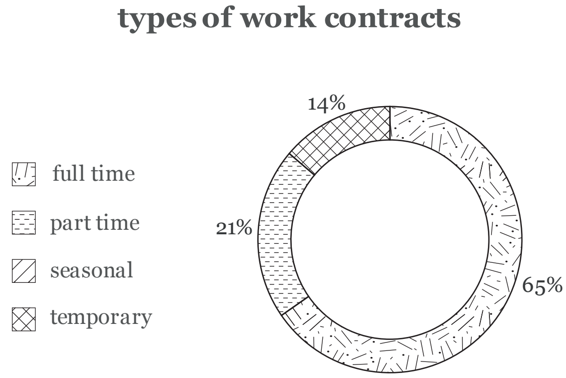


Figure 4.14 show the number of activities per number of employees.

Figure 4.15 The figure shows the number of workers per typology of contracts.

Analysis of the reference sample verified that most workers have a post-graduate diploma or have a graduation diploma. At the same time, there is a significant presence of workers with a technical diploma. The high presence of workers with only a high school diploma is due to the activities of the Mobilèt association, which has as its objective the training of young staff for career orientation.

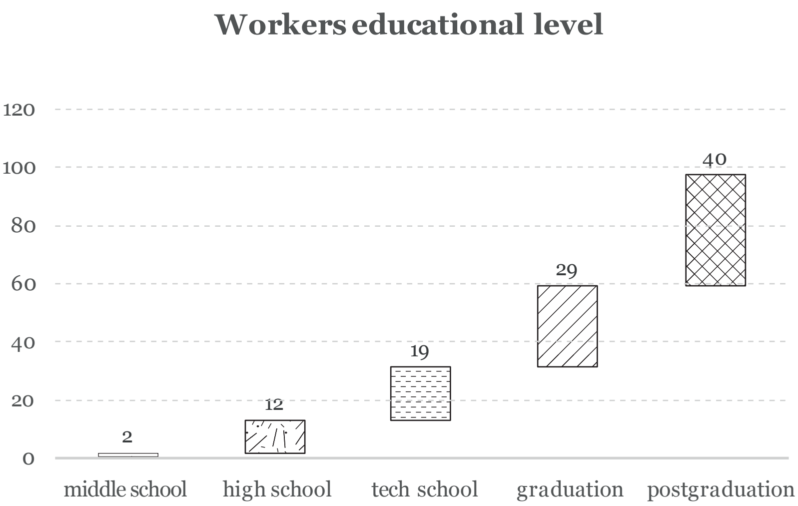


Figure 4.16 workers educational level.

Home/work means of transport

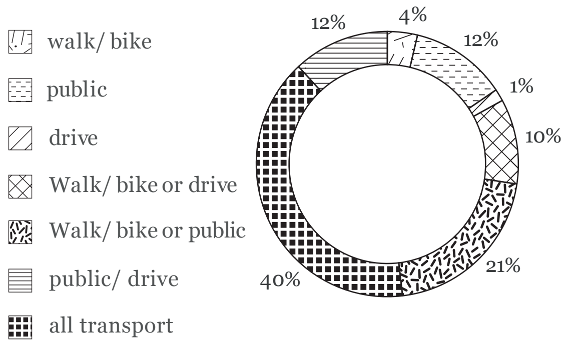


Figure 4.17 shows the preferred means of transportation for home-work travels.

Figure 4.18 shows the different places adopted by users to carry out their work operations. Most users (58%) used to work only in their offices located in Les Atelier de Renens. The remaining 42%, on the other hand, occupy other spaces for working, 31% claim to work at home or to have a second job (48%). The third most popular place is the university (19%) as many companies have direct contacts with university research. Other companies, such as Dominique Renaud, in addition to his business, are employed as university professors or researchers. Finally, public spaces and cafés are used as workplaces by 12% of users

is Les Atelier de Renens the only place of work?

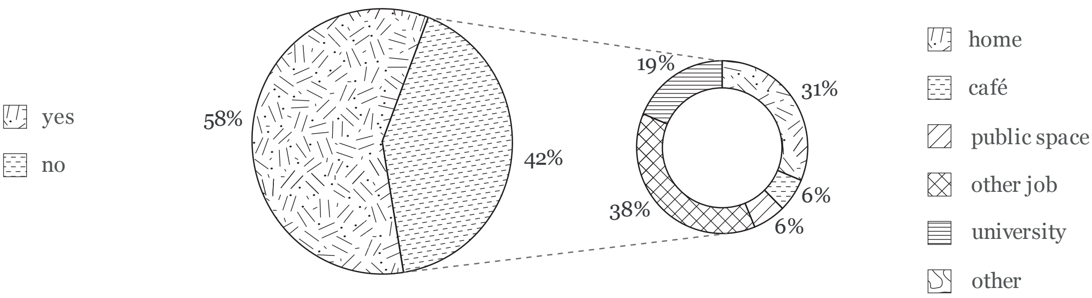
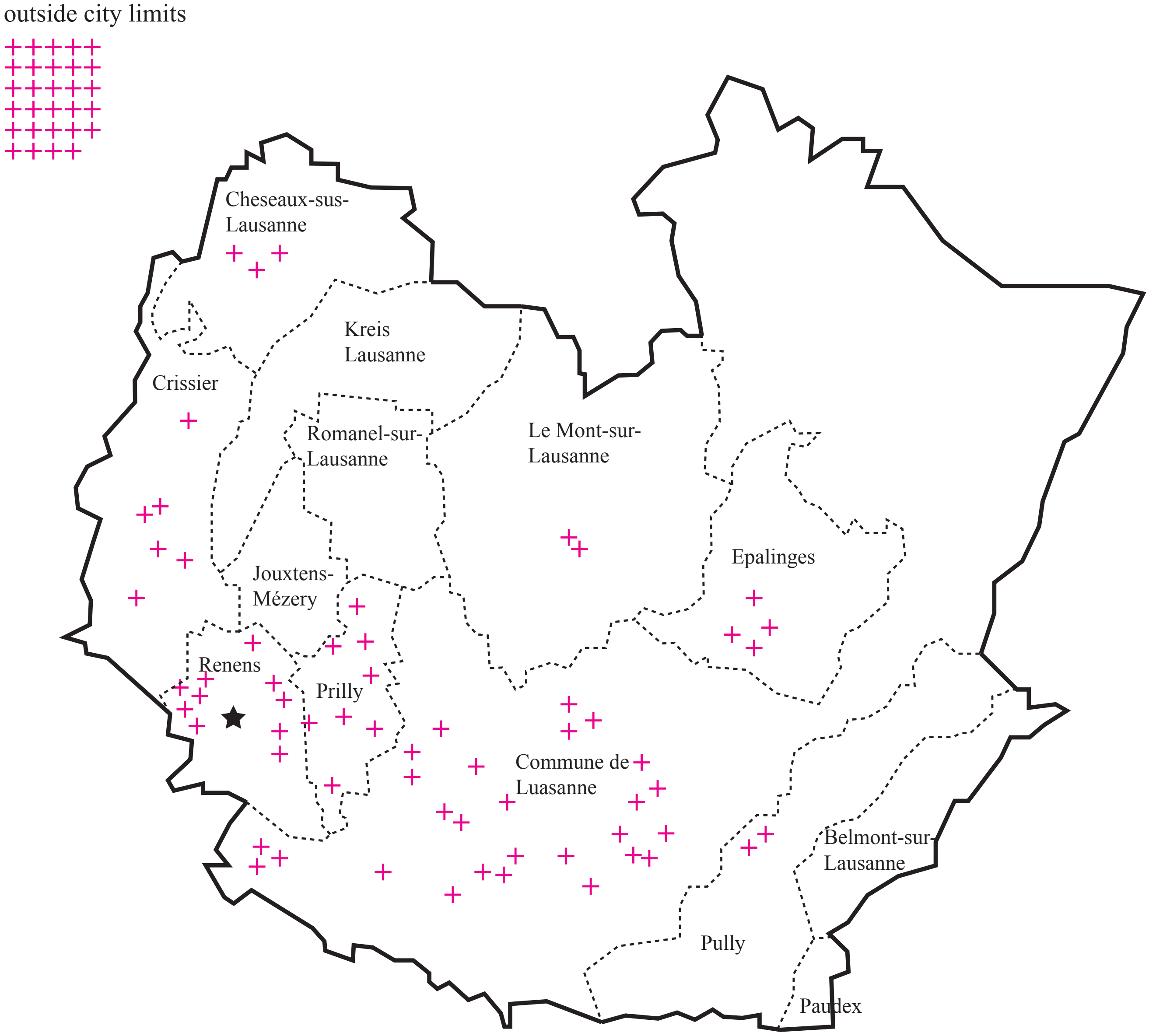


Figure 4.18 show the other places of work of the workers.

5.4.6 Home location



5.5 Comparative analysis

Data on the case studies have been included in the comparative scheme shown in figure 5.5, referring to the study of the businesses located within the incubators analyzed. The scheme shows data collected regarding the business location, underlining the main aspects that led businesses to leave the previous location and the difficulties they encountered in locating their activities within the urban context. The matrix shows that the main constrain in locating activities in the urban context relates to rental prices while available locations usually showed poor spatial qualities.

The second group of data refers to the relationship of companies with the market. The analysis of the data on case studies shows how digital platforms are a fundamental tool for business development both in terms of interaction with customers and suppliers and for the logistics network that this infrastructure allows. At the same time, the construction of a stable local network has been described as fundamental for the success of newborn or small activities operating in the urban context. In this regards, incubator allows enlarging firms network, making possible relation which would be challenging to establish without a physical infrastructure allowing everyday relations to take place.

The third group of data refers to the community inside the building. In particular, data show the interaction between companies and their engagement in the activities promoted by the incubator. Activities usually concern the promotion of companies, the construction of a shared vision of building development or the promotion of events accessible to the public. The lower engament presented in Les Ateler de Renens is directly linked to space development and and the integration of companies in the incubator's development vision.

Finally, the fourth group of data refers to workers. The diagram shows in particular two groups of data: the first refers to the educational level of the workers. All the case studies show a high level of education, making visible the transformation taking place within the work system and the high competence that today craft, design and industrial activities require. The second group refers instead to the number of workers per activity. The cases show a high concentration of micro activities with a high number of self-employed users. The only case that shows differences in this analysis is Les Atelier de Renens which hosts more advanced industrial activities, employing a larger number of workers.

The questionnaires were also used to verify the distance between the workplace and the users' homes. The survey showed that most of the users interviewed live near their workplace. This analysis indicates the importance of the proximity between residence and place of work both in terms of quality of life and as a tool for mitigating urban traffic, especially in the hours of high frequency that coincide with home-work trasferts.

	business location		business structure	
	reason to leave previous location	challenges to locate in the city	instruments for business development	product level distribution
Secite-C	- insufficient space - poor quality of space - rent increase	- rent price	- internet platforms - local contact	- national - international
Keilewerf	- insufficient space - poor quality of space	- rent price	- internet platforms - local contact	- city - region
Portland Works	- poor quality of space - rent increase	- rent price - real estate market	- internet platforms - local contactt	- no prevailing market
Les Atelier de Renens	- poor quality of space - no renewal	- rent price - labour cost	- internet platforms - local contact - others	- national - international

Figure 5.5 case studies comparative matrix.

mparative matrix

community		workers		
activities collaboration	engagement in community	education	number of workers x activity	
- high collaboration	- high engagement	- post graudate - graduate	- self-employment	
- high collaboration	- high engagement	- graduate - tech school	- self-employment - two workers	
- occasional collaborations	- occasional engagement	- post graduate - tech school - high school	- self-employment - two workers	
- low collaboration	- low engagement	- post graudate - graduate	- six workers - seven workers - two workers	

5.6 the spatiality of the incubator economices

Although these spaces are subject to rapid changes in internal organiation, data analysis reported an image, a photograph of the actual state of the places. Sectors and activities located, workers characteristics and business development, allowed to interpret the nature of the phenomenon and describe its property in relation to urban space. The paragraph reports the characteristics of the case studies, interpreting fieldwork observations and data collected, to delineate which sectors and what type of production locates in these spaces.

The incubator model is based on hosting small and medium-sized enterprises with an average surface area between 30 and 250 m^2. It is reasonable to think that these spaces are not suitable for mass production or large batches, due to the limited dimensions for storage and modern continuous cycle production lines. At the same time, the case studies show a great variation in the character of fabrications which outlines the extensive panorama of urban production. The analysis of case studies identified the following types of production:

Small artisan production: blacksmiths, woodworkers, carpenters, bike makers, knife makers, small distilleries, are part of this category. It is a small production that does not need sophisticated machines and tools or partiular spatial requirement. Products are sold directly through a local network or on digital platforms. Traditional crafts often fall into this category.

Design objects, unique pieces, prototypes: usually supported by studies in the field of design and architecture, this production involves the creation of objects for a small international niche market. The production focuses on unique pieces, often not reproduced in series except when in collaboration with a large design firm. High experimentation in the use of techniques and materials. Prototypes, produced for research and examination, also fall into this category.

Art objects: as for the previous category, these objects are produced in unique pieces, possessing an added value determined by competual ideas as well as by artist authority.

Service production: while maintaining the characteristics of small artisan production, this category includes larger light manufacturing companies focused on production for third parties. Companies are not directly involved in the creation of new products but in the execution of parts or customization of standard products. These activities are based on a dense local network or a regional network, especially for activities related to the construction industry

Product development / R&D: outsourced work units of medium and large companies focused on the development of new products, processes and materials. They often require specific spatial characteristics for security or production reasons.

Simple factory line: small-scale industrial production such as bottling and printing. Production requires a simple production line but a large storage space. These activities rely on a regional or national market.

Sectors involved are more difficult to be defined. As represented in the case studies, the incubator model responds adequately to the requirements of the creative industries and the light manufacturing sectors. In this sense, the proposed description is not exhaustive due to the ongoing debate and criticism about the definition and the sector involved in the creative industries phenomenon (Ch. 1). The same issue is encountered in the definition of urban manufacturing, still missing a shared description between scholars and institutions. Ultimately, the research does not take into account the vast presence of incubators and accelerators, developed since the late 1990s, focuses on ICT and digital businesses.

The following description of the sectors involved tries to overcome these critical issues, taking into account the blurred boundaries between manufacturing and service sector, between formal and informal economy, between a defined “creative” and a “non-creative” activity. Following the indications of the UK Government Department for Culture, Media and Sport (DCMS) regarding creative industries definition, the most involved sectors are the following: Crafts, Design (product, graphic and fashion design), Photography and Video, Publishing, Architecture, Visual Arts and Music. These sectors are those that regularly require more varied and organized workspace compared to the modern office layout, without requiring special structures, such as in the case of performing arts. In addition to creative sectors, case studies hosted activities in the light manufacturing sector, manufacturing-related services, education and research sectors, and limited informal activities.

As for the description of sectors involved, the definition of a scale of action of the phenomenon requires some simplifications to describe a general overview. Further analysis of the topic must deal with the high variability of the phenomenon due to specific local circumstances.

The two emerged market clusters can be categorised as: *the global digital market* and *the local market*. The global digital market relates to sectors as visual art, design and craft, based on the production of single or small batch objects. Digital platforms are not employed only as a marketplace but are an integrated part of marketing strategies and communication (Luckman, 2015; Anderson, 2013). The global digital market is characterised by the presence of a small community of individuals spread on the international scale. Its existence is based on a stable, fast and secure worldwide logistics service (Easterling, 2016). Light manufacturing, manufacturing-related services, architecture, education and research may relate to the second cluster focused local market. In the case of small productions or a customized design, this market is mainly characterised by a proximity network, built over time thanks to local contacts. Instead, a wide regional distribution is the norm for common and standardised products, as food processed products and construction products. In this case, the type of market is represented by a high number of individuals, located in a defined area and subject to physical relations.

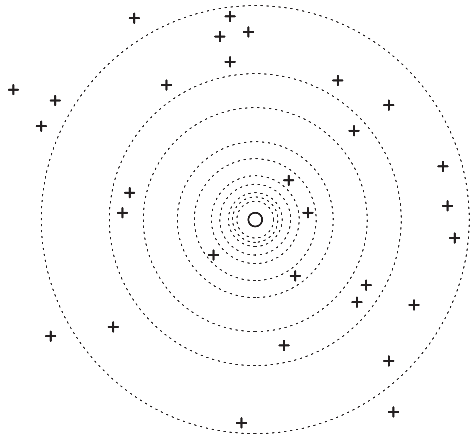
The analysis of case studies highlighted how the product level distribution of companies can be influenced by economic and cultural characters of the urban context and the contact with universities and research centers. Taking the example of Eindhoven, technological and cultural transformation imposed a conversion of the local manufacturing sectors, making possible the internationalisation of companies and a change of scale in market operation. On the other side Portland, due to an intense manufacturing crisis and a delayed transformation of the industrial and research sectors rely on a stable and enduring local market (Ch. 4).

Finally, the fourth element describing the physical characters of incubator economies has been the analysis of entry and exit rates of hosted companies. In this case, the main sources have been interviews with managers and the analysis of project development and its transformation over the years. The collected interviews provided direct information both regarding requests from companies interested in renting a venue and the exit rate of companies hosted inside. The study noted that in all the cases analysed there is a high number of requests that could not be accepted due to the complete occupation of the available spaces. The high number of requests verified in each of the case studies analyzed, highlights the importance of these places within the urban context. A large number of companies are unable to move to a new location more suited to their business due to the lack of offer of spaces suitable for industry within the urban fabric. A demand for space that makes the incubator a strategic model in the development of a new industrial plan for cities.

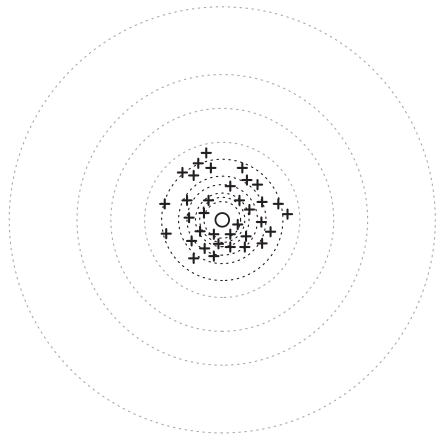
In addition, the number of companies leaving the incubator is very low. Causes can be attributable to an increase in the size of companies and the consequent necessity to find a larger venues, or the research for a location more suited to the image of the company. On the contrary, internal movements are remarkably frequent, companies that initially rent small lots, growing in terms of units and market, move to other more suitable areas. Consequently, these buildings are places in a continuous internal transformation. Each case presented a high internal transformation rate, a continuous reorganisation of the space according to the specific needs of the moment

This phenomenon reveals a significant component of the nature of the incubator. While the internal transformation rate is very high, the relocation of companies is very rare. Spatial flexibility is a main character of the incubator model, promoting expansion or reduction of hosted activity inside the building. Sectors involved in the incubator phenomenon are reluctant to a continuous relocation which requires significant logistic effort, interrupting working activities and production. The flexibility of the incubator is an essential quality for its success in supporting small businesses. In addition, the incubator relates to a physical network, constituted by the physical co-location of different activities and know-how in the same place, a competitive advantage that would be lost once relocated.

An incubator is a flexible physical place, designed to host creative and light manufacturing activities operating at a local and global digital scale, establishing a network of expertise and know-how.



global digital market



local market

Chapter 6

Conclusions

6.1 The incubator

In the last century, production activities have been subject to zoning regulation and separated by other urban functions. This articulated and conflictual process, originating from the necessity to improve hygiene and safety in cities, was theorised and developed by The Congrès Internationale d'Architecture Moderne (CIAM) and by the 1933 Charter of Athens, which described the Functional city as a rationale city organised in explicit separate functions. The productive and the living city were conceptually identified as two distinct entities.

Today this division is strongly questioned, production dynamics are recognised for their fundamental implications in the development and transformation of the city as well as for its social and economic growth (G. Leigh & Hoelzel, 2012; Winden et al., 2013). Manufacturing activities are subject to new spatial requirements induced by the development of new technologies and the strategic role assumed by R&D to compete in the international market (Sassen, 2009). Like production requirements, workplace characteristics are also changing, the *"Factory of the future"* has been the subject of recent analysis to individuate spatial and organisational characteristics of future production (Arup, 2015; Rappaport, 2014).

In relation to a revision of the dynamics between production and urban space, the research investigated the incubator and its role in the development of the emergent urban manufacturing phenomenon (Sassen, 2006). The incubator has been developed in the second half of the twenty century as a strategy for the reuse of vacant urban industrial buildings as affordable space for small businesses, supporting entrepreneurship, local community and the requalification of the disused industrial fabric. Incubators can not be described as a single architectural type, as a building configuration clearly defined in form and function. However, they exhibit common ideas: the coexistence of different companies in the same building; shared office, machines and facilities; the presence of a service organisation to deal with space management and companies necessities. The common characteristics of the incubator highlight its dual nature: as a physical place, a facility within an urban context, and as an organisation, providing tangible and intangible support to local companies, which reflects the undergoing debate regarding its definition.

The research focused on its spatial characters, defining the incubator as a multi-tenant building providing affordable, flexible space and a variety of office and support services which share the common purposes: sustain the foundation and/ or growth of new businesses. Concerning city dynamics, the incubator has been recognised as a crucial urban component, a catalyst of local development strategies, community enhancement and economic growth (Mian et al., 2016; Marsh et al., 2003; Centre for Strategy & Evaluation, 2002; Kuratko & LaFollette, 1987; Eley & Worthington, 1984). The study examined the incubator as a strategic instrument for the reuse of vacant industrial buildings as space for urban manufacturing (Sassen, 2006) and creative industries (Howkins, 2001).

For this purpose, the first part of the research focused on the emerging trend in the labour system and in urban manufacturing, defining how servitisation and digital technologies are leading to new requirements in production processes and working spaces, influenced at the same time by a change in lifestyle and profile of the labour force. Regarding the relation between production and the city, the research explored the evolution of spatial forms of production: from proto-industry to the development of the model factory, up to the emergence of the incubator.

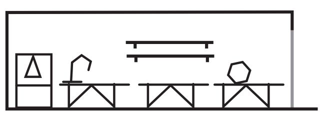
Parallel to the historical research and the literary review, the study of incubators has been developed through a fieldwork analysis in the European territory, characterised by the strong presence of small and micro enterprises (European Commission 2018), selecting four case studies located in traditionally industrial metropolises in transition or small industrial cities.

The first approach to case studies analysis has been challenging. Externally these buildings are simple objects, pure volumes, establishing a clear connection with the urban landscape, communicating to the observer their function and their relationship with the morphology of the city. On a closer view, discovering what volumes contain in their inside, these buildings turned out to be a complex, layered object, composed by a network of spatial and social relationships that required in-depth knowledge to be deciphered. For the purpose, research distinguished three elements of analysis: space, processes and users, as critical elements to depict the complex reality of incubators. The study examined the selected cases as socio-technical objects, as places characterised by technical aspects, related to spatial organisation and design, and by anthropic characters, its social and economic organisation. Questionnaires and semi-structured interviews have been implemented to support the graphic and photographic apparatus.

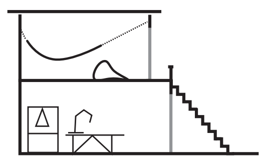
Located in a dense urban context, the selected case studies are involved in the adaptive reuse of former industrial buildings, developing functional and peculiar spatial solution which integrated different form of work. Since the first generation developed between the 1960s and 1970s (Eley & Worthington, 1984), the incubator saw in the reuse of the vast stock of vacant urban industrial buildings a strategic asset to realize affordable workspaces, favouring small businesses and promoting local development (Campbell & Allen, 1987).

The reuse of old industrial buildings has strategic advantages for the sucess of the incubator model, not only for the functional variety that they can host but also for the organisational flexibility. The multi-occupancy buildings analysed made possible the expansion of firms within the building. They guarantee high intensity of space, maintaining the possibility to host single floor production line layouts while reducing storage space as a result of a just in time production and global flexible logistic infrastrcture.

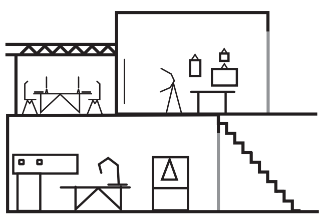
Old buildings grow and mature with time. Unlike new buildings which tend to have a simple form, the old industrial stock is more complex, with varying shaped spaces. The potential asset of the city location is the complexity of its building stock, which provides a variety of character and responds to a multitude of requirements. To maximize the local material asset, its urban legacy, mixed-use can be developed, matching the requirements of each use with the character of the space available. The analysis on case studied (Appendix Chapter 4) showed how the incubator integrates different strategies of mixed-use developments: from *new urban micro-factories*, where manufacturing, training, display and selling are located in the same space, *working-living communities* where the workshops, the outlet and domestic functions are combined, *working communities* or *new enterprises workshops*, up to *research or community centres* where work and training are merged with education and social welfare.



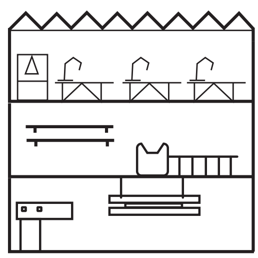
working communities
new enterprises workshops



working-living communities



Research / community centres



urban micro-factories

6.2 Space, management and user: common design patterns

The analysis of case studies showed common evolutive patterns, recognized as structural in the development of the incubator model. The first aspect regards design and spatial organization. After an initial phase of recovery of the building and the realization of a basic grid defining plot size, the design and construction of the individual and collective space is coordinated with the final users, with the realization of an informal landscape, strongly characterizing its atmosphere. This process activates in the user a sense of belonging to the place that the individual contributed to realize, developing community relations and a more conscious partecipation local activities.

The second aspect regards the management and actors involved in the process of recovery and reuse. The first phase of rehabilitation is often characterized by the occupation of the building and the free use of space, dictated by events without any planning. In most cases, this model evolves rapidly with the formation of an operative group, which could be internal or external, to take care of the maintenance and the organization of the space. The more organization grows, the more freedom and informality in the use of space decreases. Achieving a form of self-sustenance, albeit as a collective instrument, requires the organization of a managerial group and the definition of strict rules in the use of space. Even if case studies presented different management model (private, public, no-profit) the analysis recognized similiar patters of space organization through adaptive reuse strategies.

The third aspect concerns the users and activities located. As production methods changed, and the rigid division between economic sectors blurred, also the types of work and skills required are changing. Businesses analysis showed that the type of user of these spaces are not comparable to the typical categories of blue-collar and white-collar worker, demanding a more flexible working environment and different services. At the same time, the co-presence of wide-ranging of activities in the same place allows the creation of social and working collaboration, mentoring and knowledge spillover dynamics, which supported the growth of the physical community and the development of stable networks of innovation, characterizing the relationship with the urban context.

In addition to the interpretation of the shared development dynamics, the methodology applied in case studies analysis highlighted three critical characters that illustrate the role of the incubator within the urban dynamics.

6.3 The incubator and urban economy

The significant role that small businesses possess within the European and national economy directly affects local and regional contexts where most significant benefits are visible. Today in Europe, cumulatively small firms represent 99.8% of enterprises, accounting for 66% of total employment and generating 57% of the value-added. Of these, 93% are micro-enterprises employing less than ten persons

(European Commission 2018). Today, the city continues to offer the most attractive environment for embryo and infant enterprises as well as for decentralised units of big firms that want to relocate in urban space to take advantage of networks and quality of life (Sassen, 2009), but suitable sized premises at affordable price are often missing due to the frequent transformation of industrial areas for more profitable uses.

The analysis of the data collected denotes a high presence of micro-enterprise or self-employed individuals within the incubators analysed. As described by case studies spatial analysis, small firms are more versatile and specialised, combining almost all the possible functions in one place. The development of small businesses has been described as favouring stable local development (European Commission 2018), while possessing advantages for actors involved, primarily employees and customers. Data analysis and interviews showed how smaller workplace means greater co-operation between workers and management as well as greater involvement in all phases of work, while customers can rely on greater flexibility and responsiveness to personal needs. On the local scale, small sized enterprises create resilience and local variety while supporting stability and job creation of the area (Eley & Worthington, 1984; Falk, 2000; European Commission, 2016).

Moreover, the variety of firms and sectors make possible the presence of a wide product diversification, encouraging the development of services that large companies may suppress or ignore. The analysis verified how the coexistence of different and complementary activities, their agglomeration in the incubator environment made possible to develop collaborative and innovative processes between companies, developing a stable network of relationships, collaborations and knowledge spillover.

On the contrary, the promotion of a small business on a local scale find an obstacle in urban development, which relies on a post-industrial vision, promoting the transformation of industrial neighbourhoods to more profitable uses, with a significant loss of suitable area for the establishment of new industrial activities within the city (G. Leigh & Hoelzel, 2012; Falk, 2000; 1984; Eley & Worthington, 1984). Data surveys on case studies reveal how the main problem for small businesses that want to locate in the city has been the high costs of rents, a crucial investment for new companies, which often corresponds to small size and low quality of available spaces. The existing units are often in poor condition and require significant maintenance, located in areas of planning uncertainty and subject to short term lease, which makes the financing for renovation more difficult. Likewise, large industrial buildings are complicated to divide; they require a high investment in space organization and management and budget that small businesses alone often cannot provide. In addition, commercial developers are not inclined to provide small units due to the high development cost and less convenient management respect to few large units. Small businesses are vulnerable, especially in the early years on the market, representing a high risk for the developer who fears their failure, in contrast to the favourable investment in new accommodation for large established companies or other functions.

For this reason, the incubator is often supported by participatory planning, stimulated by the desire of communities to develop the use of their major assets: land and buildings. The incubator model resulted to be directly related to local development planning, reinvesting profits into the development of new enterprises, and consequently into additional jobs, or into benefiting the internal and local community. All the case studies analyzed, albeit presenting different management models (private, public, no-profit) presented a common interest in local development and community enhancement.

Urban industrial buildings converted into incubators are usually subject to adaptive reuse strategies that require long-term planning, investments in maintenance and rental monitoring. The development of social bonds and a sense of belonging to the place are subject to an active investment by tenants which requires a long-term perspective to be effective. The same reasons are also valid for the growth of hosted companies and the emergence of a collaborative network between tenants and external entities. Case studies analysis highlighted the critical issues of temporary use strategies in urban development. Temporary use is often subject to short term lease and planning uncertainty which strongly affect the development of an incubator. If a temporary use regime can be advantageous for an incubator in the early stages of development, allowing uses and standards that would not be acceptable in an ordinary use regime, its permanence reduces its potential. The incubator model necessitates, for its stable development, long-term urban policies, preserving at the same time a degree of experimentation in mixed-use development and simplified urban rules.

6.4 The space of incubator

Urban industrial buildings are usually categorizable as multi-storey buildings. In the development of industrial architecture multi-storey building were substituted by single-story facilities, usually realised on greenfield peripheral areas, due to their inadequacy to contain modern factory layouts and efficient material handling techniques. They did not provide a floor to ceiling height and large interrupted space suitable for flow line layouts with no possibility to expand. Today, these criteria are no longer so relevant as the industrial base changed, with a greater emphasis on firms that produce goods with high value-added and small material inputs, organised for one-off or batch production with sophisticated small-scale machinery (Rappaport, 2014; Carpo, 2012).

The study of the dimensional and spatial characteristics of case studies showed a demand for units accommodation that hardly exceeds 250 m^2 for firms in service, assembly or component manufacture with an average size of lots between 30 and 60 m^2. Production units are frequently divided into two different areas: the space used for production, the workshop and the office, a quiet and private place. Common or additional space is usually provided to carry out operation requiring larger working areas. The organisation of working units in the same physical place allows the creation of shared work areas, equipped with machines that would constitute a too high cost for the single activity, that through sharing becomes accessible.

The incubator model appears to be based on pre-modern spatial production typologies such as the workshop or the shared machine shop, extracting its functional and organisational aspects, adapted to support a change in scale and technology involved in production processes. Moreover, case studies showed how the incubator is frequently associated with public activities, with areas made available to the local community, or connected to spaces for art and events, as well as temporary forms of residence or research and educational activities.

The large modern factory gives way to a hybrid model that recalls the spatial and social dynamics of the *"Casa-Bottega"*, the atelier or the laboratory, responding to changes in the dynamics of the urban economy. An evolutionary process because it does not replace the global dynamics of large decentralised supply chains but responds to a change in local urban production, in those manufacturing, craft, technological or artistic activities which locate and develop in the city. The incubator combines three primary characters for the of the factory of the future: education (learning by doing), research and manufacturing, making visible the advantages of physical relations.

Unlike industrial areas, detached from the urban fabric and public life, case studies are characterised by being a mixed place, connected to the urban context, integrated into its transformation and evolution. The cases selected in the research describe a transformation of the factory space in continuity with the transformation of the city. Contrary to a revolutionary process, which implies a rupture, a conflict, the new identity assumed by the factory is in continuity with the its urban role. In particular adaptive reuse strategy and the active involvement of tenants in the design and construction of single workshops and common spaces, have been decisive for the development of a shared vision for the place. Case studies analysis show an aesthetic and functional language in the use of space, displaying the freedom promoted by the *"Typical Plan"* (Marullo, 2013; Koolhaas et al., 1998), where spatial forms are chosen through a negotiation and adaptation to contemporary uses and needs, inside a world of shapes and technologies inscribed in the Craft and Making culture.

The result involves social and cultural constructs of occupants, making visible polarisation and conflicts directly involved in the production of its architecture. In this sense, freedom and participation involved in the production of space (Lefebvre, 1991) created a unique and authentic place.

6.5 The incubator model, middle ground of the creative city

The incubator is an essential part of what has been called the creative city (Landry, 2005; 2008). The analysis of the case studies has highlighted how the presence of a strong community and a stable professional network were the critical elements for the success and growth of the project. The community acted as promoter and facilitator of the individual user by making available the profound professional knowledge of the community. In the same way, the internal network can expand, as the members of the community often belong and actively participate in other types of communities, thus promoting a knowledge-spillover process and the development of new collaborations between internal and external actors. This network acts not only socially but also materially, allowing individual skills to be developed through the continuous improvement of common practice.

At the same time, the case studies show the fundamental role assumed by physical space in the development of community relations. The sharp description of the middleground as an entity, as a network of dynamic relation, presented by Cohendet et al., missed to point out the importance of physical space as a catalyst, as the essential infrastructure enabling social and personal relation to take place.

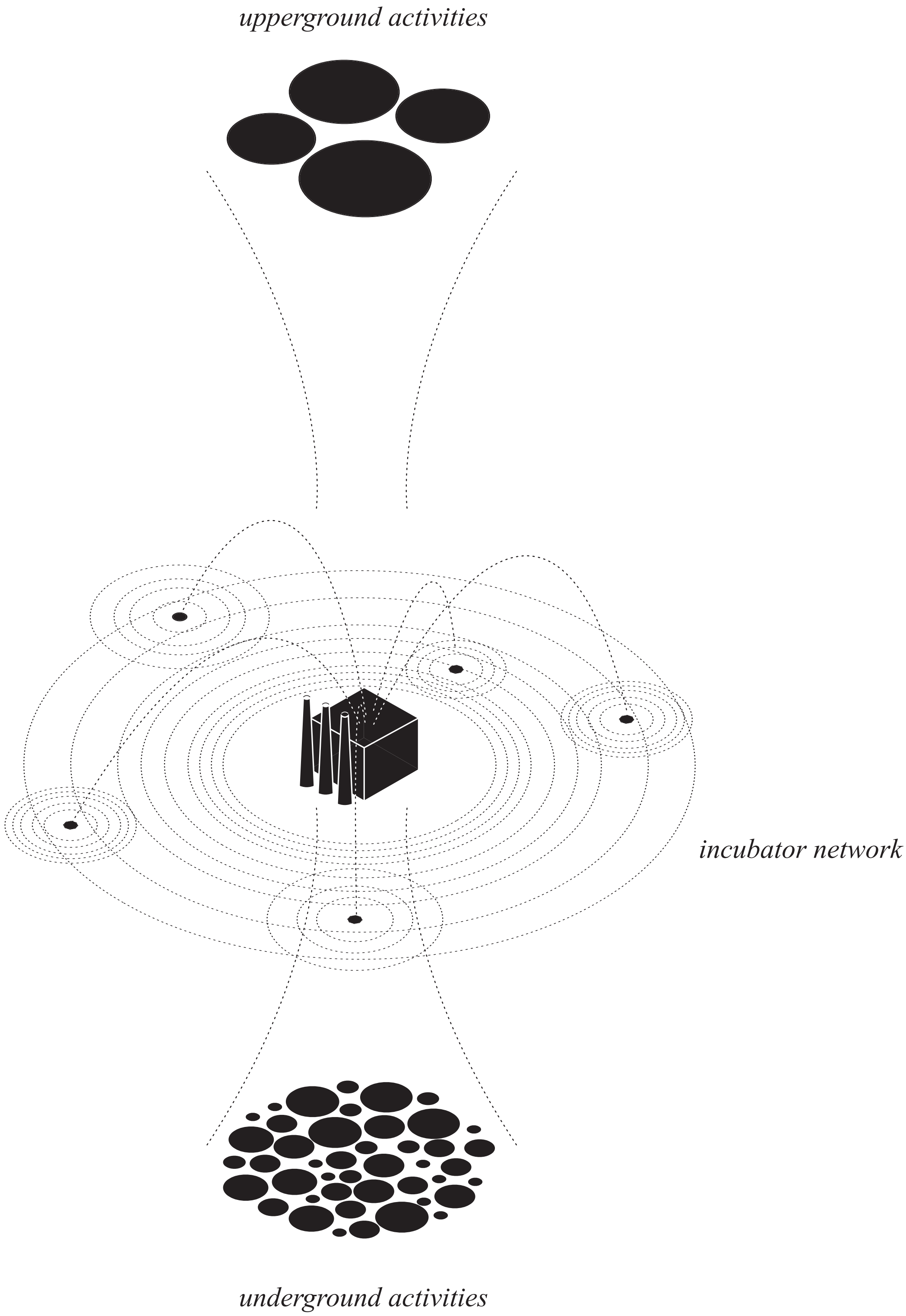
The analysis of the case studies depicted how the creation of a stable and vibrant community was subject to physical relations and common trust. Strong community dynamics were present where tenants had an active involvement in space creation, investing in the construction of their personal workspace and collaborating in the management of daily life operation, developing a sense of belonging to the place. At the same time, physical encounter and sharing practice enable the development of new ideas and collaboration. The physical place of the incubator generated internal and external economies, as subcontractors or as a provider, creating a stable local network.

In relation to the dynamics of the creative city, the incubator model acts as a spatial middle-ground in the local urban environment. It brings together components from the underground, as designers, artists, collectives or informal groups. It involves technical knowledge, represented by craft and artisanal competences or by industrial firms, transforming ideas and concepts into physical objects through a formal and informal decision-making process. It is directly connected to the uppergorund, with the presence of bigger companies and formal institution directly involved in the market.

Within the creative city, the incubator posses a strategic role. It is a cornerstone for the development and growth of small businesses while promoting community interactions and collaborations in the advancement of local economy. The incubator is the physical presence of a middle-ground, it is a key asset for urban and business development and a possible response to rising inequality and an increasing economic divide that the new economy has brought, encouraging local networks of innovation and a diversified local resilient economy.

6.6 Incubator today and tomorrow

In the general and academic literature, the concept of the “incubator” has been defined following different approaches, producing a large number of different definitions. The research highlighted how incubator definitions have moved



upperground activities
incubator network
underground activities

from emphasizing spatial characters to concentrate on administrative, amenities or business development services. At the same time, the rise of accelerators, co-working spaces and real estate projects for the development of shared office buildings created more confusion and misuse of the term (Latouche, 2019).

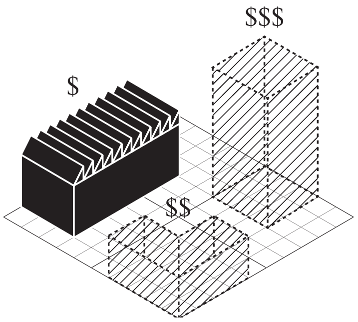
Based on the original concept, the study identified the incubator as a physical object, a building, characterized by specific spatial and managerial strategies fostering the precise aim of providing affordable space for small companies within the city. Today, the incubator still presents an innovative strategy of urban development capable of responding to an ongoing transformation of the working system and the rising phenomenon of urban manufacturing. As the first concepts developed in the 1960s, the analysis identified the structural role of incubators in promoting affordable space for small companies, local development and urban regeneration. The analysis has also recognized the vocation of incubators to respond to novelty, adapting its features in relation to global trends and peculiar spatial and socio-economic characters of the site.

Flexibility is the fundamental and strategic characteristic of incubators, impacting spatial and managerial aspects and their success over time. Indeed, promoting affordable space and services for small businesses is subject to high risks related to economic fluctuations and companies' vulnerability. Strategically, risk management and flexibility are usually achieved by incubators through the adaptive reuse of the existing building, exploiting the adaptability of former urban industrial buildings, and by promoting the presence of different functions to manage the risk related to short-term leases. For the high risks associated with their development and maintenance, incubators are not favourable to commercial and real estate investments.

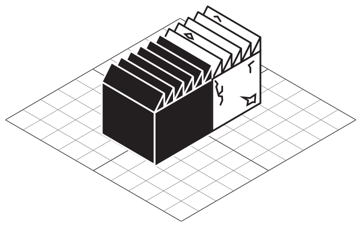
Another fundamental feature of incubators is the creation of a network between tenants. Physical proximity enabled by incubators enhances interaction and exchange between small businesses, a critical aspect for their growth and mutual help, developing collaborations on the local scale and allowing knowledge-spillover between different realities. Case studies showed how incubator networks contribute in setting up a solid internal community, based on sharing and on a sense of belonging to the place which could imprint a shared vision of space development, or more simply encourage collaborations and contacts between different activities and competences that are located in the same place, making possible the escalation of the network. The creation of a tenants network is fundamental for the success and resilience of incubators.

The incubator has a critical role within the urban environment and a complex organization, requiring different skills and incentives for its development. In this regard, the analysis of the case studies has highlighted some incentives that can help the development of incubators within urban contexts.

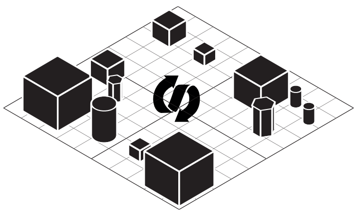
The first incentive concerns incubator spaces and their maintenance. The reuse of existing buildings has to cope with significant maintenance works that require large investments. As the incubator aims to provide low-cost space and services to small local businesses, its development requires investments that can hardly be covered by rental income alone. Case studies show how private (Sectie-C) or public investment, in the form of a loan (Keilewerf 2), or as funds (Portland Works) has been fundamental for their development. In this regard, municipalities can play an essential role in encouraging the development of incubators through the creation of public-private collaboration agreements for the use of public buildings or areas and the partial subsidy of renovation works.



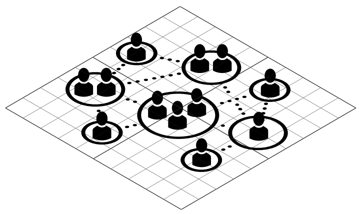
affordable rent



adaptive reuse



flexibility

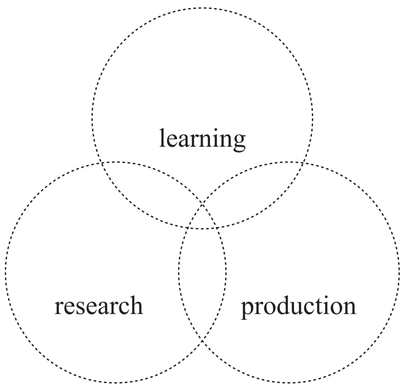


network

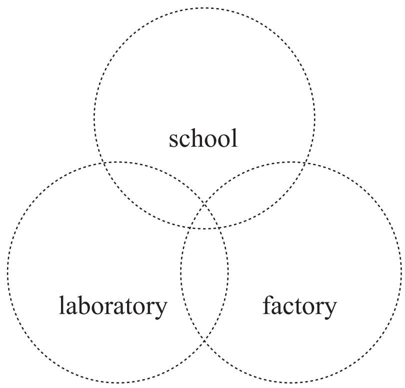
The second incentive, directly linked to the first, concerns the development of companies and the incubator community. Companies and their networks are subject to slow maturation over time, which requires guarantees regarding space and rental contracts, thus allowing long-term planning. The analysis of the case studies highlighted how these conditions allowed companies to invest in the territory, enhancing local economy and urban redevelopment. Unfortunately, these circumstances are often far from reality as the incubator, and the mix of activities that it hosts are generally subject to temporary use regime. This type of contract allows the use of spaces notwithstanding local regulations, that would otherwise hinder the adaptive reuse of buildings, but it is the main factor influencing the investment and interest of businesses in place development. Cities must consider incubators as structural elements of the urban ecosystem, promoting their development not only as temporary use of peripheral spaces awaiting transformation but promoting instead their growth and development aiming at consolidating activities that create local value.

The third element to be encouraged concerns the research and impact evaluation of incubators in relation to their specific urban environment. As the study showed, incubators are underestimated in their role in the urban environment and in the promotion of the local economy. Municipalities can take advantage of the high concentration of businesses located in the incubator to analyze sectors involved and their characteristics, job creation and local income, providing valuable data and instruments for city planning. At the same time, as cities are facing a transformation of work system which will strongly affect future urban development, the high grande of experimentation shown by incubators can be a critical element in reviewing workplace standards and regulations, updating them to the new trends imposed by digitalization and new technologies while reconsidering the important interconnection between working and living activities.

Places such as incubators will play an increasingly important role within the city due to their ability to host different functions and adapt to different conditions while supporting the local community and economy. Incubator diffusion within urban contexts all over the world is stimulated by its capacity to host and integrate functions that the urban culture of the last century has often planned as separated. The incubator makes possible the integration of research, production and learning activities in the same place, and its future development is directly linked to their transformation and evolution. The merging of these activities will increasingly influence future incubators development which will be spatially characterized as the integration of laboratories, factories and schools in the same place.



funcional integration



spatial integration

6.7 critical issues and future research

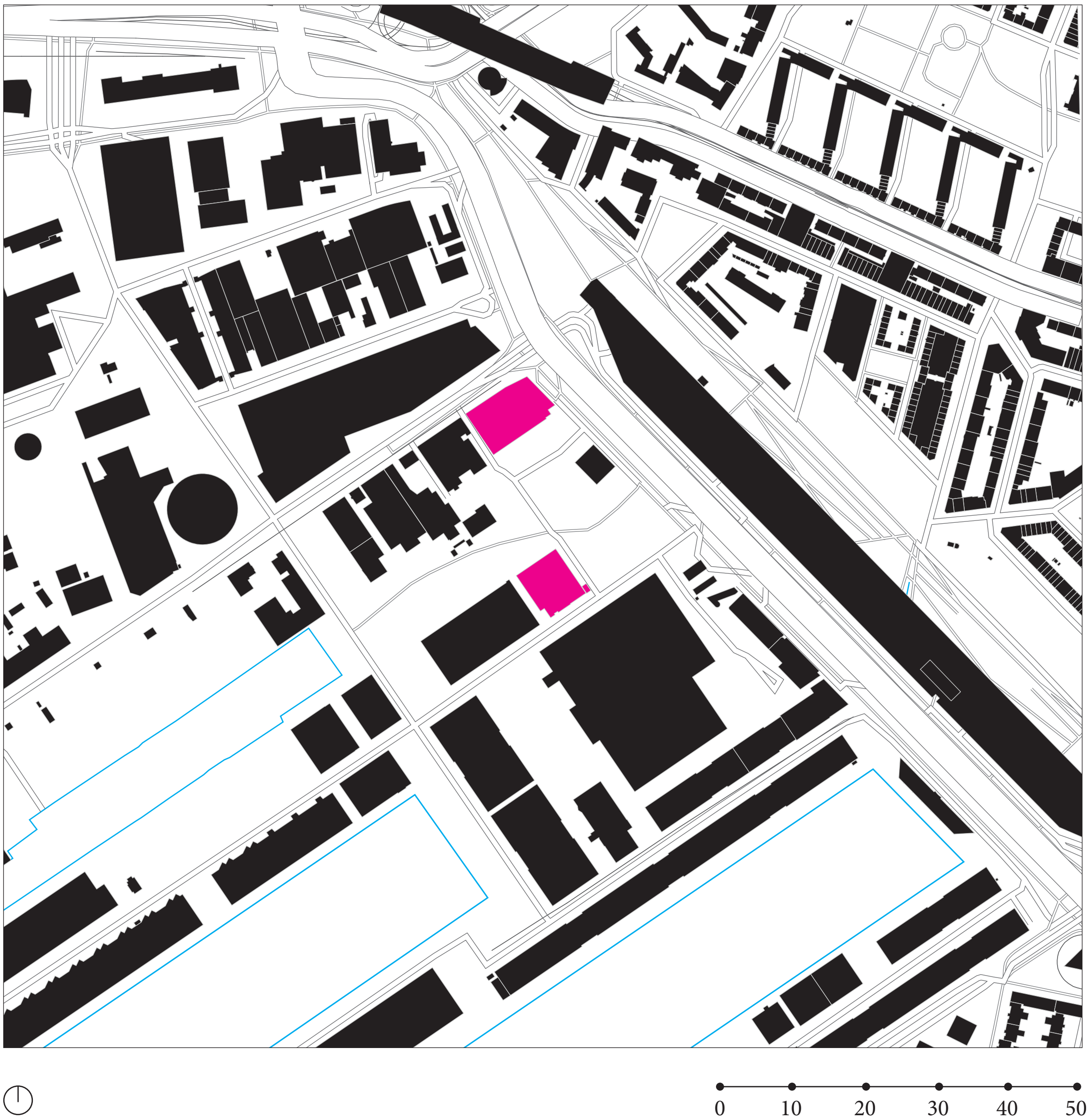
Research critical issues mainly concern fieldwork and data collection. The research has found difficulties in the inspection and analysis of areas dedicated to production activities due to security reasons. At the same time, interaction with companies and individual workers encountered difficulties which led to a partial collection of data about firms. Likewise, a higher number of cases would have made it possible to broaden the spectrum of analysis.

At the same time, the study has identified three areas that are considered strategic for future research on the subject. The first area concerns the birth of incubators and their first phase of development, in particular linked to the British public initiative of the 1970s and their diffusion throughout Europe. In-depth research on the history of incubator could highlight the interconnection that incubator development has with other models of space occupation, primarily with alternative living models and squatting practice. The second theme concerns the analysis of incubator space and management strategies. The research has identified four exemplary cases, but the number of cases present in the European territory is much higher. A study of a larger sample of cases can strengthen knowledge about incubators and their spatial characters, finalized at developing operational tools for their development and planning. Finally, the high density of activities that are hosted inside the incubator can provide valuable data to analyze the characteristics of urban manufacturing and creative activities, which play an increasingly important role in the urban economy. Future research on incubator activities can provide relevant information to support policies development and public management while supporting recent researches on the productive city and a more conscious mixed-use development.

Chapter 4 - appendix:

Case studies Analysis

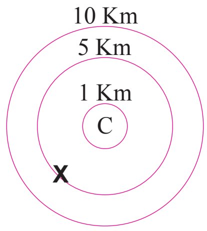
KEILEWERF | Rotterdam



OPENING TIME

8/19 h Tenants

09/18 h Public store

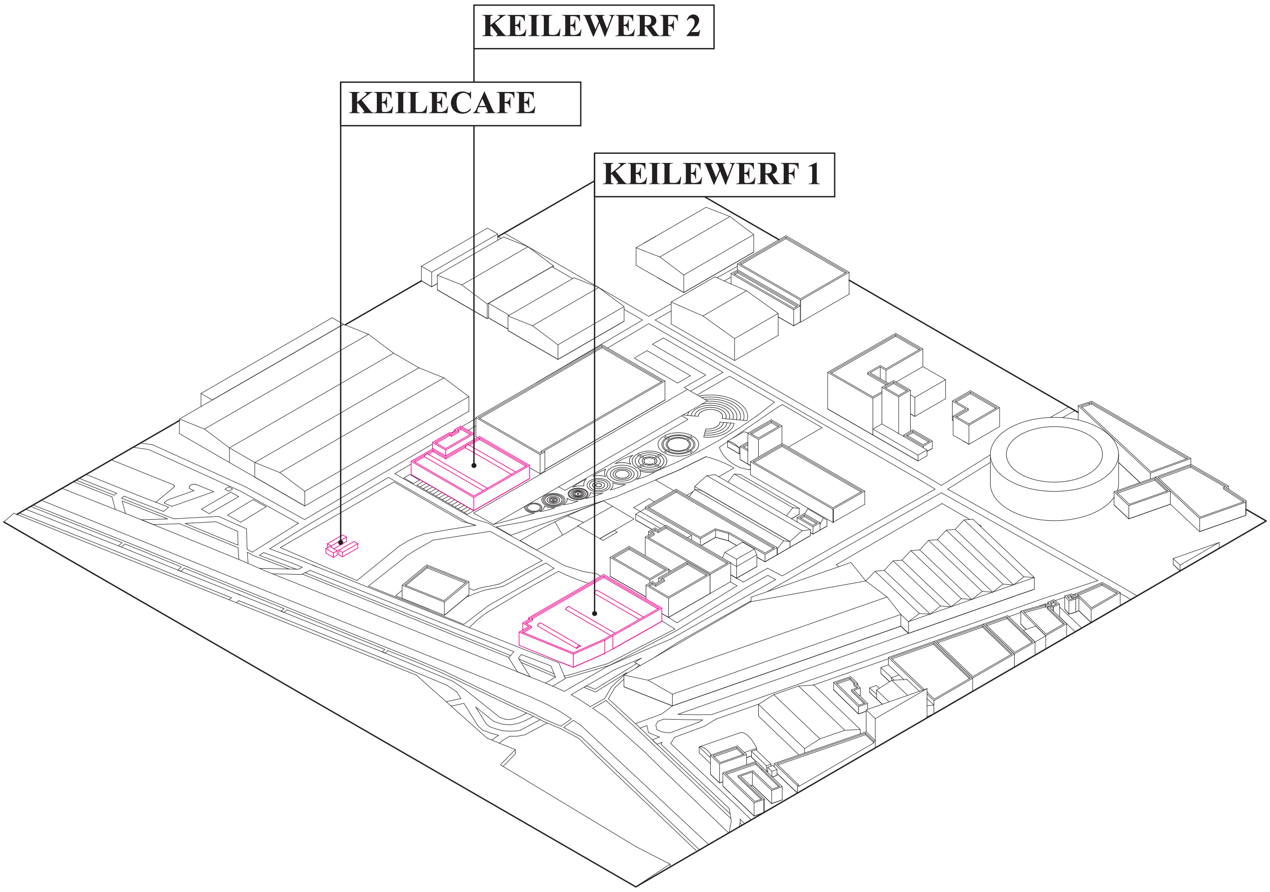


PUBLIC TRASPORT INFO

From station: 20min/bus
13 min/bike
9 min/car

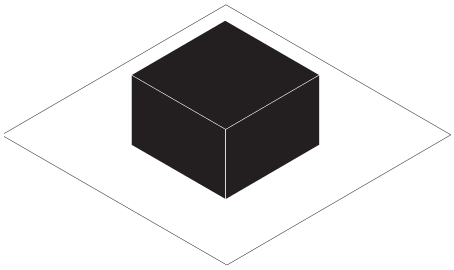
1a

Keilewerf 1/2 | **urban characters** | district



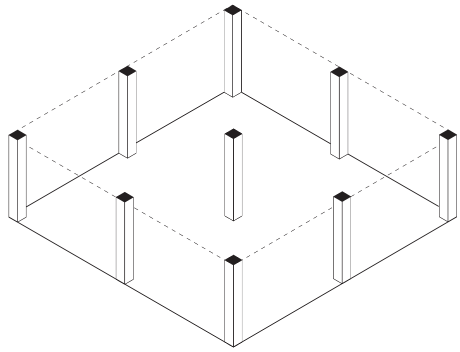
1b

Keilewerf 1/2 | **urban characters** | area



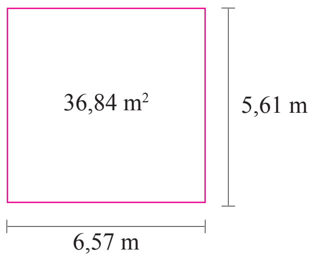
building dimensions

7272 m²
48.200 m³

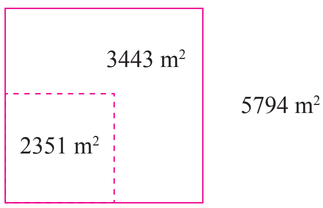


structural form

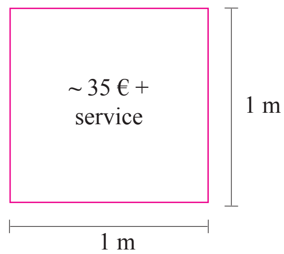
freme construction



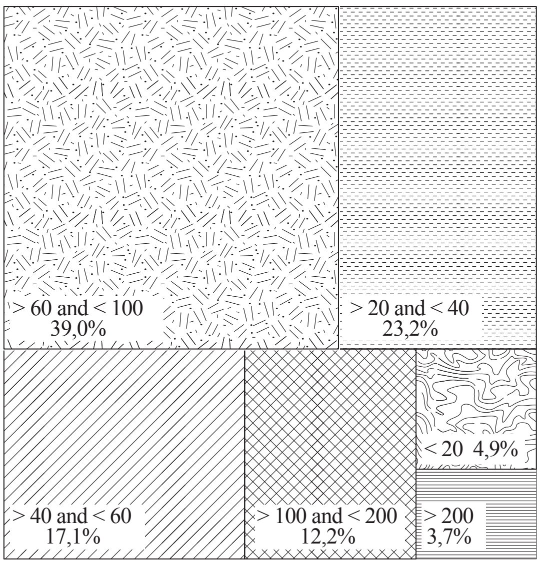
single plot average size



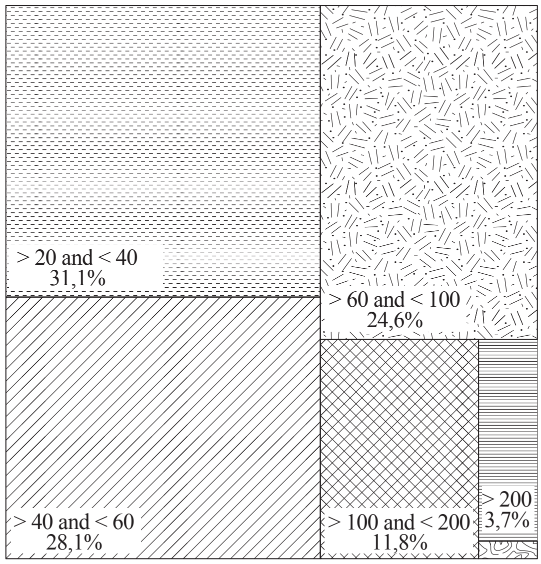
open/close area



cost × m² × y



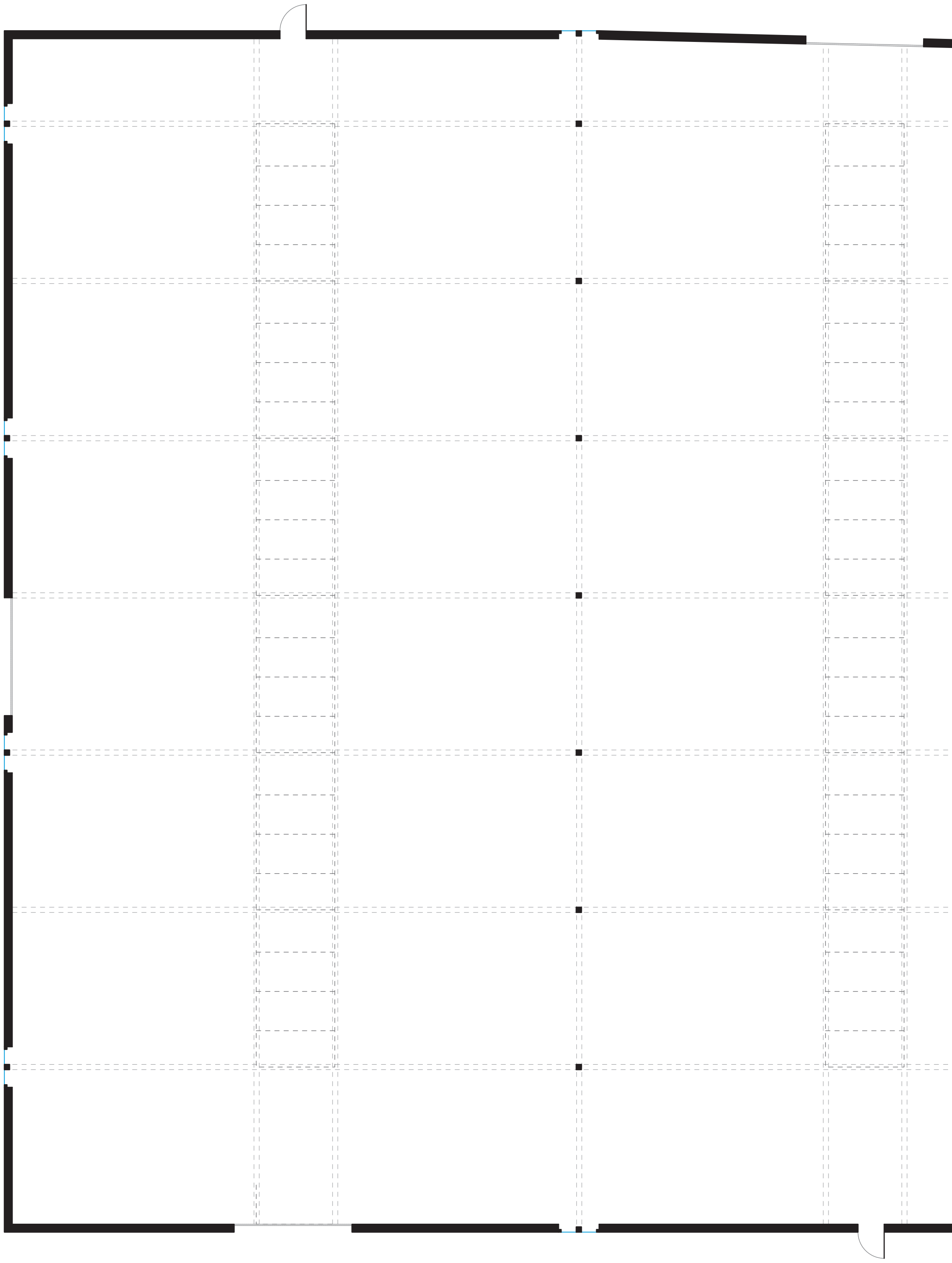
N° of space distribution



Surface category distribution

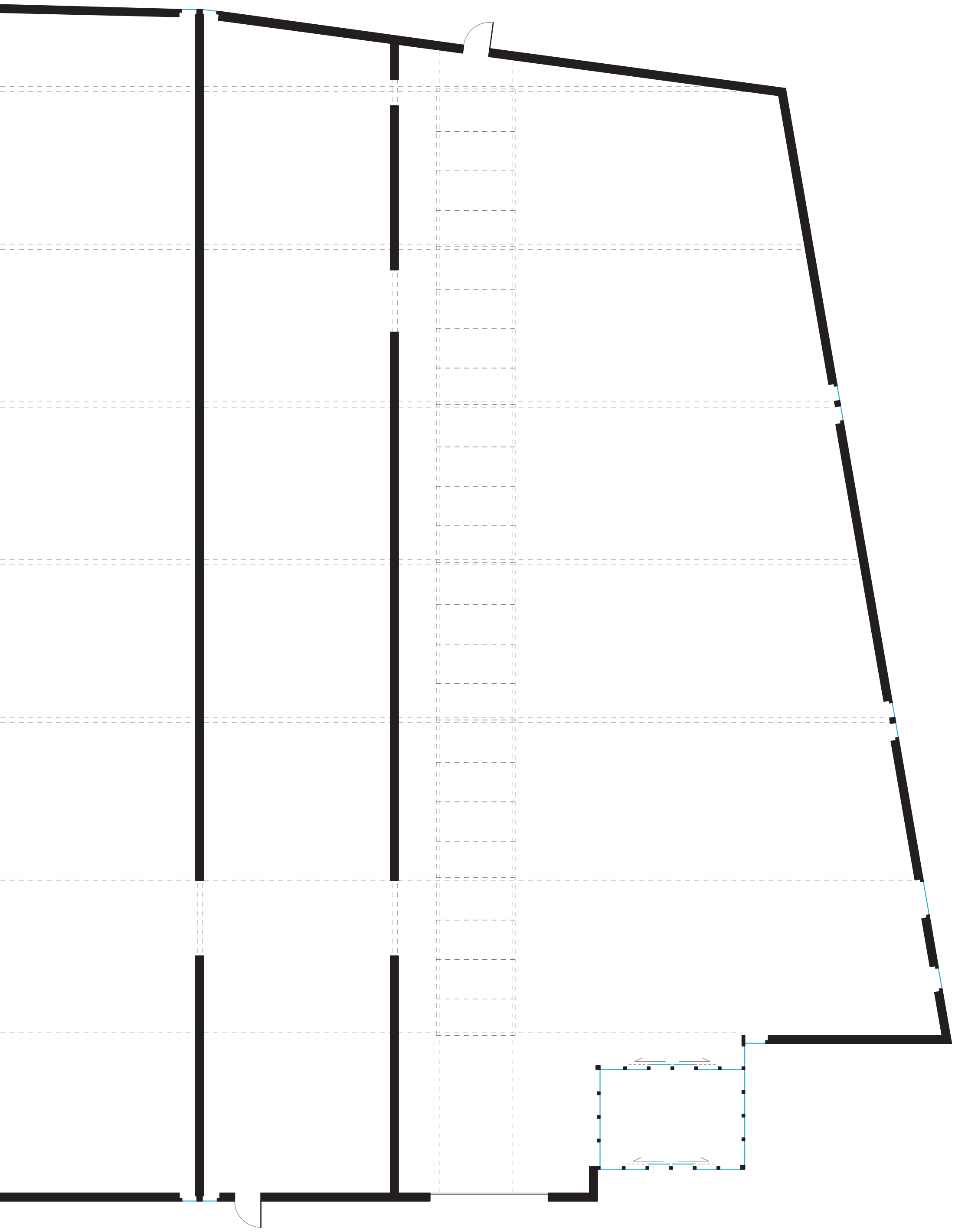
1c

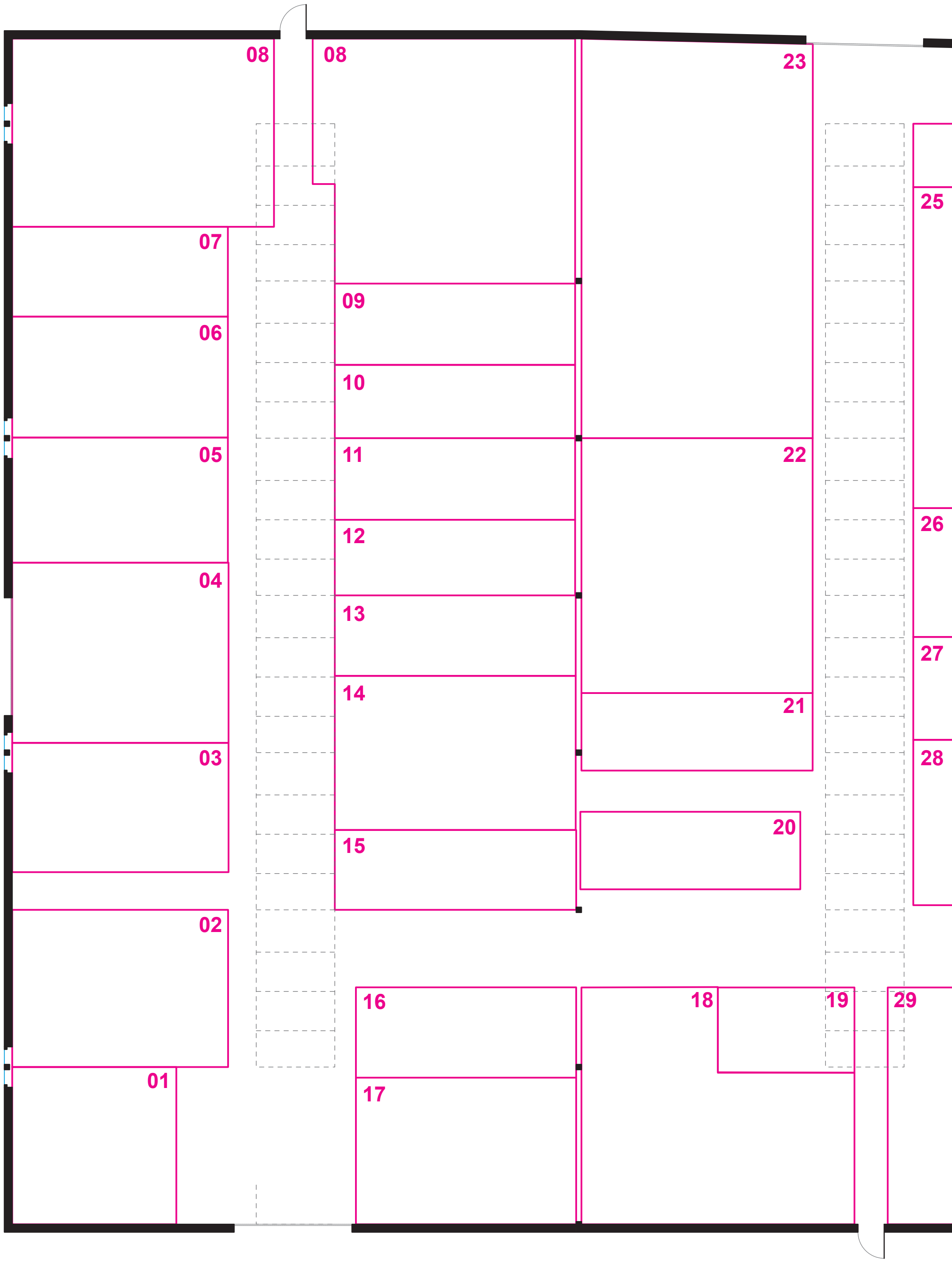
Keilewerf 1/2 | **dimension analysis** | data on the building



2a

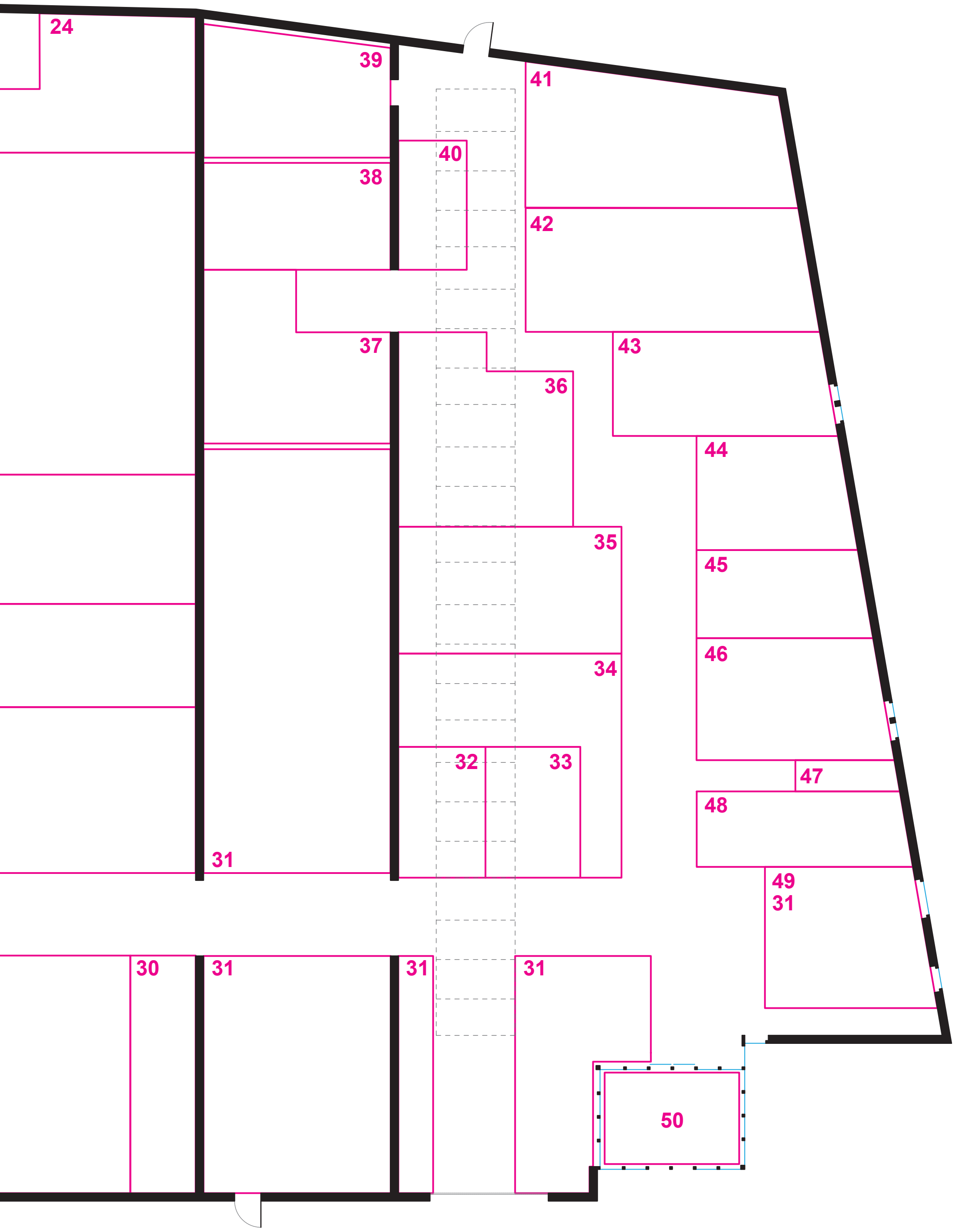
Keilewerf 1 | **architectural characters** | structure plan





3a

Keilewerf 1 | **space use** | plot subdivision


24
39
41
40
38
42
37
43
36
44
35
45
46
34
32
33
47
48
31
49
31
30
31
31
31
50

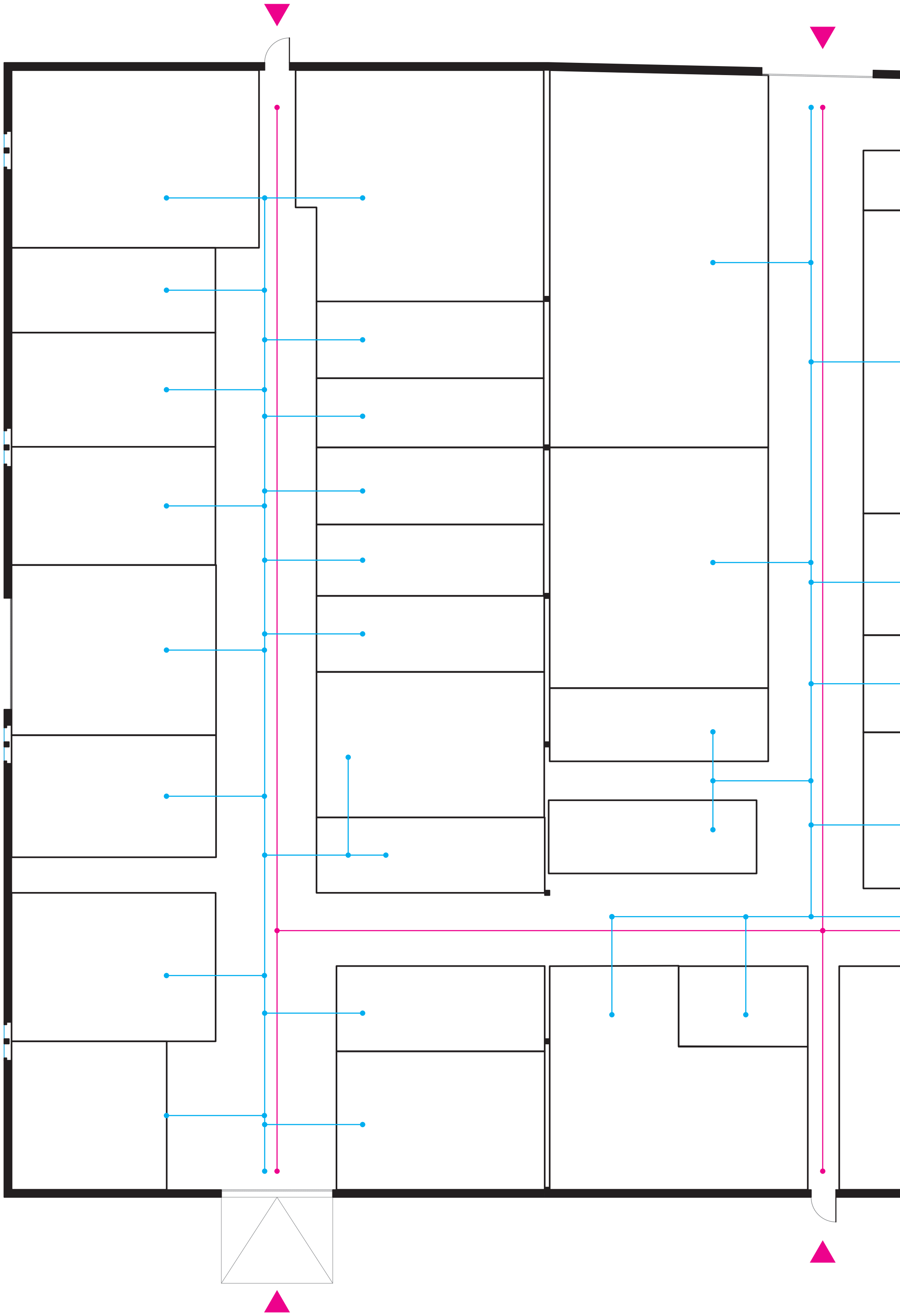
- 01 Event Motor Company
- Alex Zaagat
- 02 Mobile escape room
- 03 United Enterprise
- 04 De Verbaasde Ree
- 05 De Meester Meubelmaker
- Meesterlijk Stofferen
- 06 Magic Desingz
- 07 Spacecreators
- 08 De Bende
- 09 In scene Gezet
- 10 Ester Rademaker
- Spaak
- 11 Studio Met
- 12 A69 Design
- 13 Handelsonderneming Walter
- 14 Funkie
- 15 Tijn
- 16 Edutones
- 17 John Wood Cases
- 18 Pixel Bar
- 19 Letolab
- 20 Restroom
- 21 Weller Design
- 22 Staalslagerij
- 23 Joost Goudriaan
- 24 Bram Spruit de badmeestert
- 25 Plant vierkant

3b

Keilewerf 1 | **space use** | activities environment

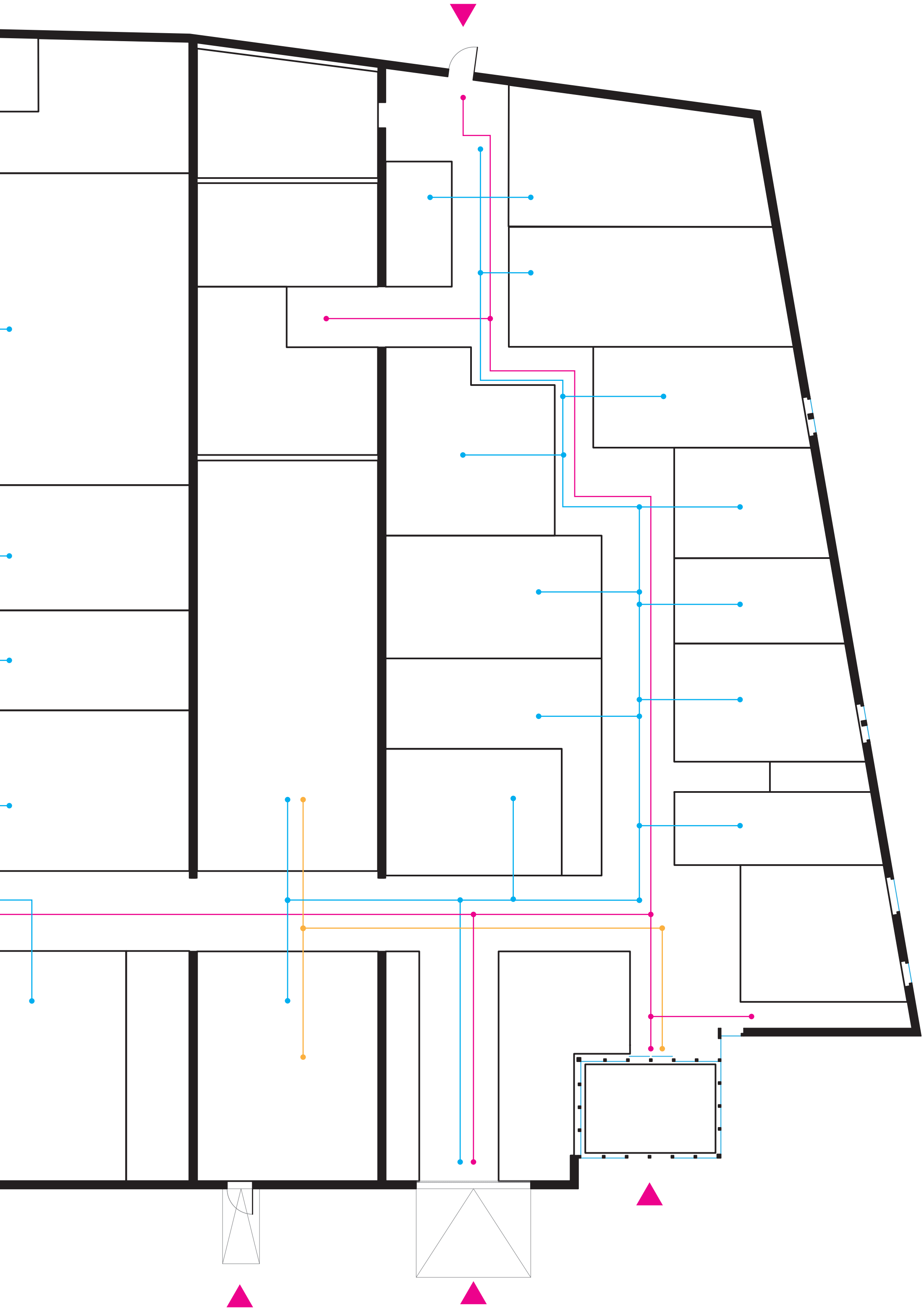
- 26 Bink Meubel
- 27 Hart voor hout
- 28 Shared Machine
- 29 Shared project space
- 30 Judith
- 31 Buurman
- 32 Annette Vermeij
- 33 Michel
- 34 Studio Jorn Heidekamp
- 35 Just Just
- 36 Albert Potgieter
- furaha
- 37 Maarten Bel & Willem
- 38 Give a bike Foundation
- 39 Ko & Florian
- 40 Guyot Duquesnoy
- 41 Friends of the Family
- 42 The Cosmic Caarnival
- 43 Unger Beerends
- 44 Sil Krol
- 45 Art in Marble
- 46 Hokori
- 47 Restroom
- 48 Bart Lentze
- Studio Lentekind
- 49 Shared Kitchen
- Buurman Office
- 50 Entrance

- Crafts
- Wood Working
- Service
- Fine art
- Architecture
- Design

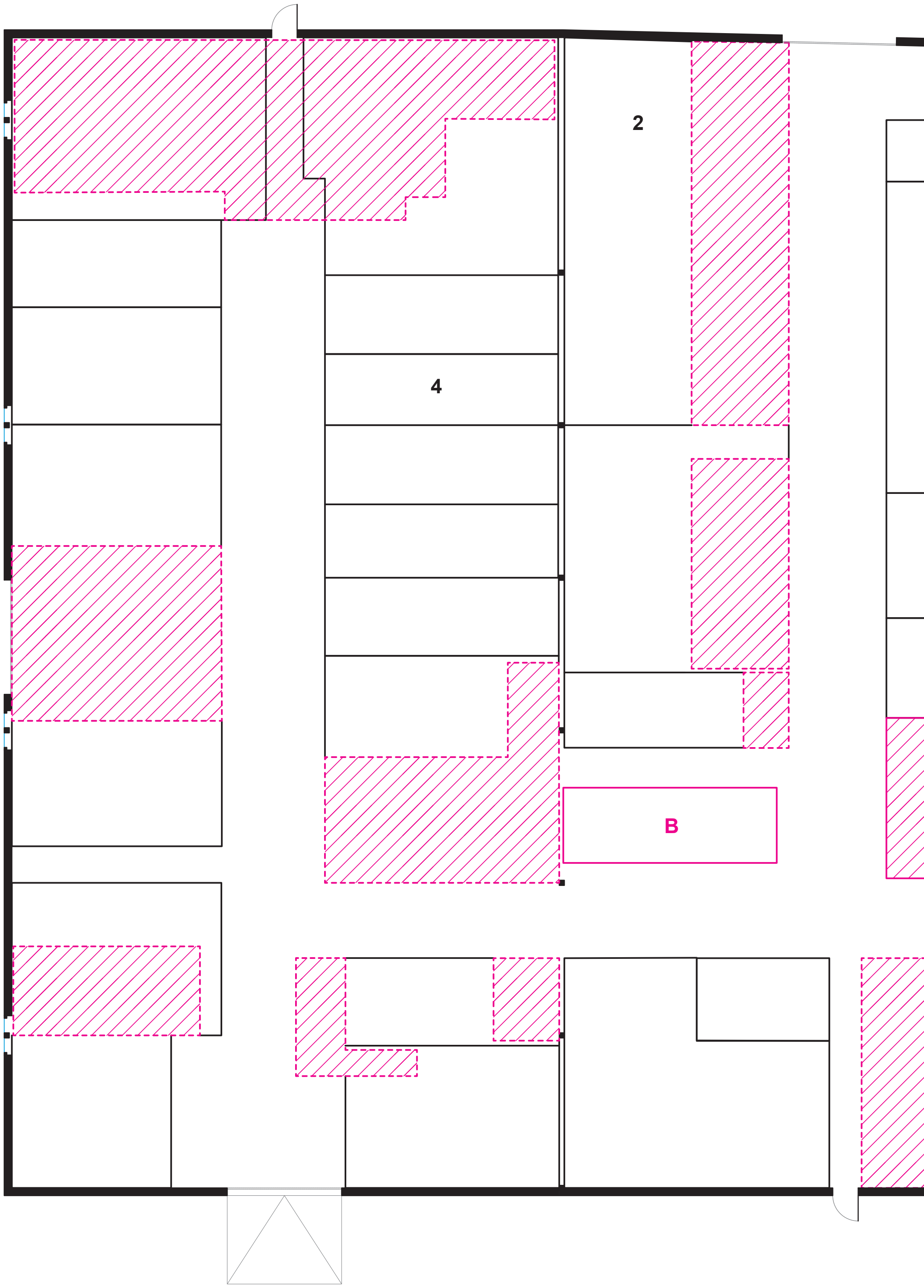


4a

Keilewerf 1 | **space use** | flux analisys

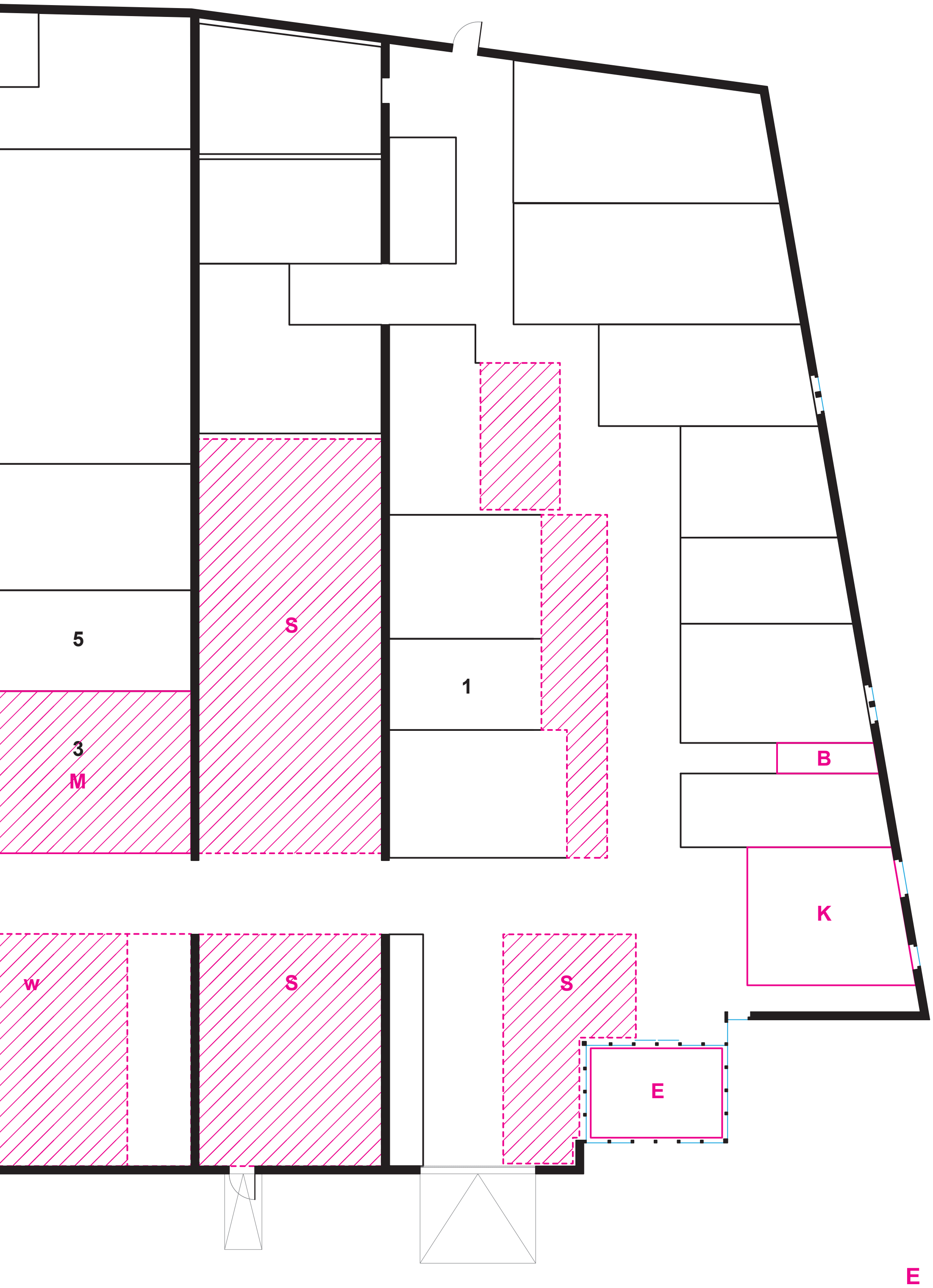


vehicular access
material flow
tenants flow
public flow



5a

Keilewerf 1 | **space use** | common areas and services

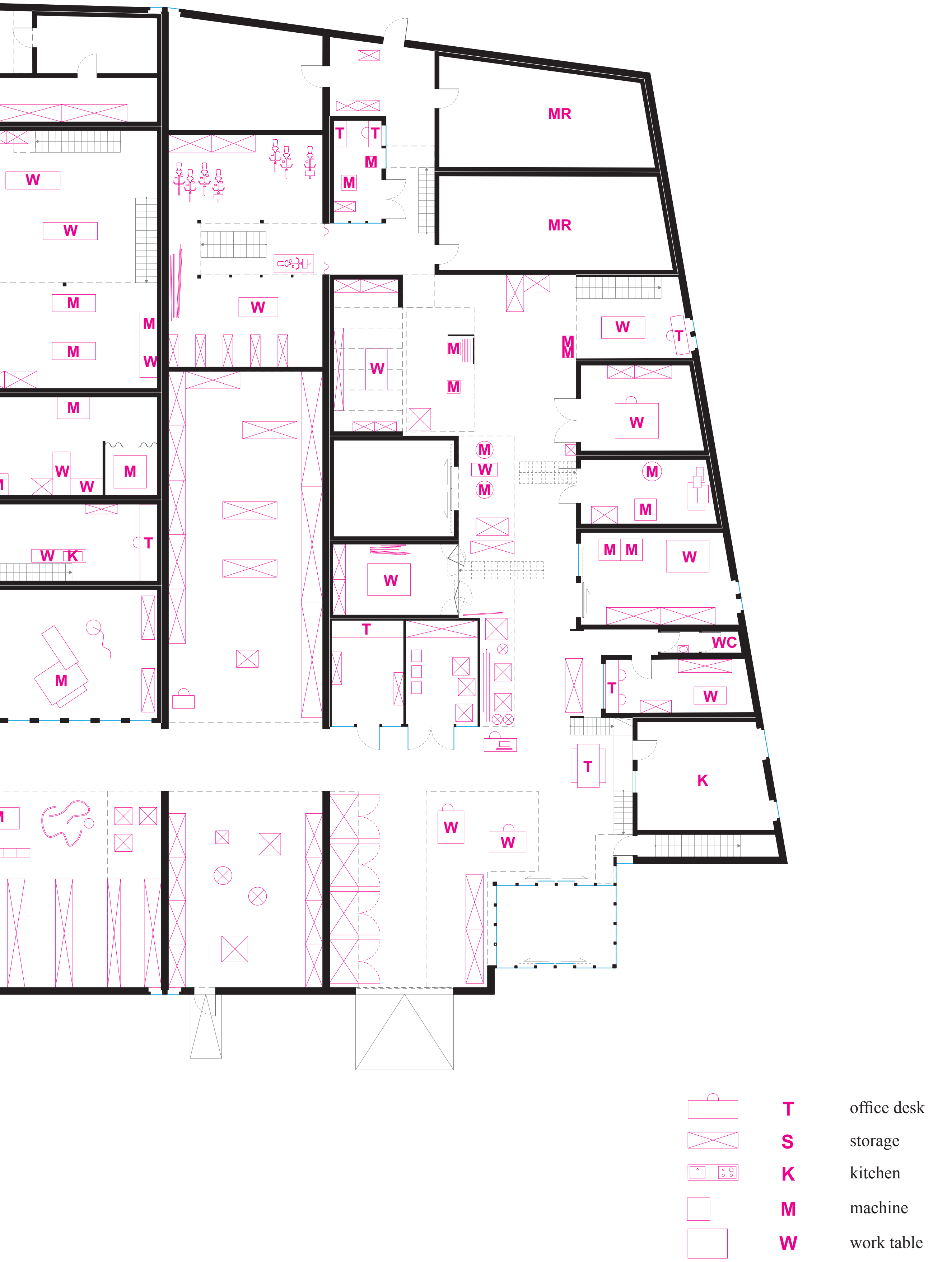


closed space
open space
workspace

E public entrance
M shared machine
B restroom
K shared kitchen
W shared showcase
S public storefront

6a

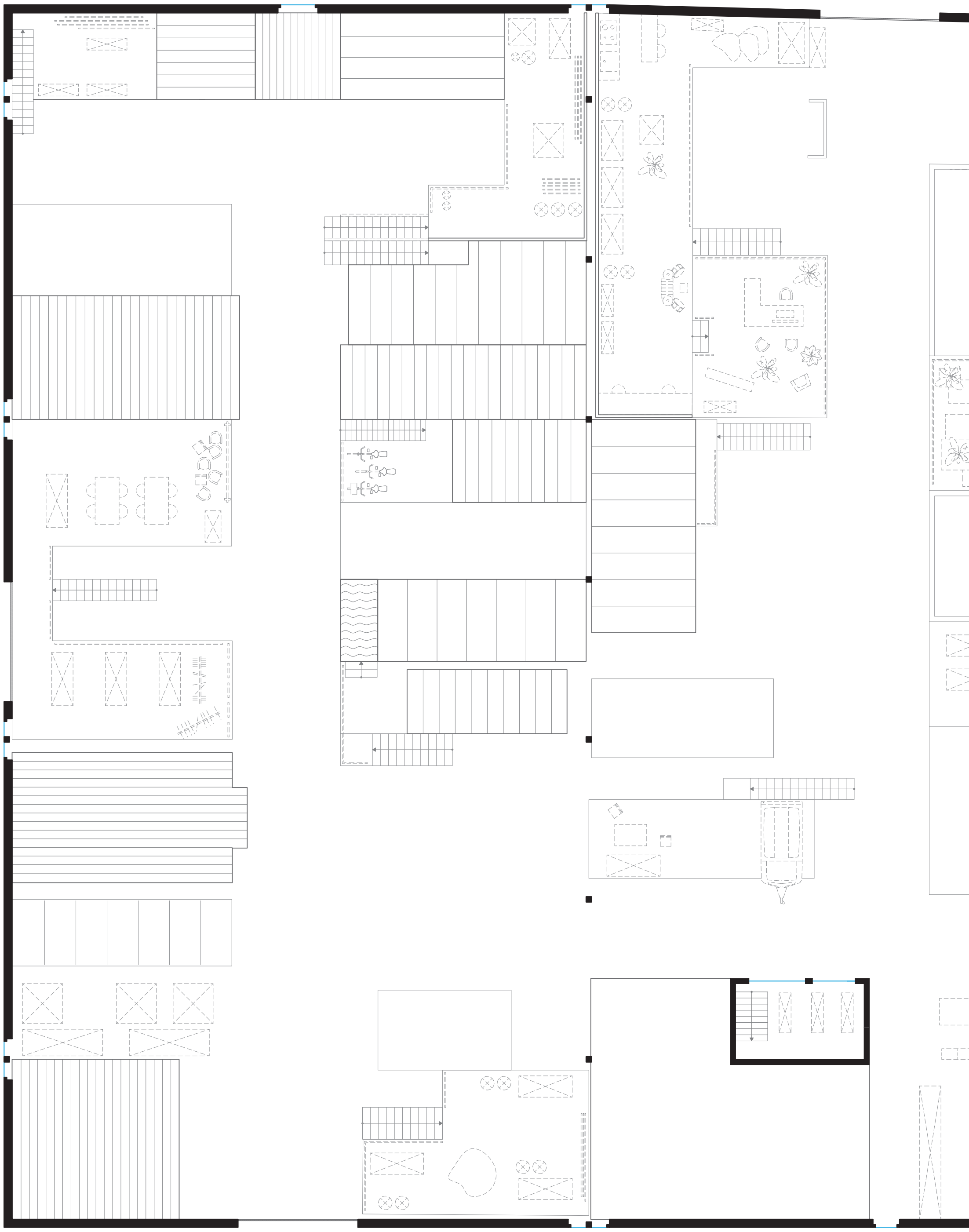
Keilewerf 1 | **space use** | Ground floor


MR
MR
T
M
W
K
WC
T office desk
S storage
K kitchen
M machine
W work table

6b

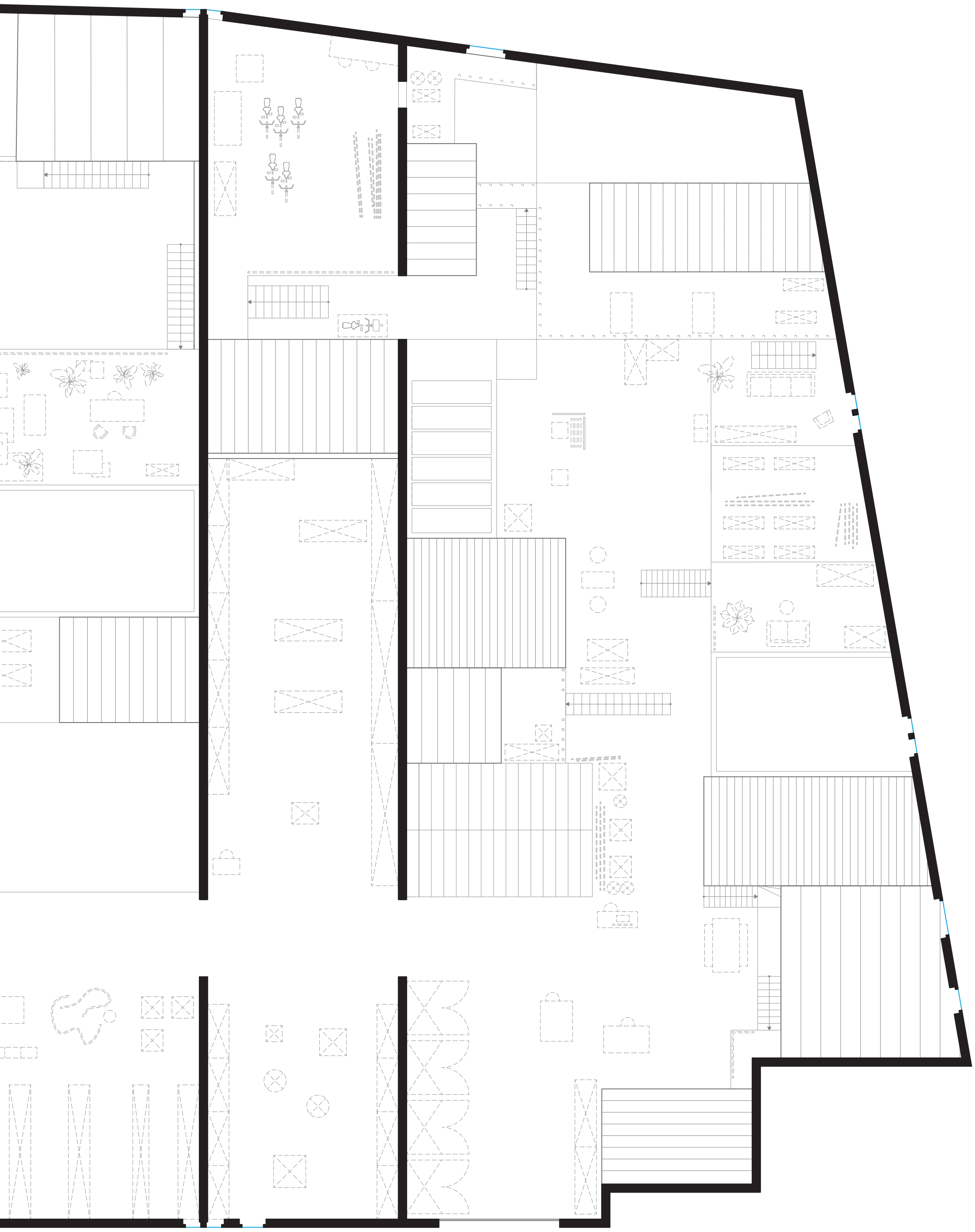
Keilewerf 1 | **space use** | First floor


M
M
M
M
T
T
T
M
T
T
T
M
T
T
T
T office desk
S storage
K kitchen
M machine
W work table

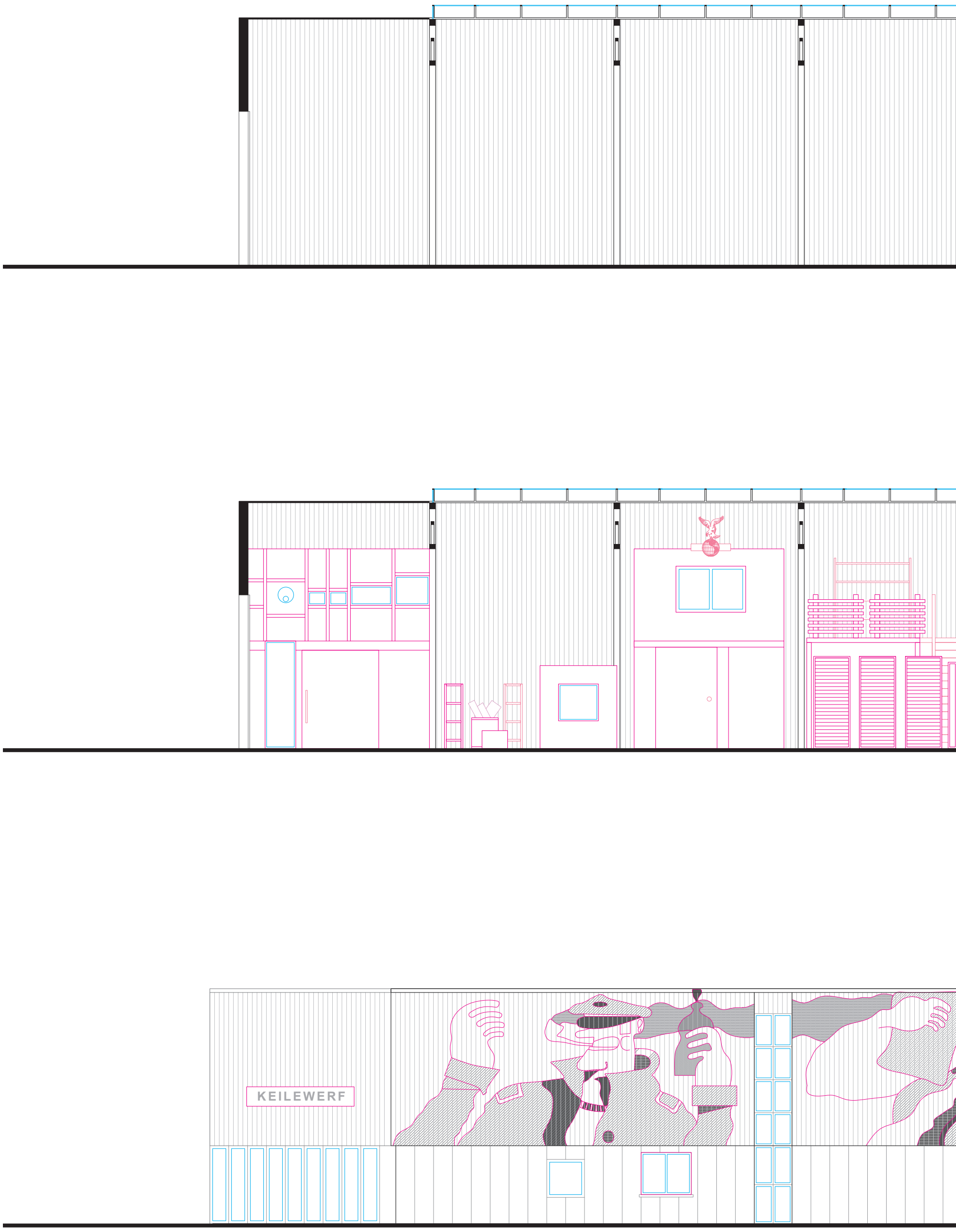


6c

Keilewerf 1 | **space use** | Second floor

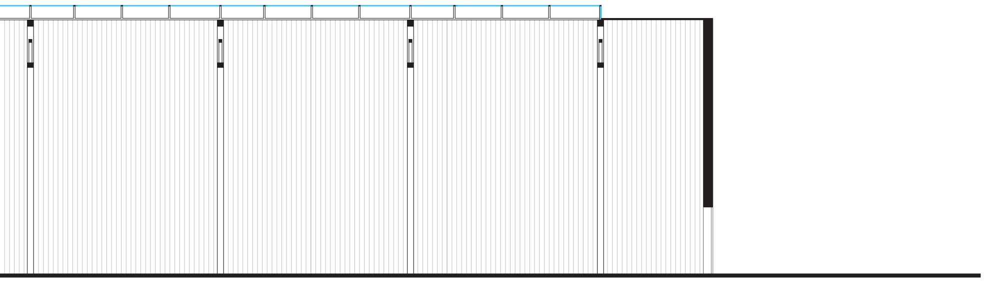


	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table

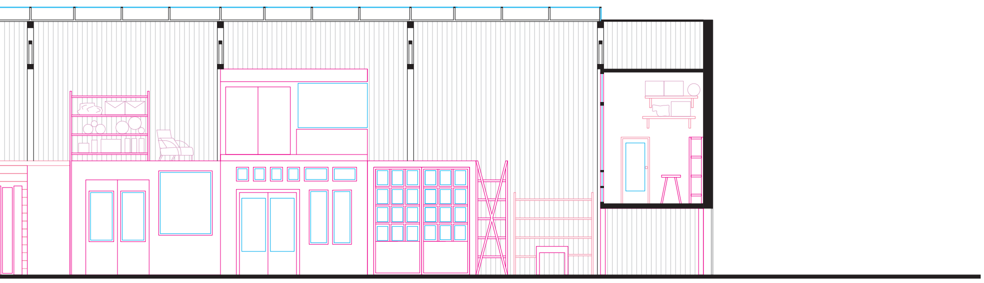


7a

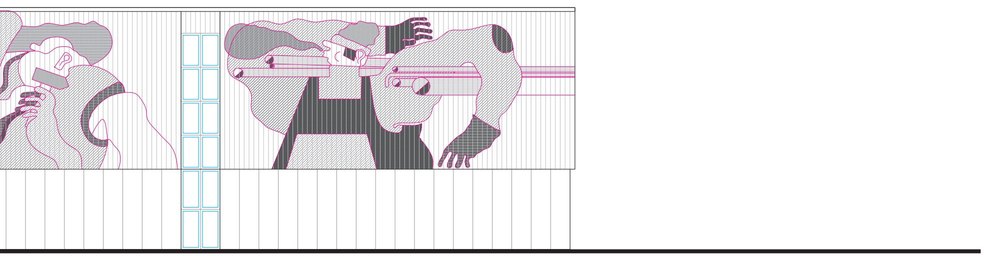
Keilewerf 1 | **material characters** |Structural section | Re-use strategy | Elevation



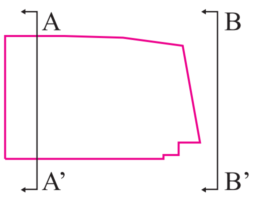
A-A’

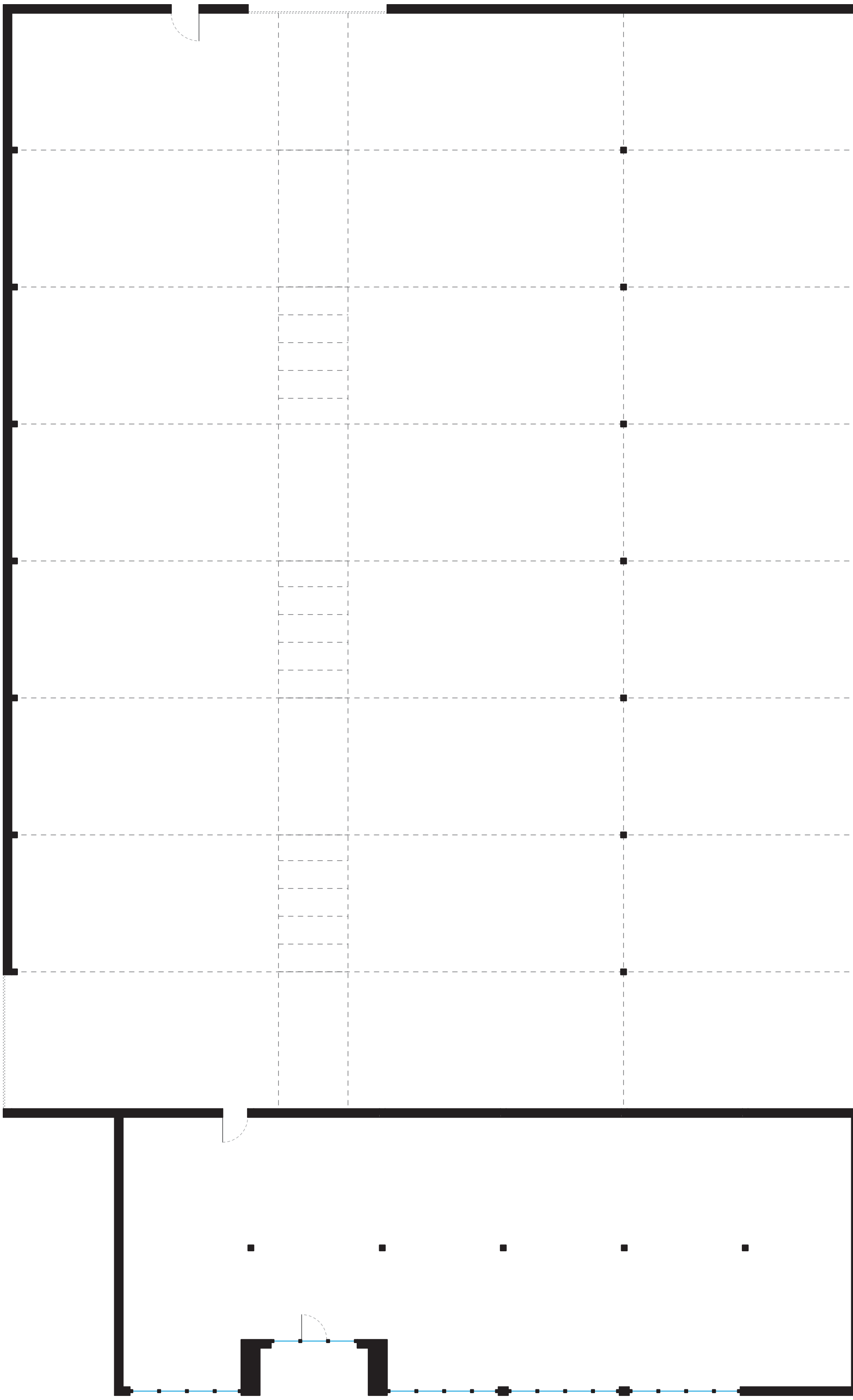


A-A’



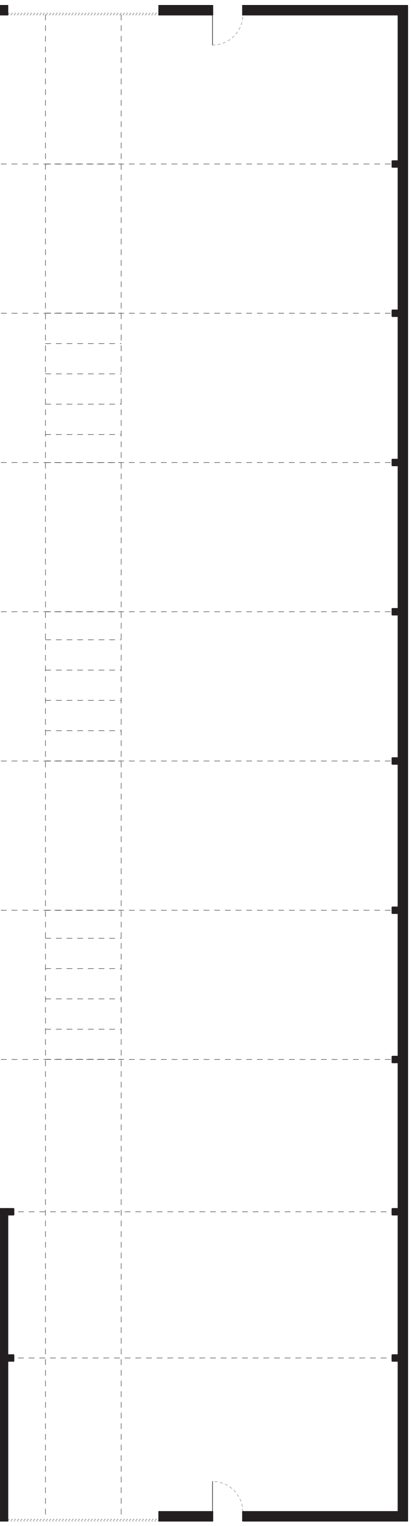
B-B’

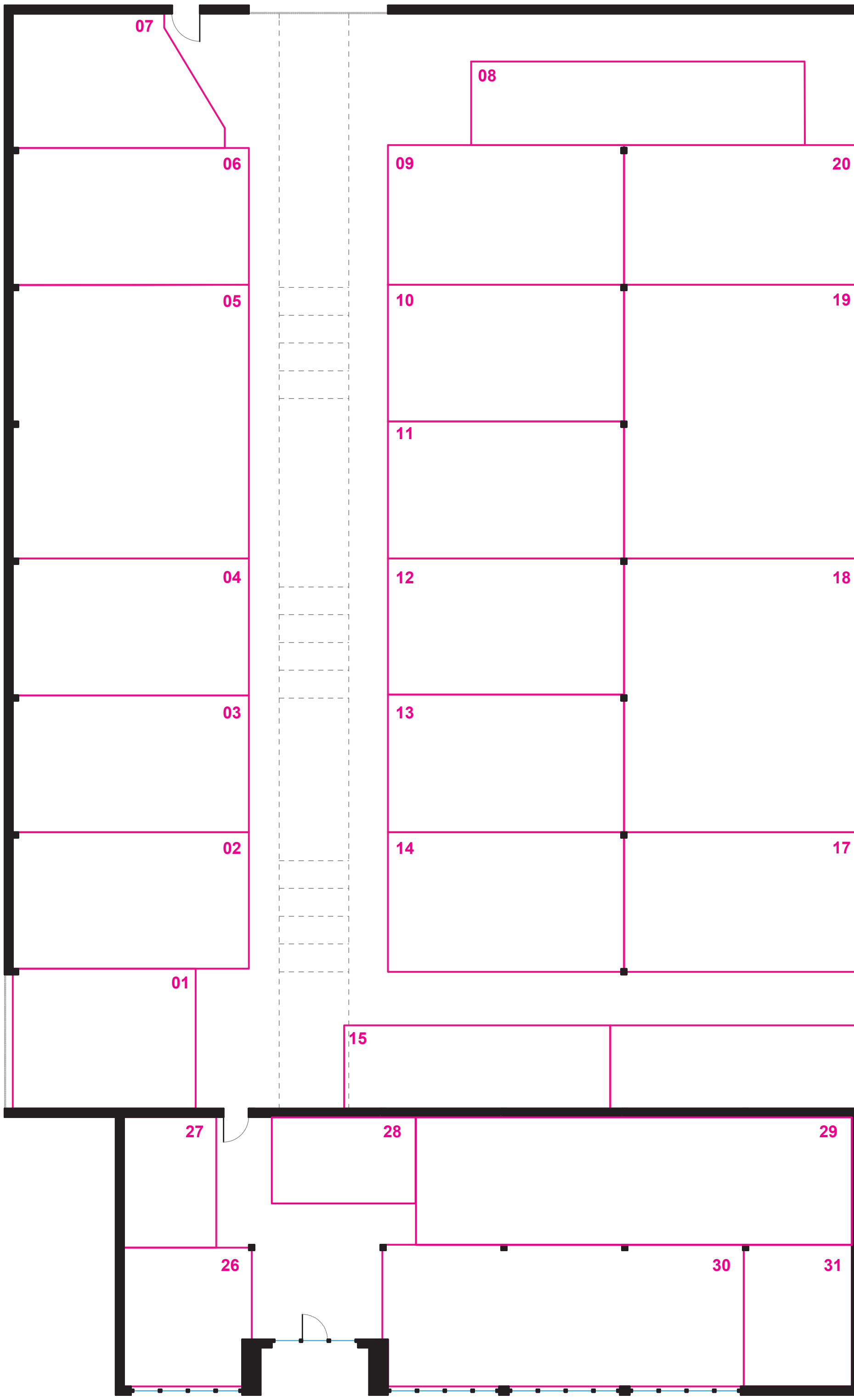




2a

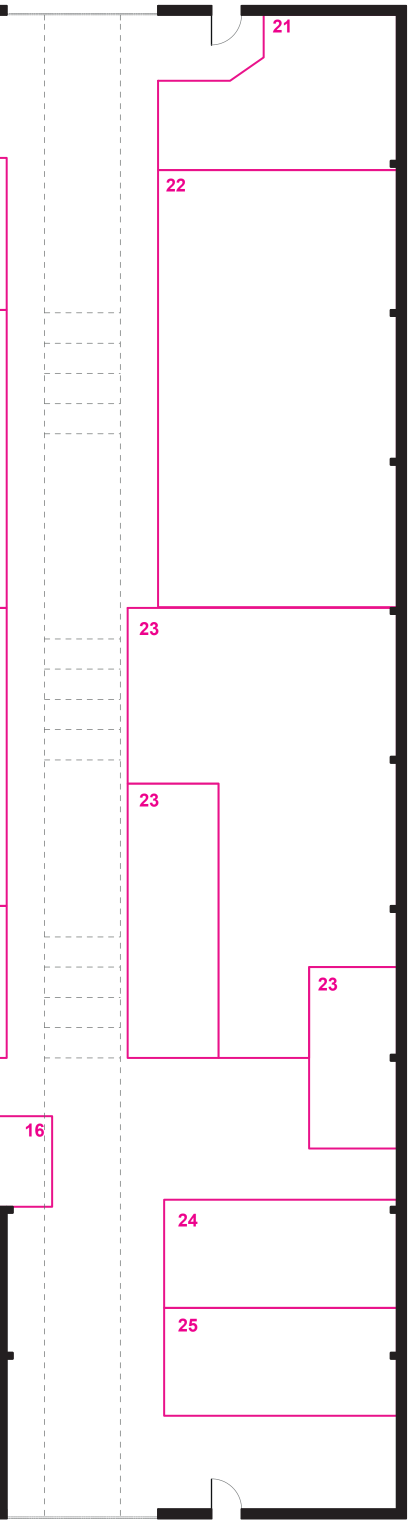
Keilewerf 2 | **architectural characters** | structure plan

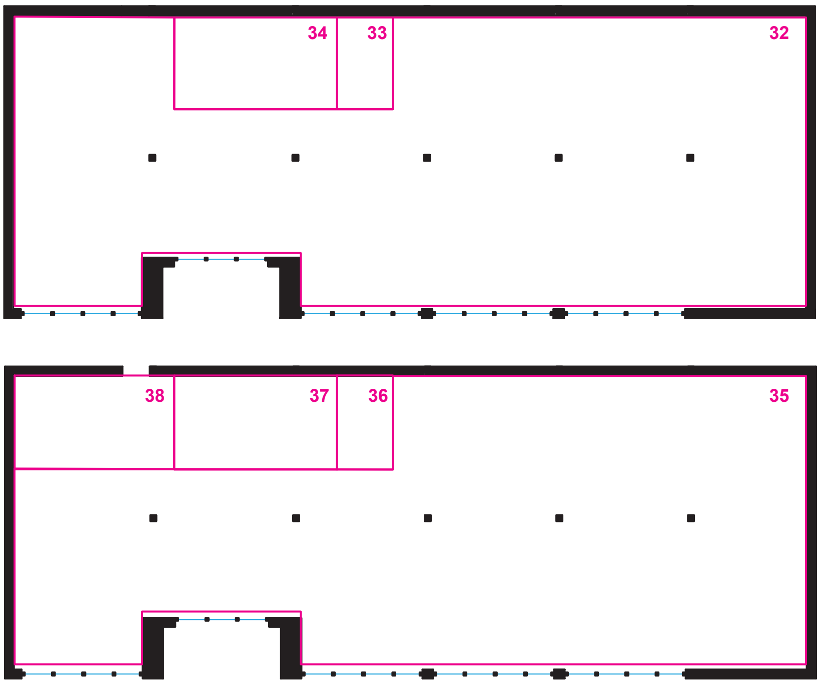




3a

Keilewerf 2 | **space use** | plot subdivision


21
22
23
23
23
16
24
25

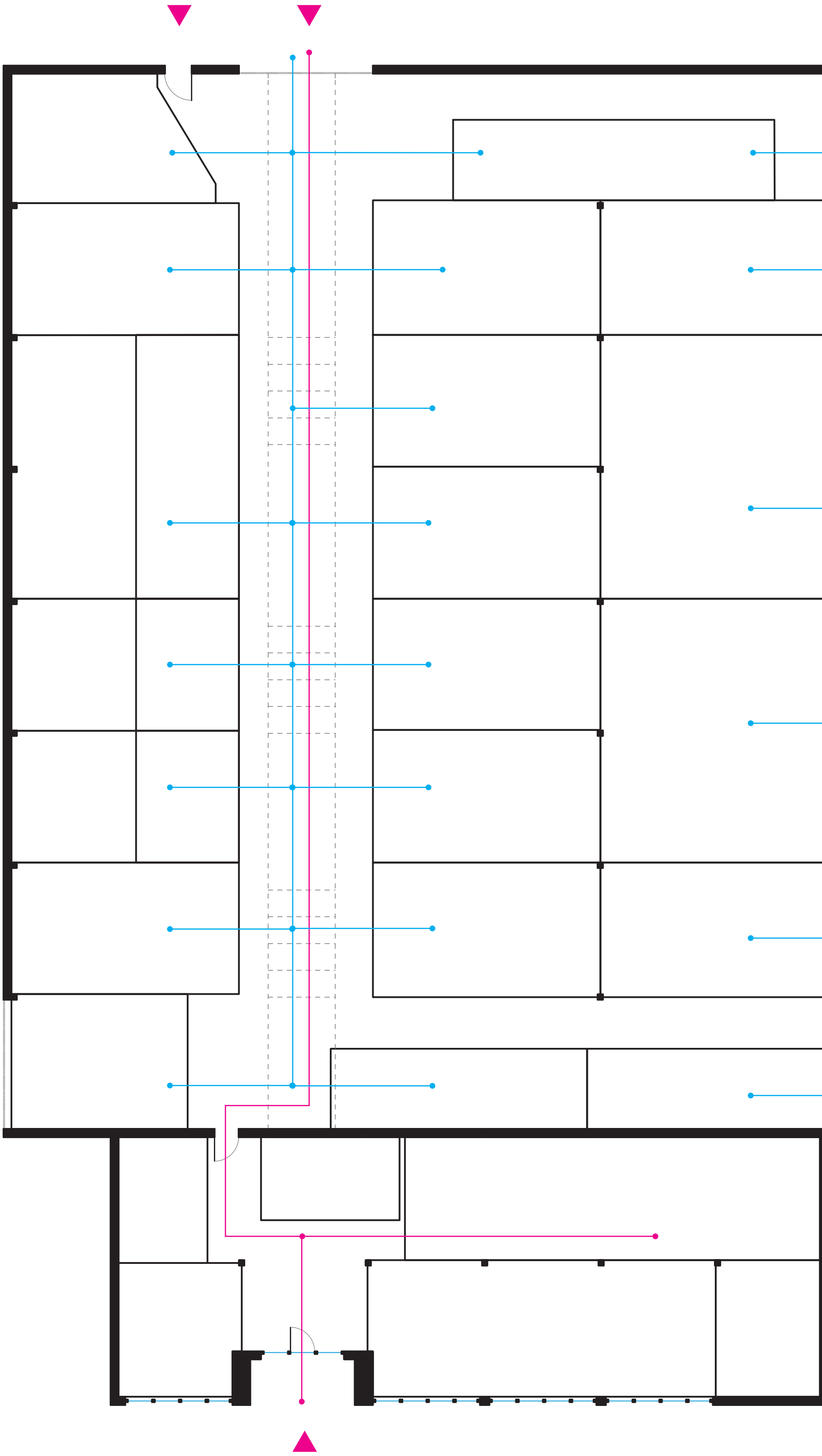

34
33
32
38
37
36
35

- 01 Studio Selma Hamstra
- 02 Studio Lotte Douwes
- 03 Studio Yorgos Bournousouzis
- 04 Studio Sio
- 05 Stadler Made
- 06 Bluewave design
  - Studio Joep Swagemakers
- 07 This is Bouw
  - The commune
- 08 Le Sappelier
- 09 Charlotte van Otterloo
  - M&H Reizende Tentoonstellingen
- 10 Iwan Pol
  - Studio van der Stel
- 11 Studio Simone Post
- 12 Rott
- 13 Door & Door Design
  - Protoproto
- 14 Kavva
- 15 Living Light
- 16 Dansvoer
- 17 Bende
- 18 Flexible space
- 19 Simone post
- 20 Fynder
- 21 Buro van Wieren
- 22 Tiny house accademy
- 23 Bouw Akademie
- 24 warehouse
- 25 warehouse
- 26 Studio I-focus
- 27 Hart voor hout
- 28 bathroom
- 29 Kitchen
- 30 De Voedseltuin

3b

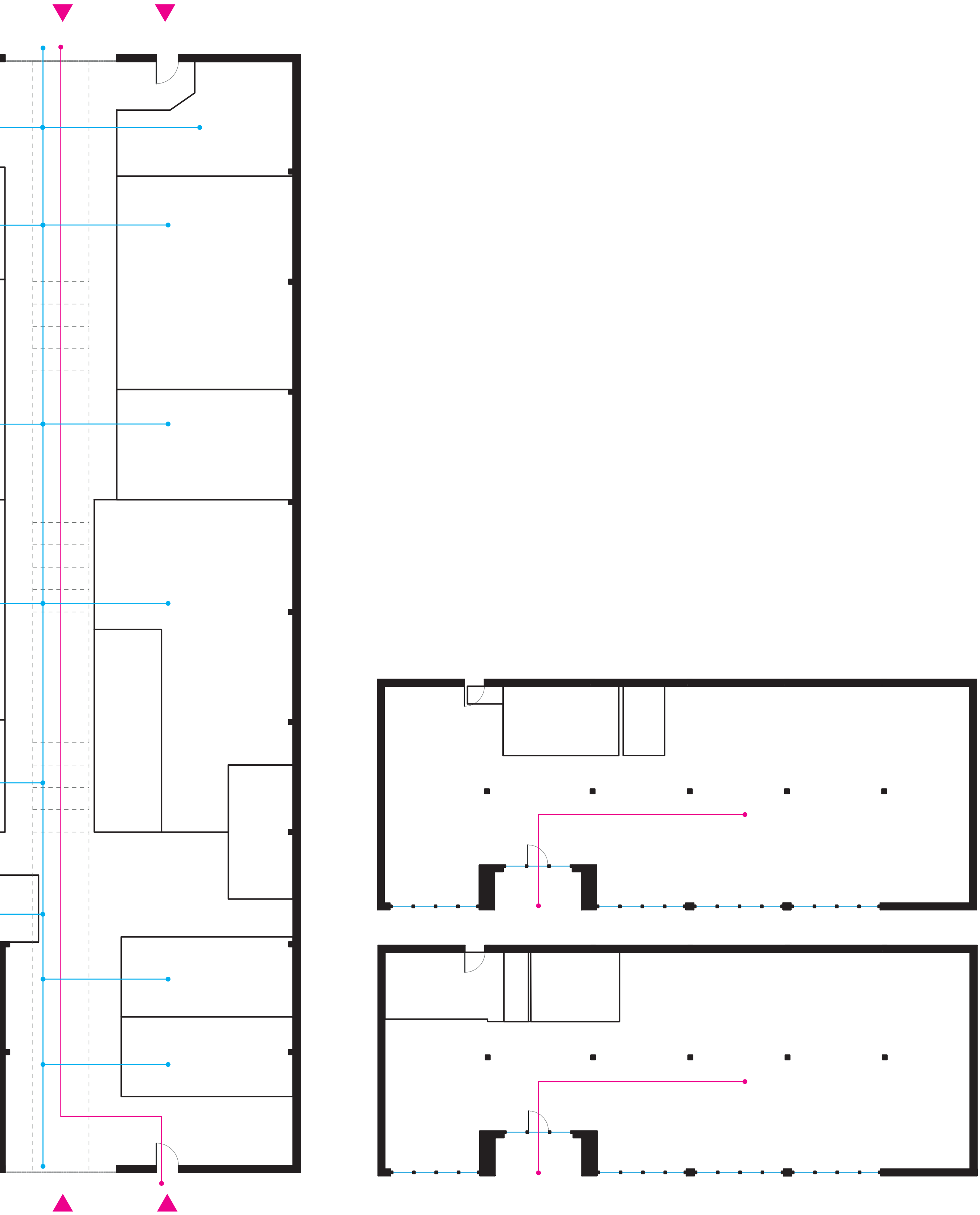
Keilewerf 2 | **space use** | activities environment

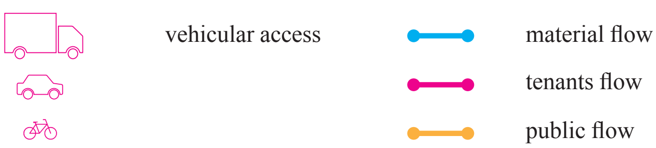
- Crafts
- Wood Working
- Service
- Fine art
- Architecture
- Design

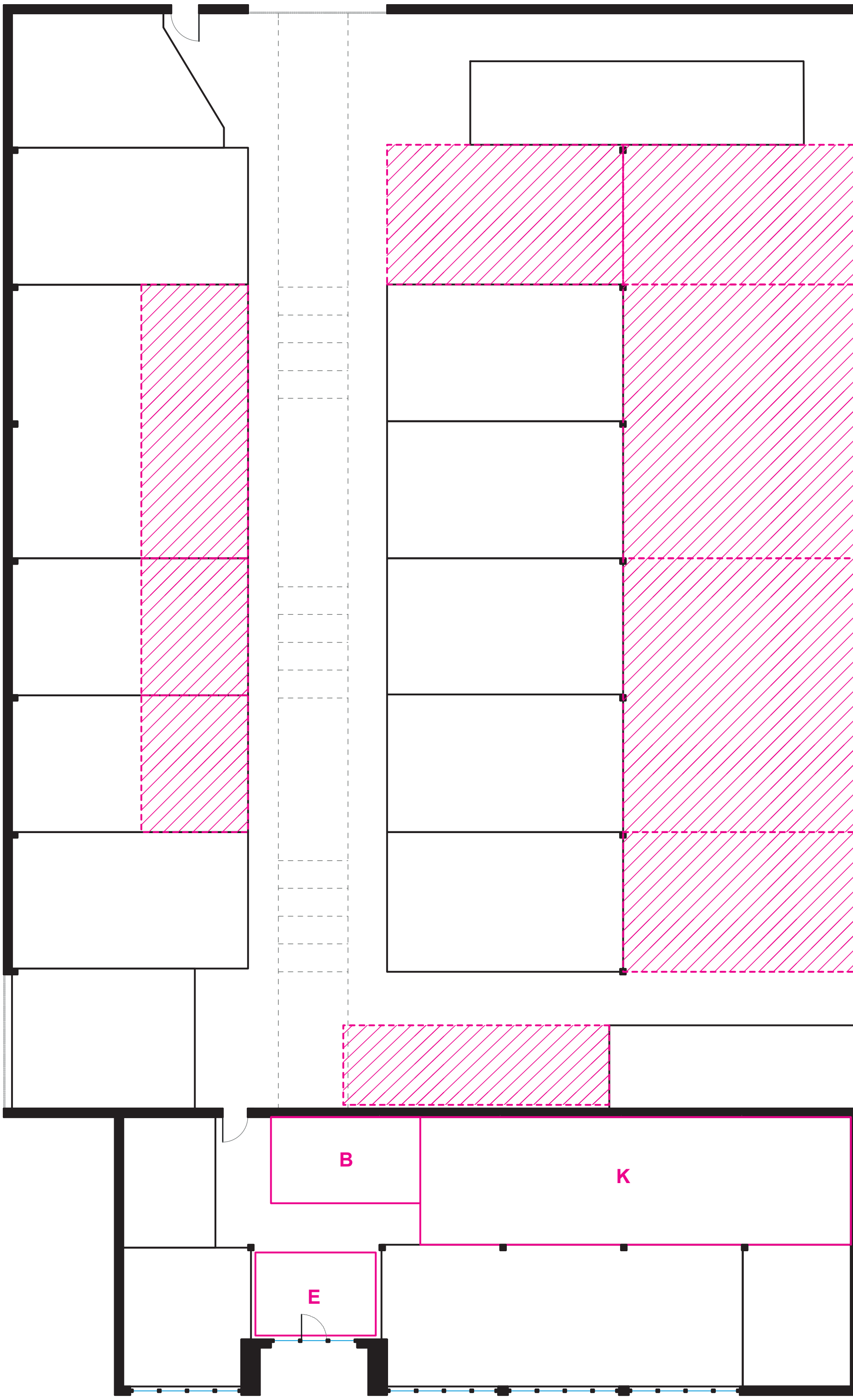


4a

Keilewerf 2| **space use** | flux analisys

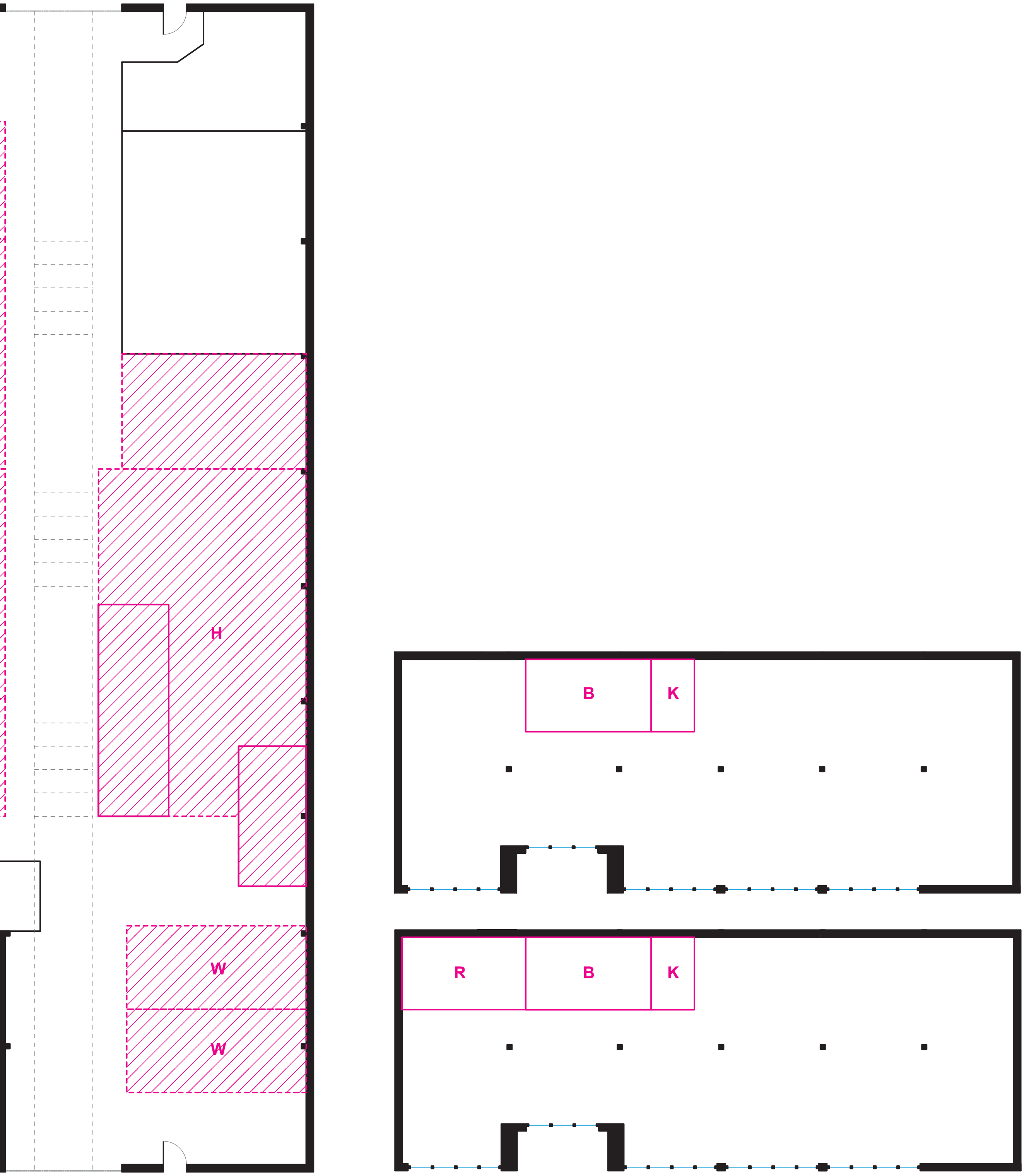



vehicular access
material flow
tenants flow
public flow



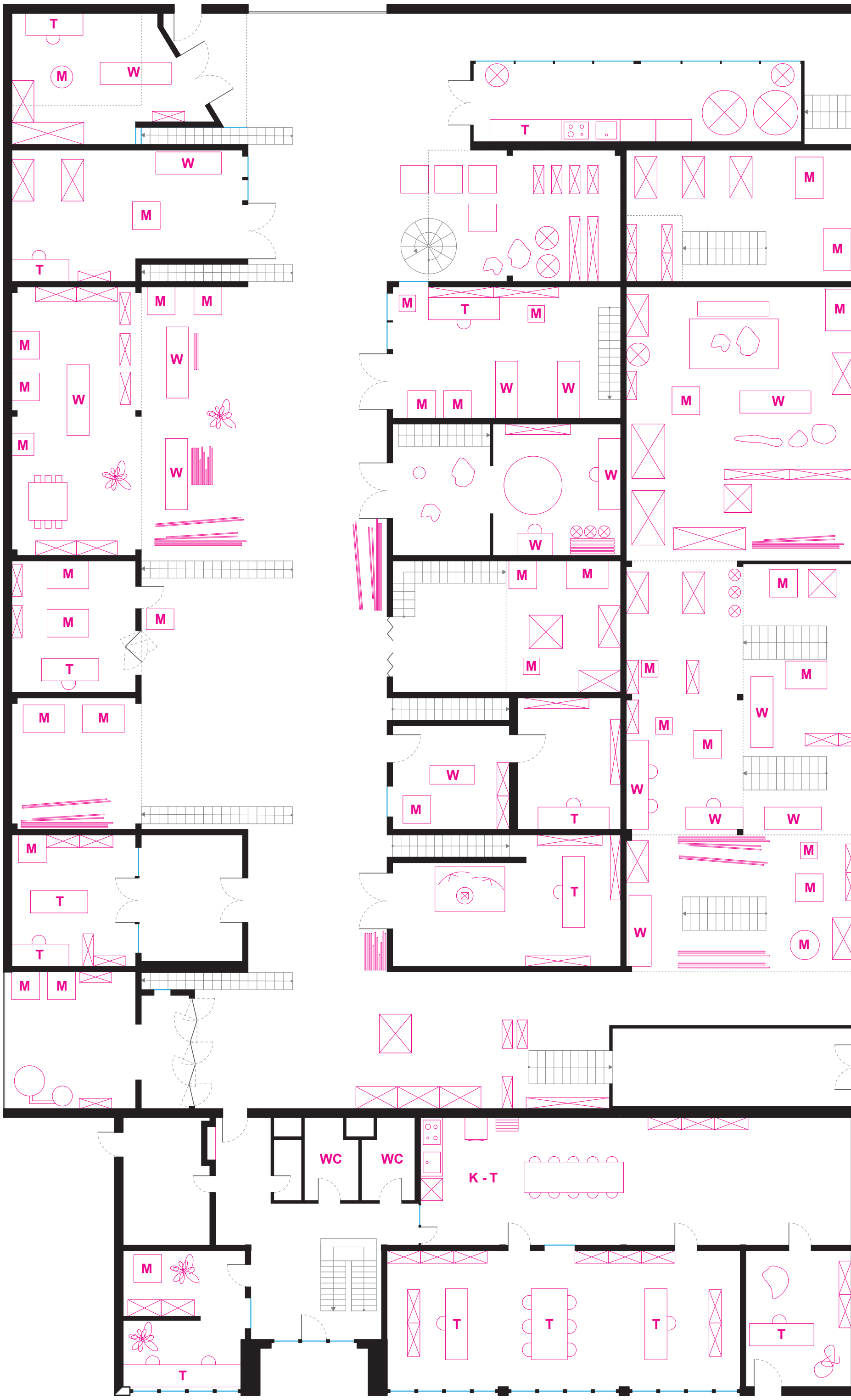
5a

Keilewerf 2 | **space use** | common areas and services



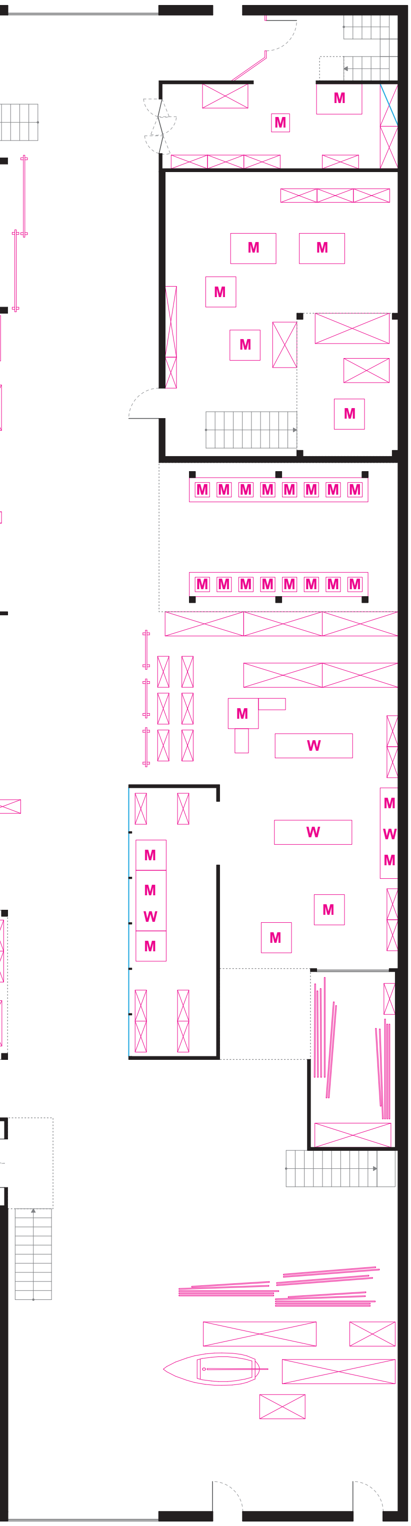
closed space
open space
workspace

E public entrance
R meeting room
B restroom
K shared kitchen
W shared workspace
H training area

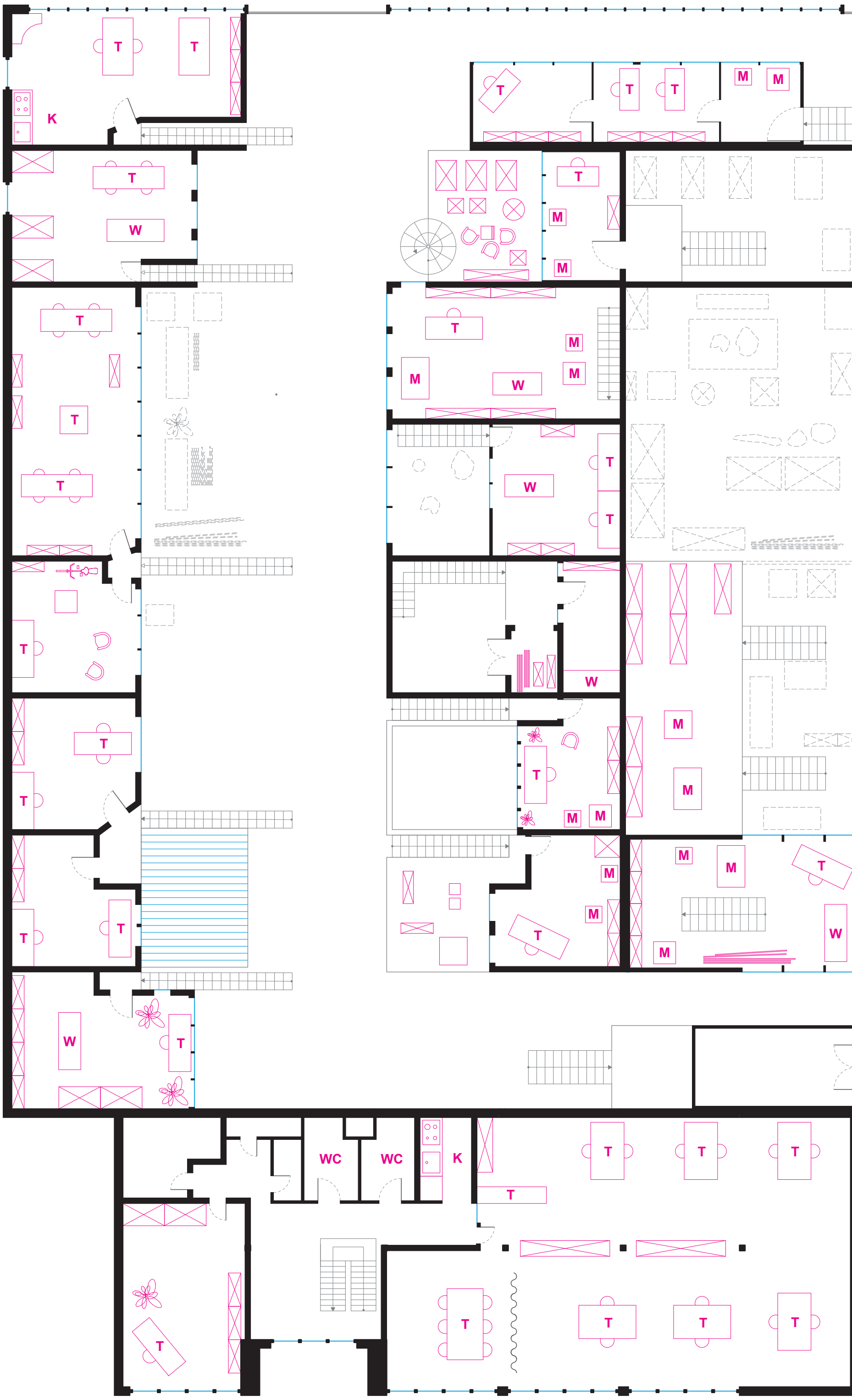


6a

Keilewerf 2 | **space use** | Ground floor

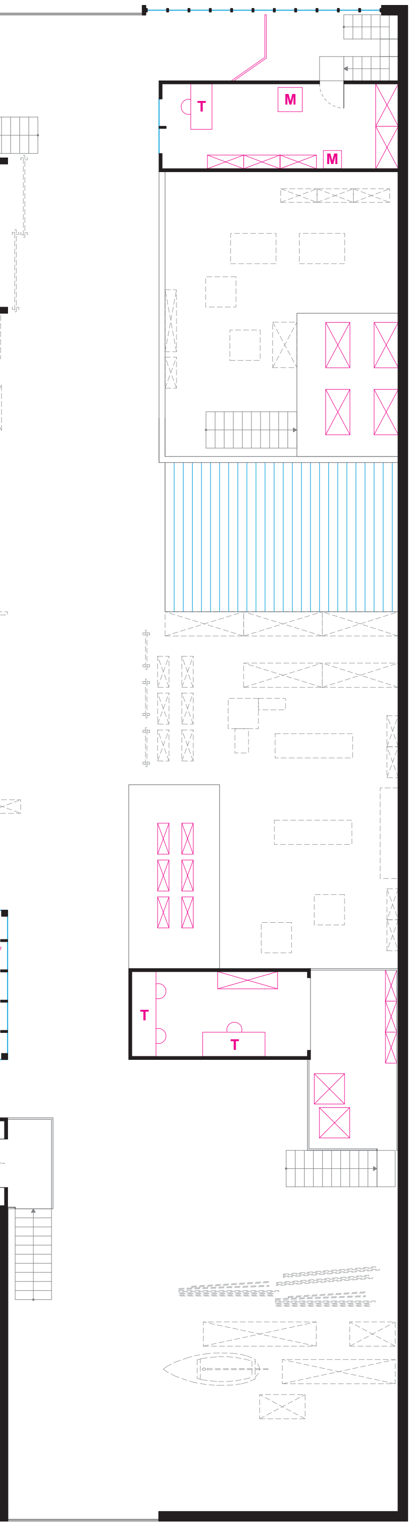


	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table



6b

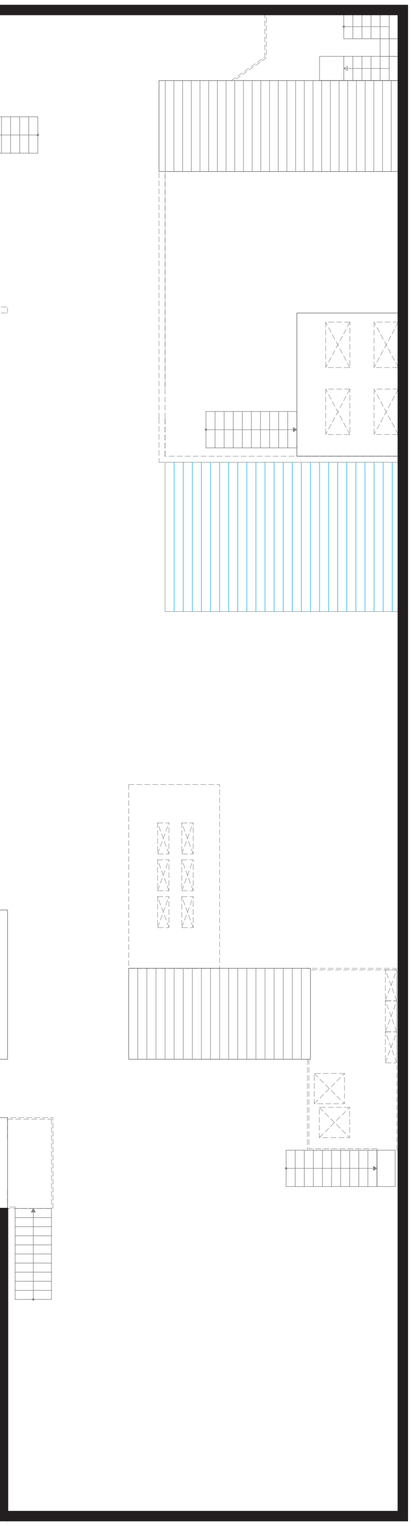
Keilewerf 2 | **space use** | First floor



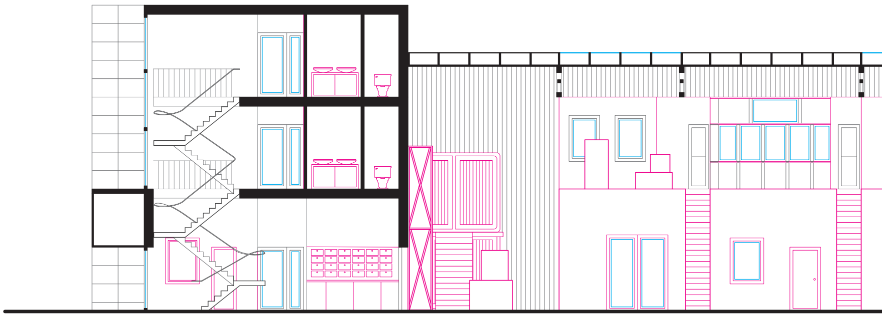
	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table

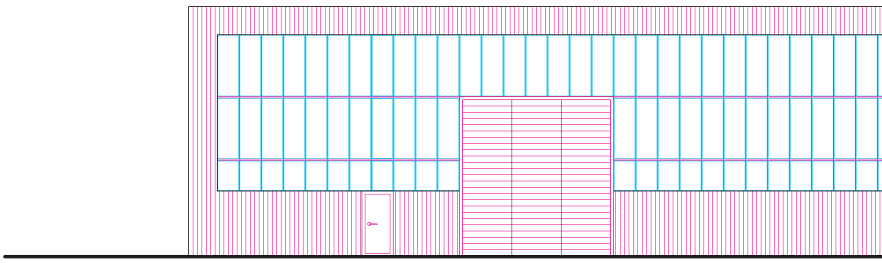
6c

Keilewerf 2 | **space use** | Second floor



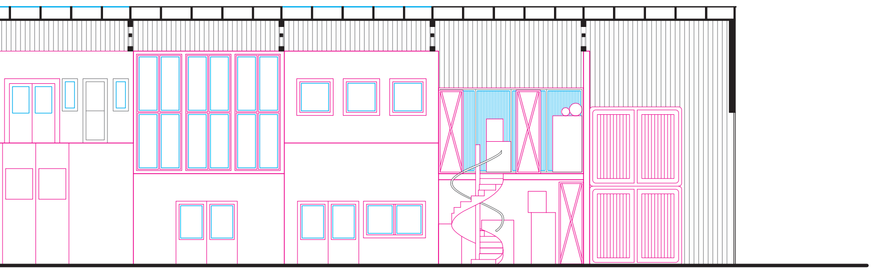
T	office desk
S	storage
K	kitchen
M	machine
W	work table



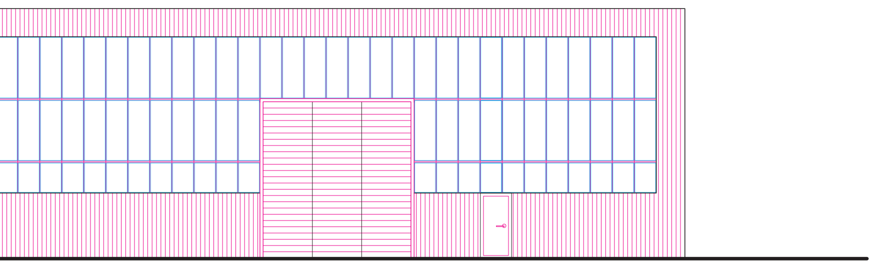


7a

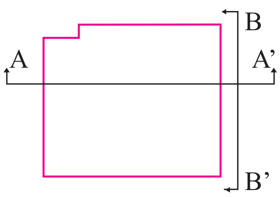
Keilewerf 2 | **material characters** |Structural section | Re-use strategy | Eleva-



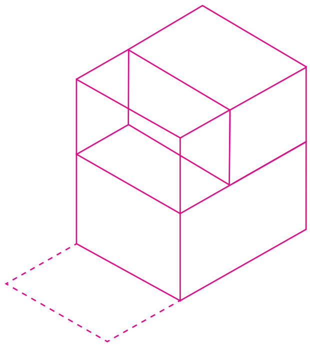
A-A’



B-B’



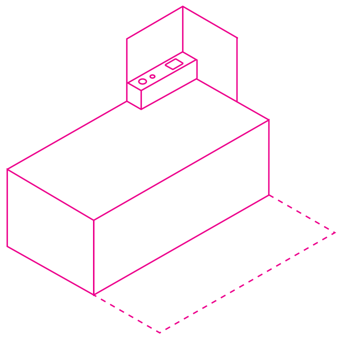
1



OFFICE/
WORKSHOP

This spatial typology is structured through the coexistence of a work space on the ground floor, where objects and prototypes are made, and an office space on the first floor where design activities and meeting take place.

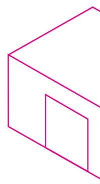
2



DOMESTIC/
WORKSHOP

This typology sees the coexistence of a work space on the ground floor with domestic and private spaces on the upper floor. The realization of the kitchen and a relaxation area define a high degree of intimacy that exists between work, personal and community activities among workers.

3



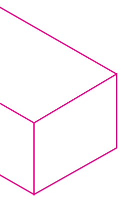
SH
WOR

The high co
size of indu
nery are oft
for the sing
condition ha
creation of
area where
use machin
processes.

8a

Keilewerf 1/2 | **space analysis** | functional typology

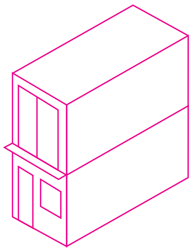
3



ARED
RKSHOP

ost and large
strial machi-
en prohibitive
le tenant. This
as led to the
a common
carpenters can
ery for specific

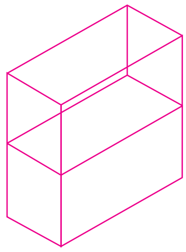
4



STORAGE/
STORE

this type present the particular combination of a store on the ground floor, where the material is sold, while on the upper floor there is a warehouse accessible from the outside through a freight elevator. The materials sold are often for an industrial use, reason for which the same tenants of keilewerf are customers of the shop.

5



STORAGE/
WORKSHOP

This type is the most common within Keilewerf. The space on the ground floor is used for working activities as it is easy to access, while a staircase leads to the first floor where the material is stacked waiting to be worked.

Keiliewerf 1 - External view from Vierhavensstraat. Source: photo of the author, 2017

Keiliewerf 1 - External view from the internal parking. Source: photo of the author, 2017

Keiliewerf 1 - Internal plot subdivision. Source: photo of the author, 2017

Keiliewerf 1 - Typical workshop consisting of a work area on the ground floor and office area on the first floor. Source: photo of the author, 2017

Keiliewerf 1 - Internal organization. Source: photo of the author, 2017

Keiliewerf 1 -De Bende workshop Source: photo of the author, 2017

Keiliewerf 1 - Internal organization. Source: photo of the author, 2017

Keiliewerf 1 - Internal organization. Source: photo of the author, 2017

Keiliewerf 1 - Interior view of a workspace. Source: photo of the author, 2017

Keiliewerf 1 - View of the shared workspace and machines. Source: photo of the author, 2017

Keiliewerf 1 - Living room and office area on the first floor. Source: photo of the author, 2017

Keiliewerf 1 - Office space on the first floor of a workshop. Source: photo of the author, 2017

Keiliewerf 2 - External view from the inner courtyard. Source: photo of the author, 2018

Keiliewerf 2 - External view from Keilestraat. Source: photo of the author, 2018

Keiliewerf 2 - Internal view. Source: photo of the author, 2018

Keiliewerf 2 - Internal view. Source: photo of the author, 2018

Keiliewerf 2 - Internal workshops organiation. Source: photo of the author, 2018

Keiliewerf 2 - Buro van Wieren workshop. Source: photo of the author, 2018

Keiliewerf 2 - Internal workshops organiation. Source: photo of the author, 2018

Keiliewerf 2 - Internal organization Buro van Wieren workshop . Source: photo of the author, 2018

Keiliewerf 2 - Interior of a workshop. Source: photo of the author, 2018

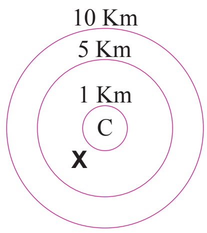
Keiliewerf 2 - Shared kitchen . Source: photo of the author, 2018

SECTIE-C | Eindhoven

OPENING TIME

08/19 h Tenants

08/19 h Public area

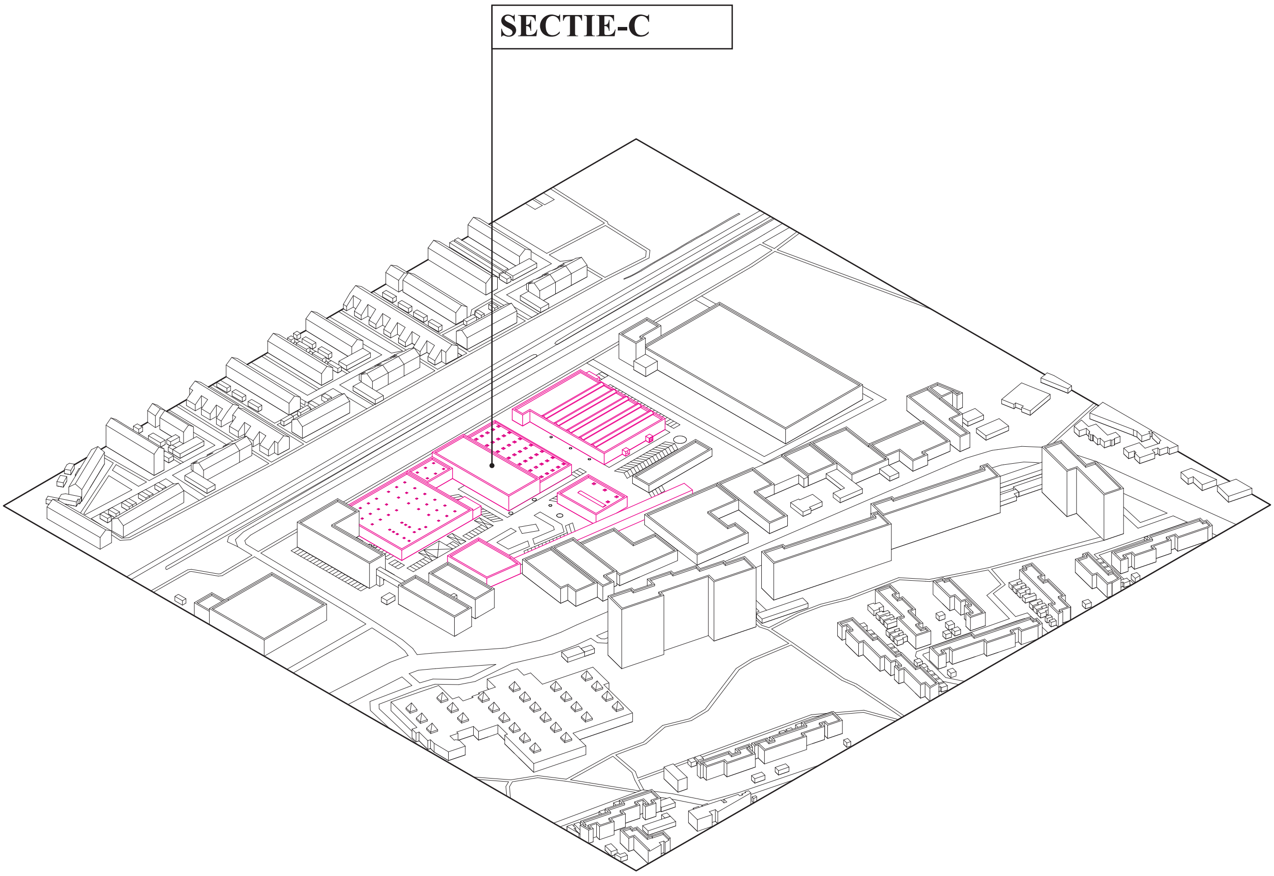


PUBLIC TRASPORT INFO

From station: 30 min/bus
15 min/bike
7 min/car

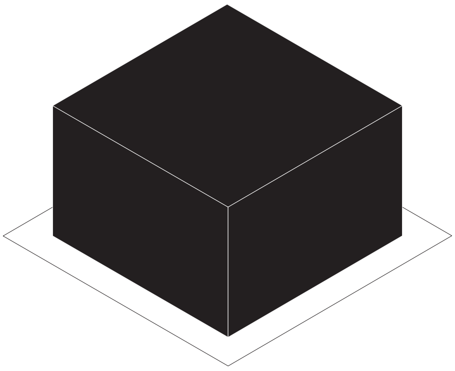
1a

Sectie-C | **urban characters** | district



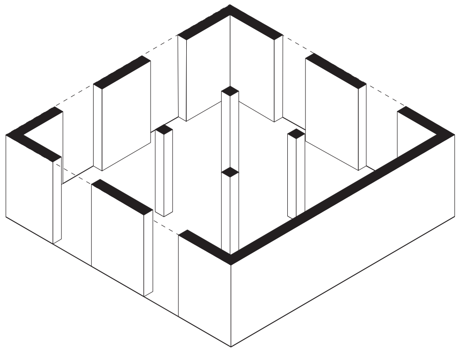
1b

Keilewerf | **urban characters** | area



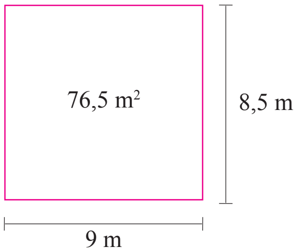
building dimensions

13130 m^2
87800 m^3

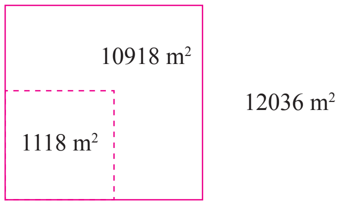


structural form

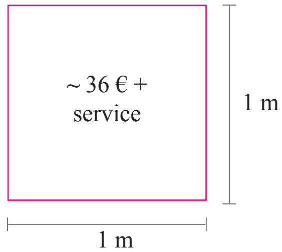
load bearing perimeter
wall and internal colums



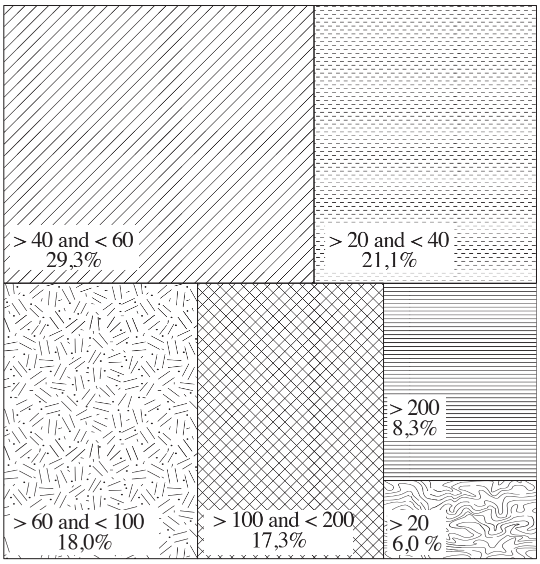
single plot average size



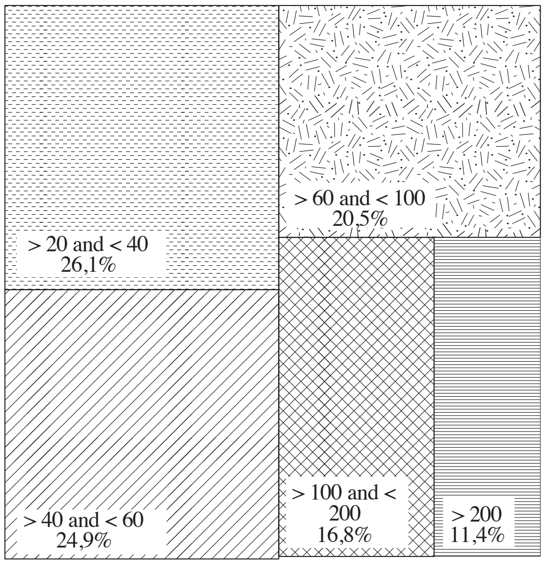
open/close area



cost × m^2 × y



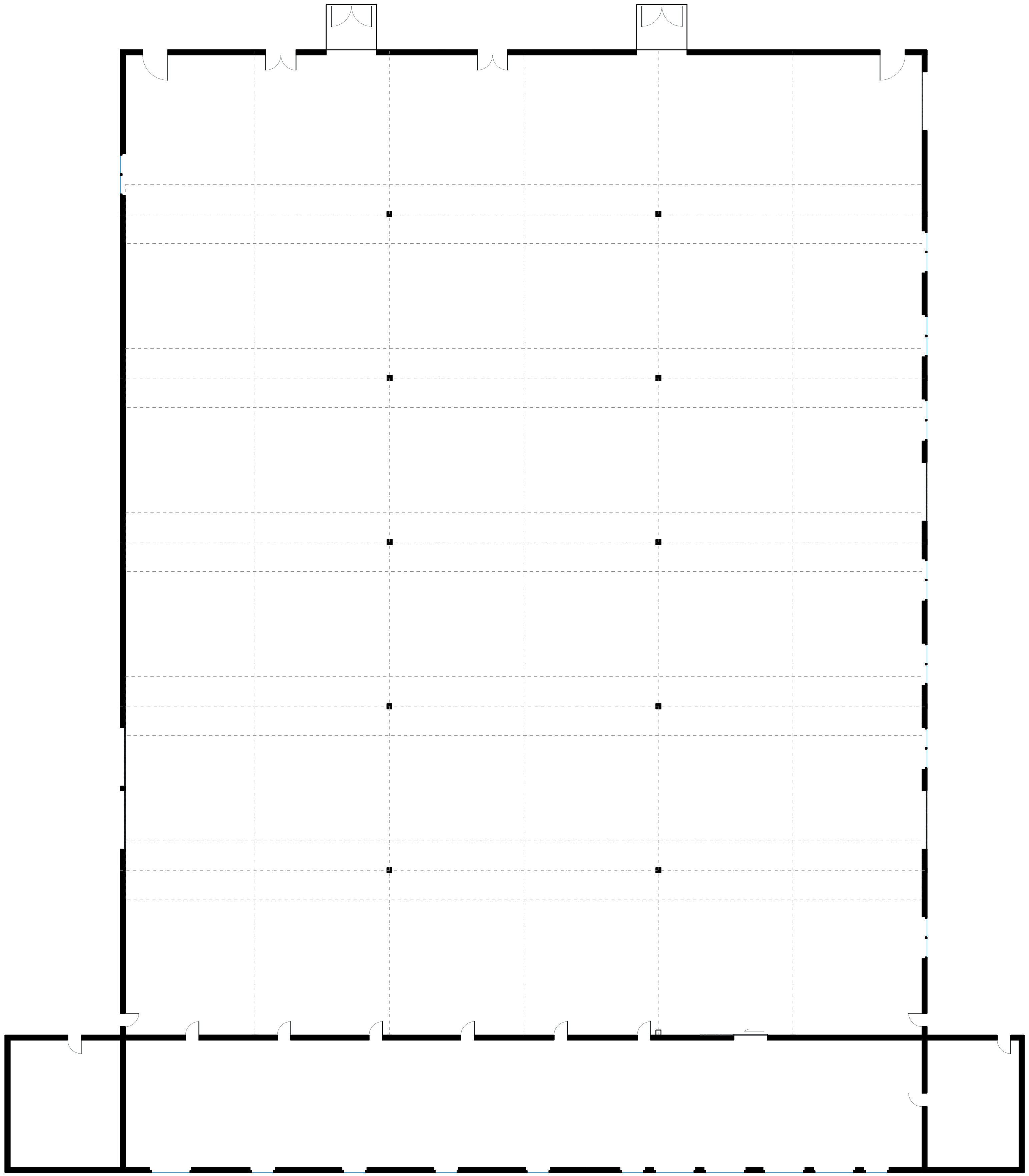
N° of space distribution

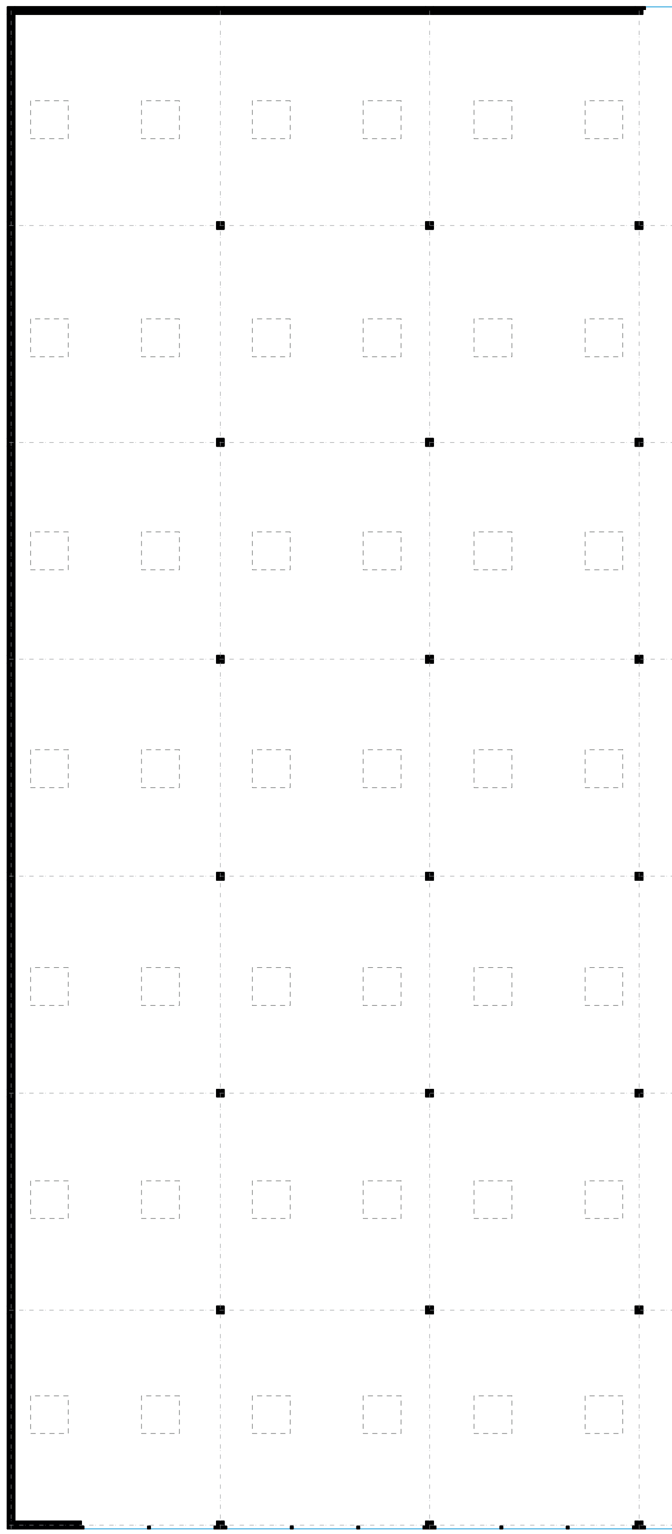


Surface category disribution

1c

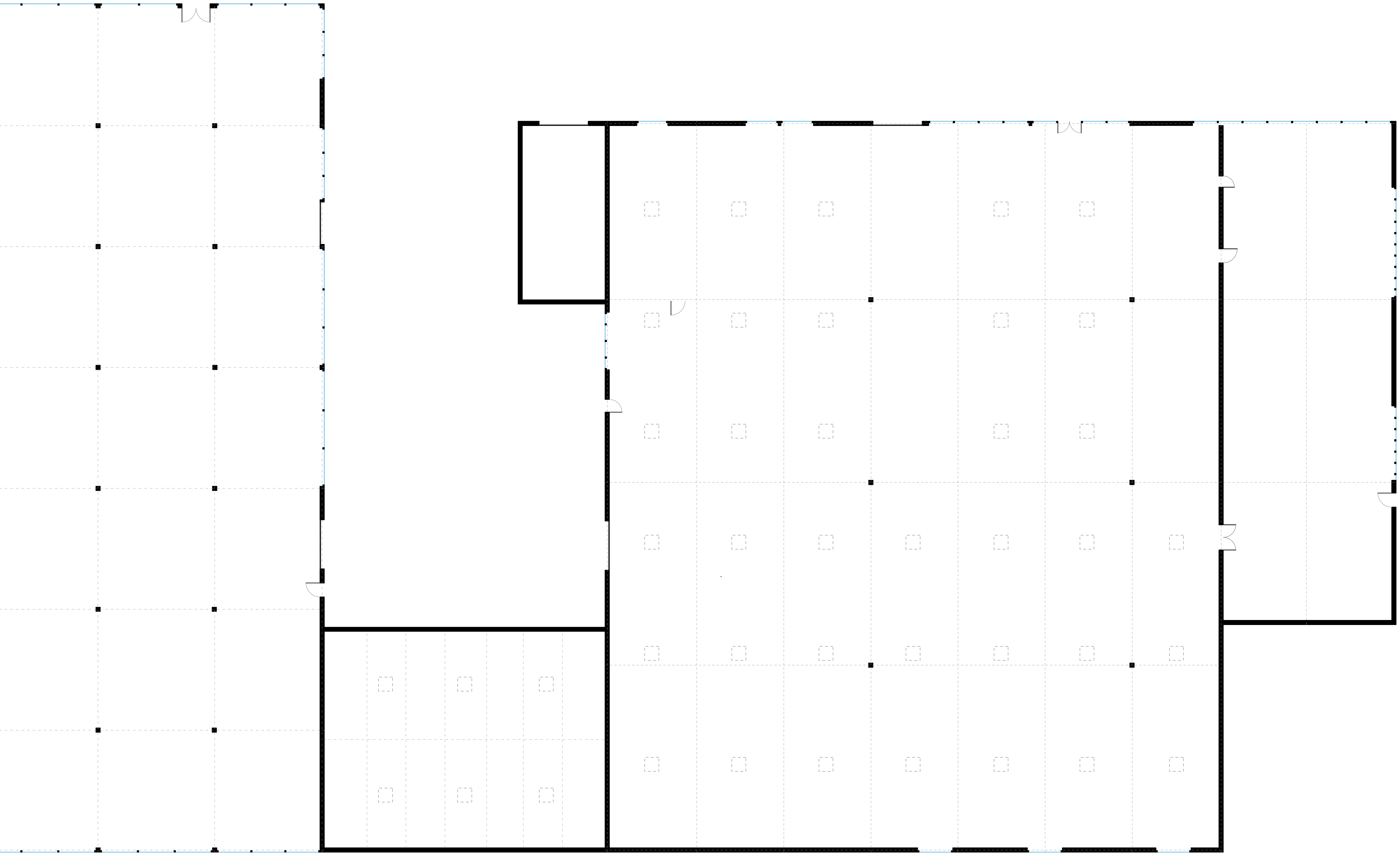
Sectie-C | **dimension analysis** | data on the building

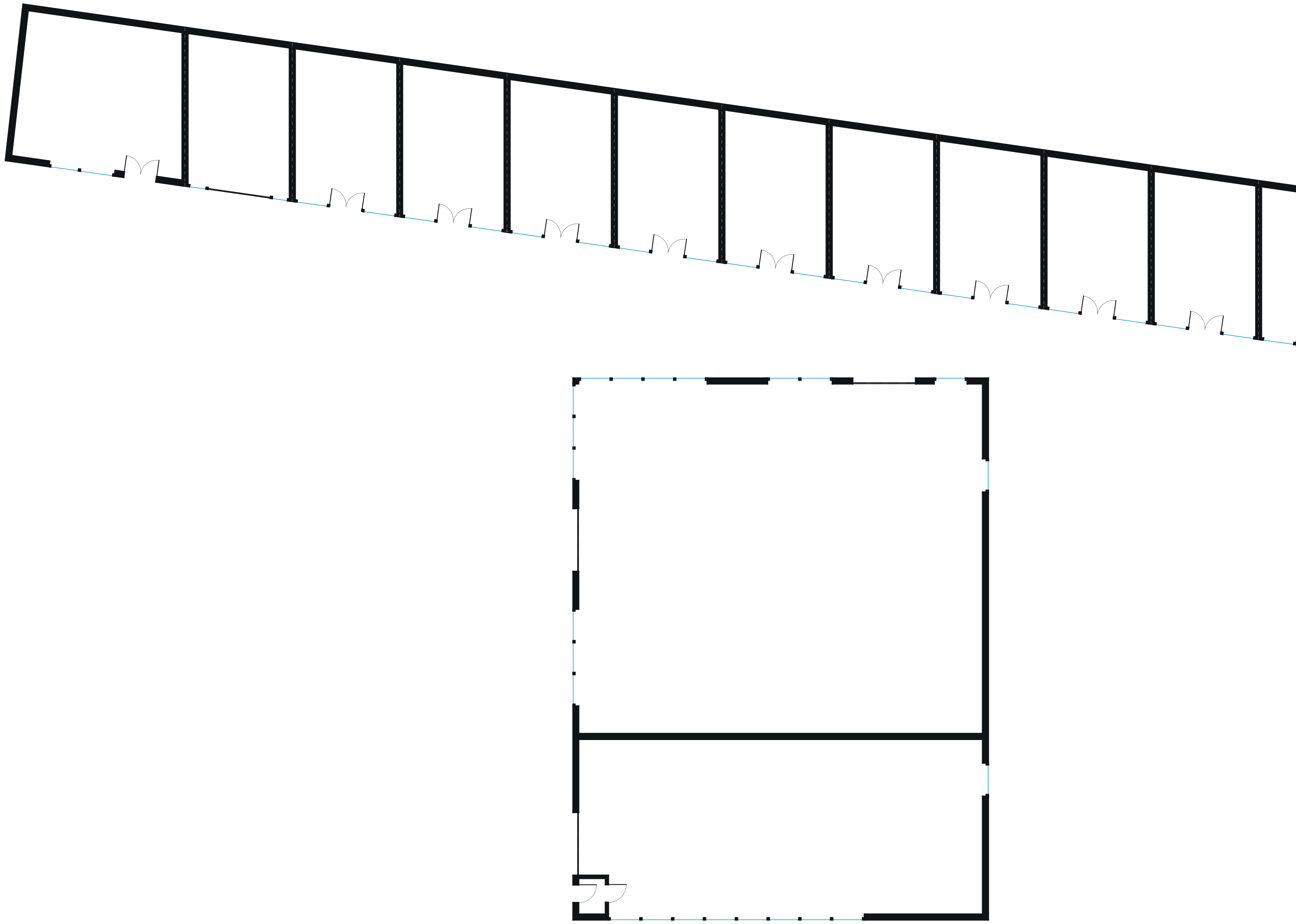




2a

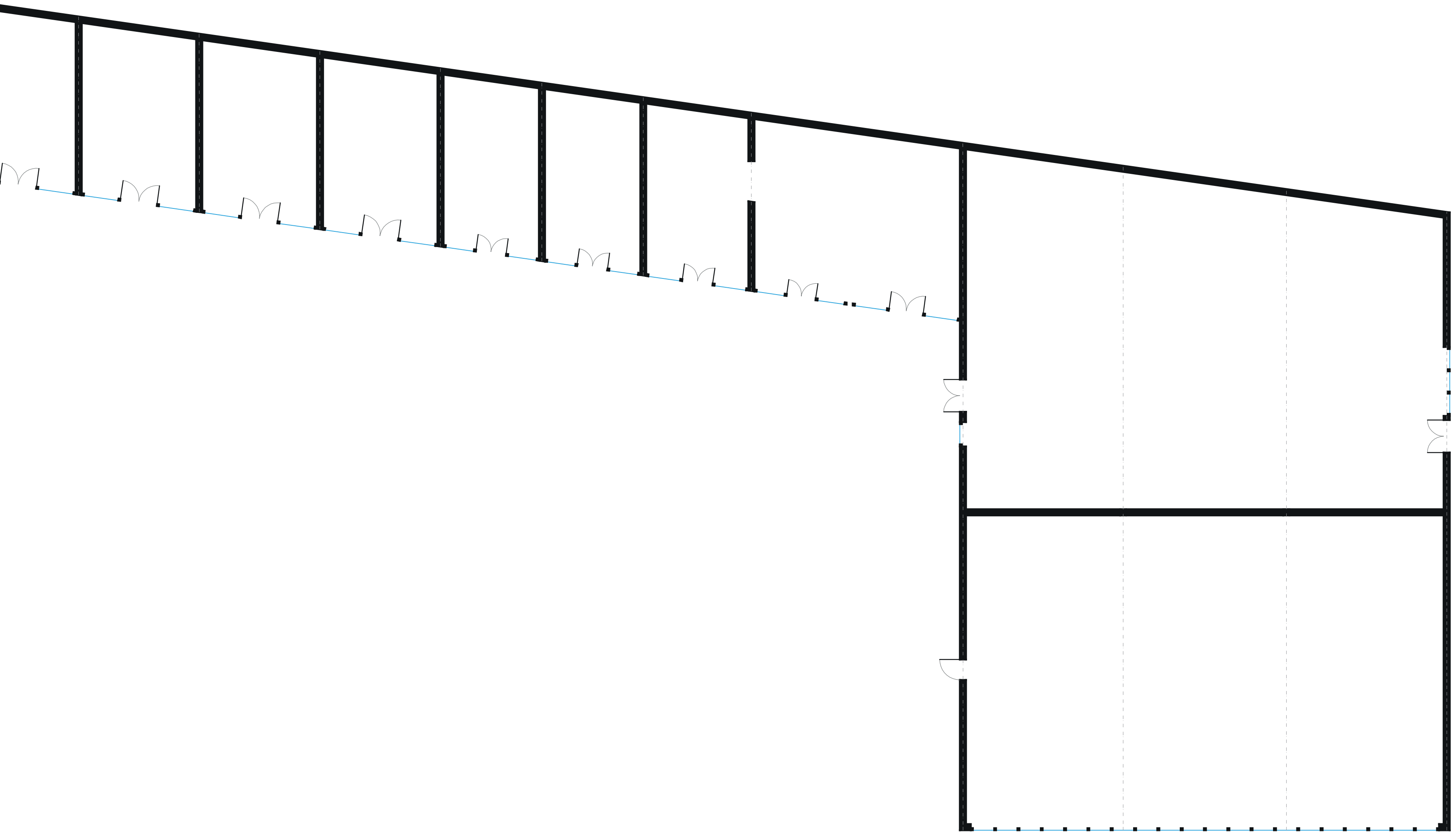
Sectie-C | **architectural characters** | structure plan

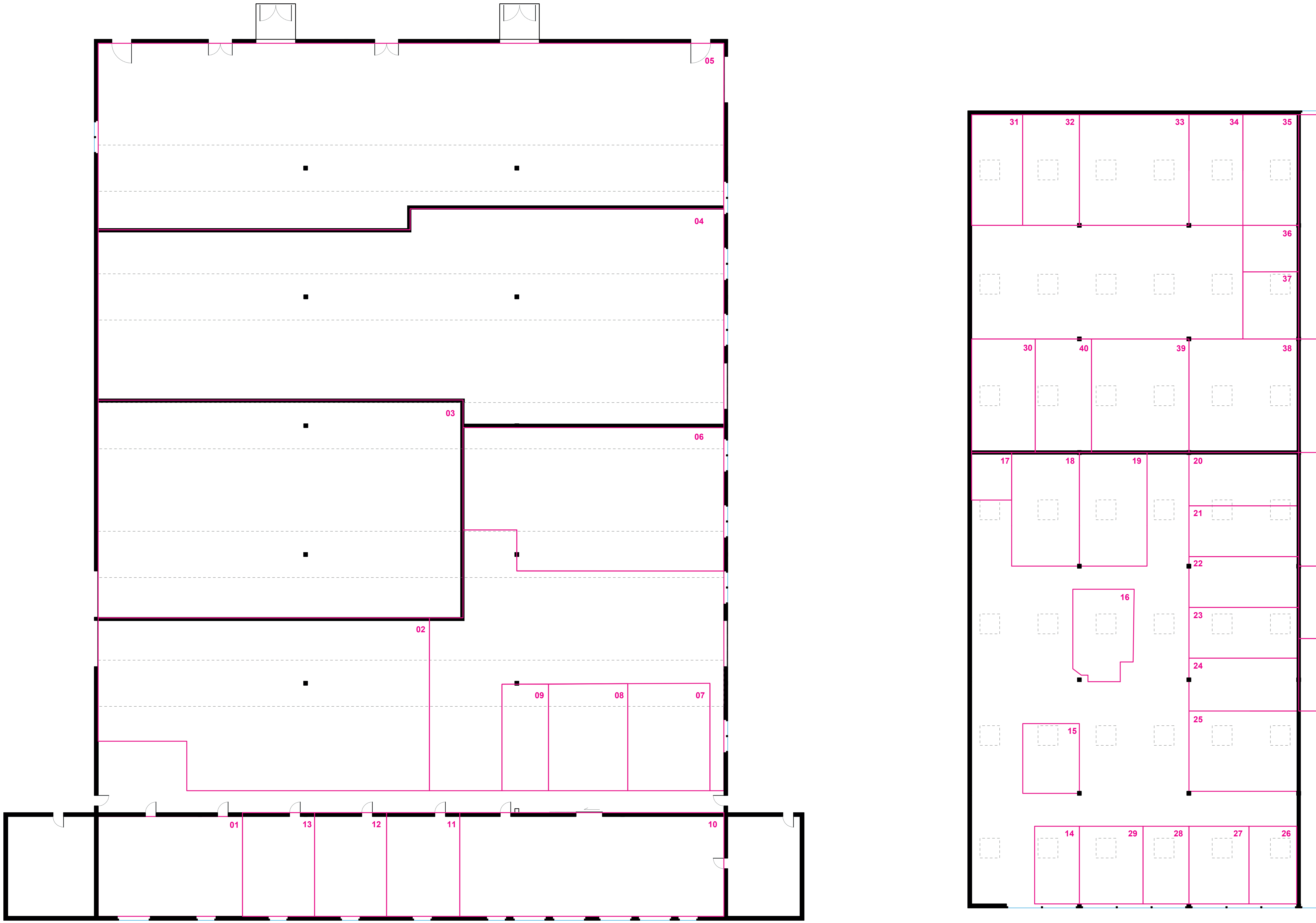




2b

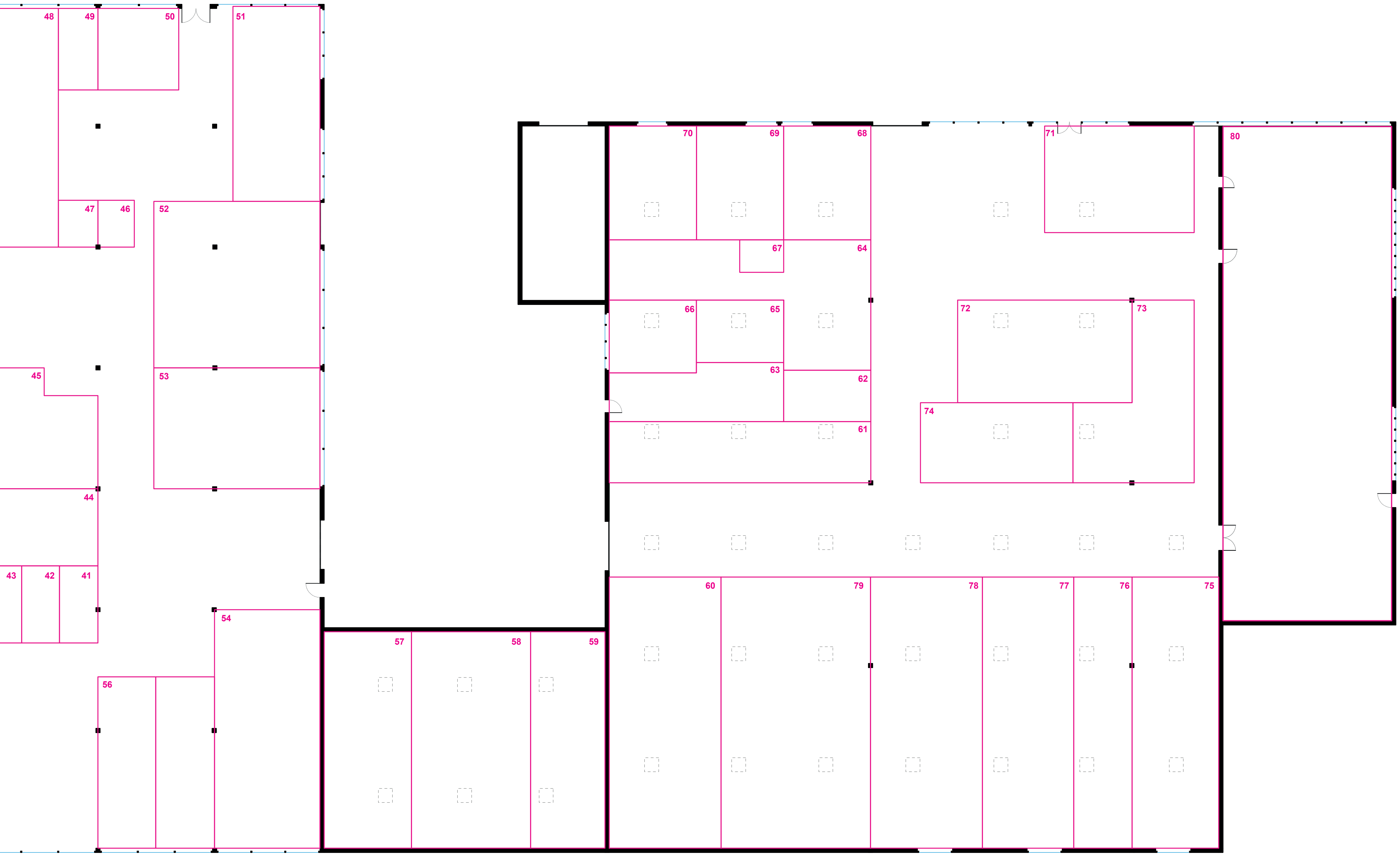
Sectie-C | **architectural characters** | structure plan

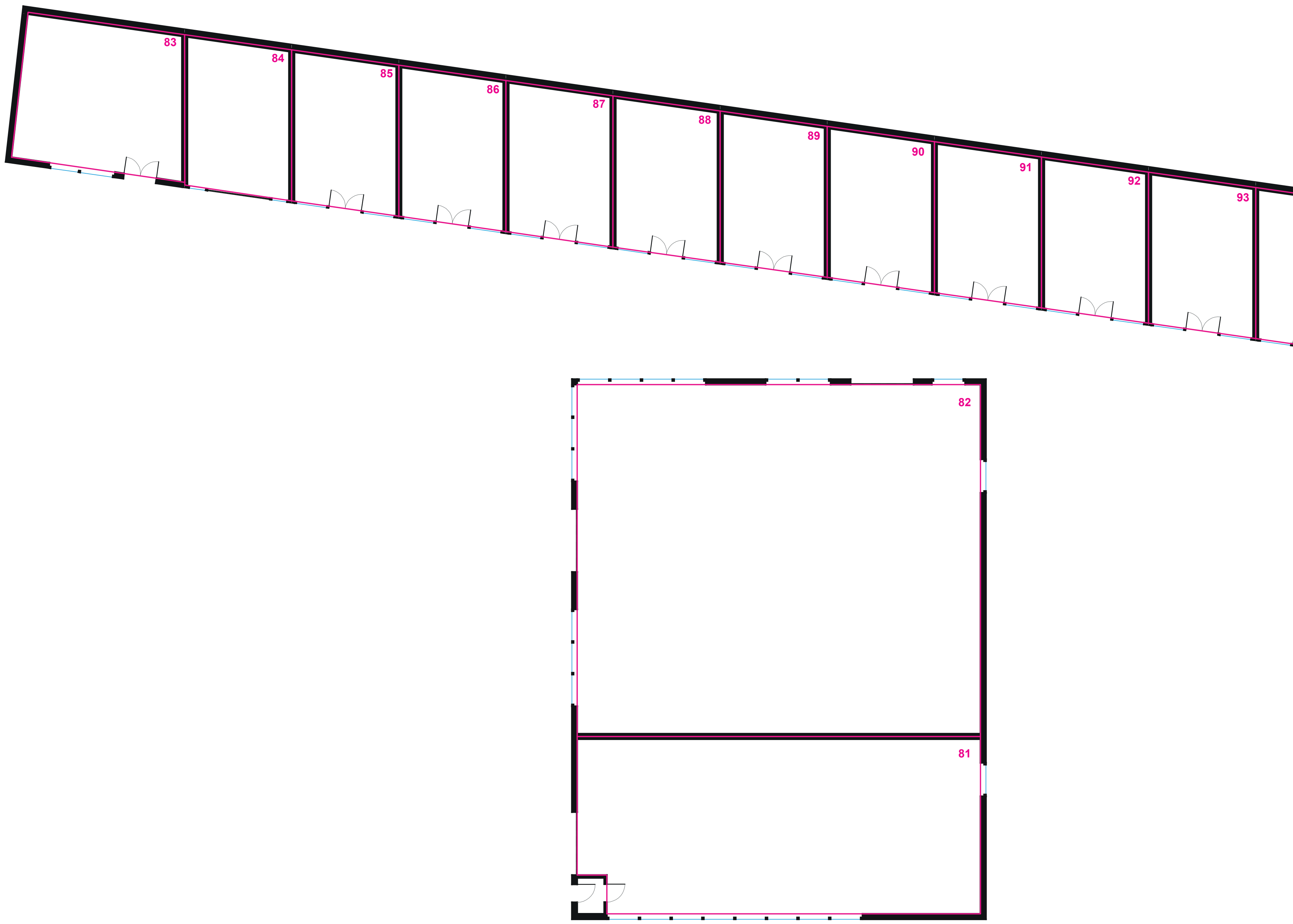




3a

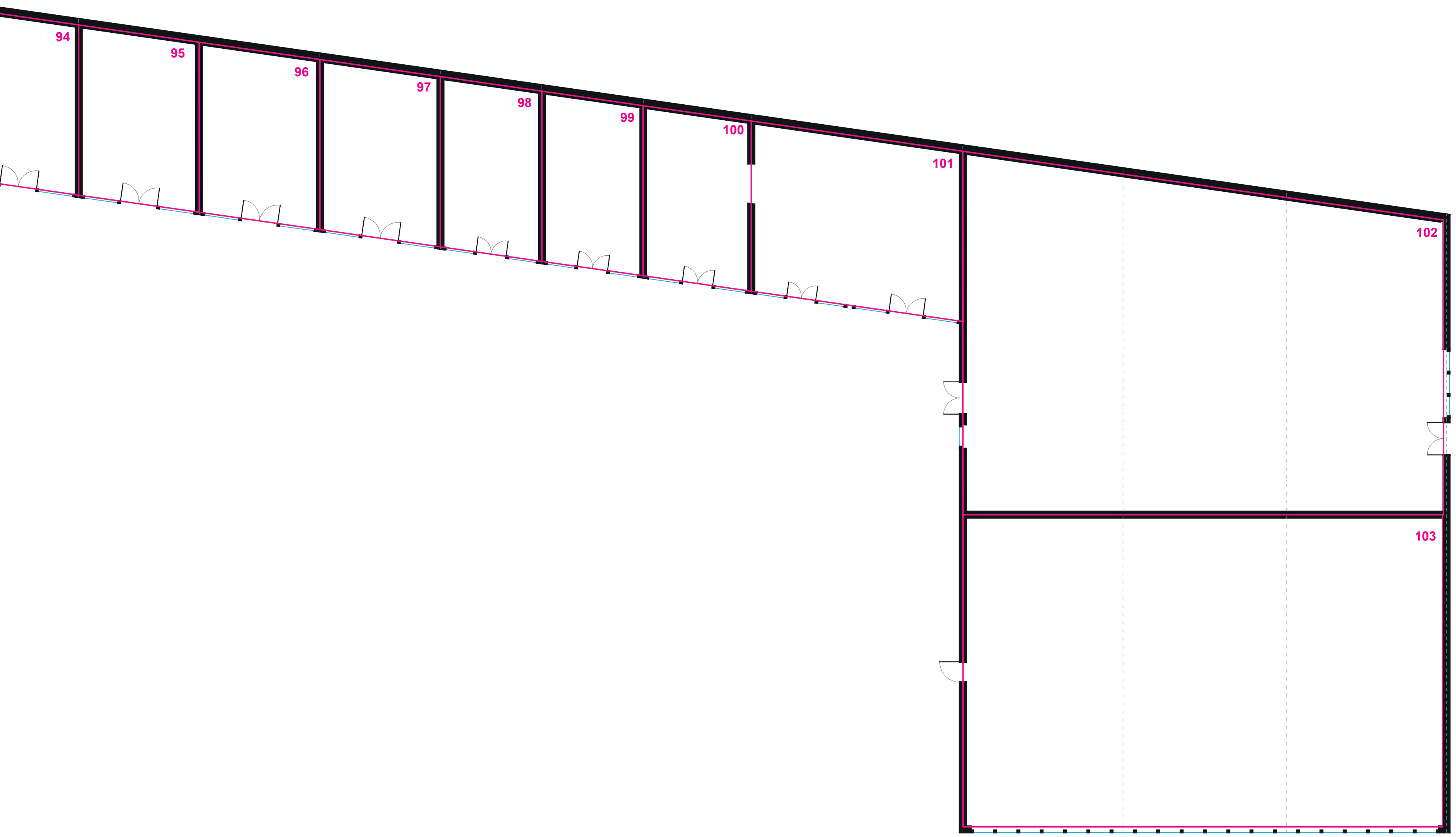
Sectie-C | **space use** | plot subdivision


48
49
50
51
47
46
52
45
53
44
43
42
41
54
56
57
58
59
70
69
68
67
64
66
65
63
62
61
71
80
72
73
74
60
79
78
77
76
75



3b

Sectie-C | **space use** | plot subdivision


94
95
96
97
98
99
100
101
102
103

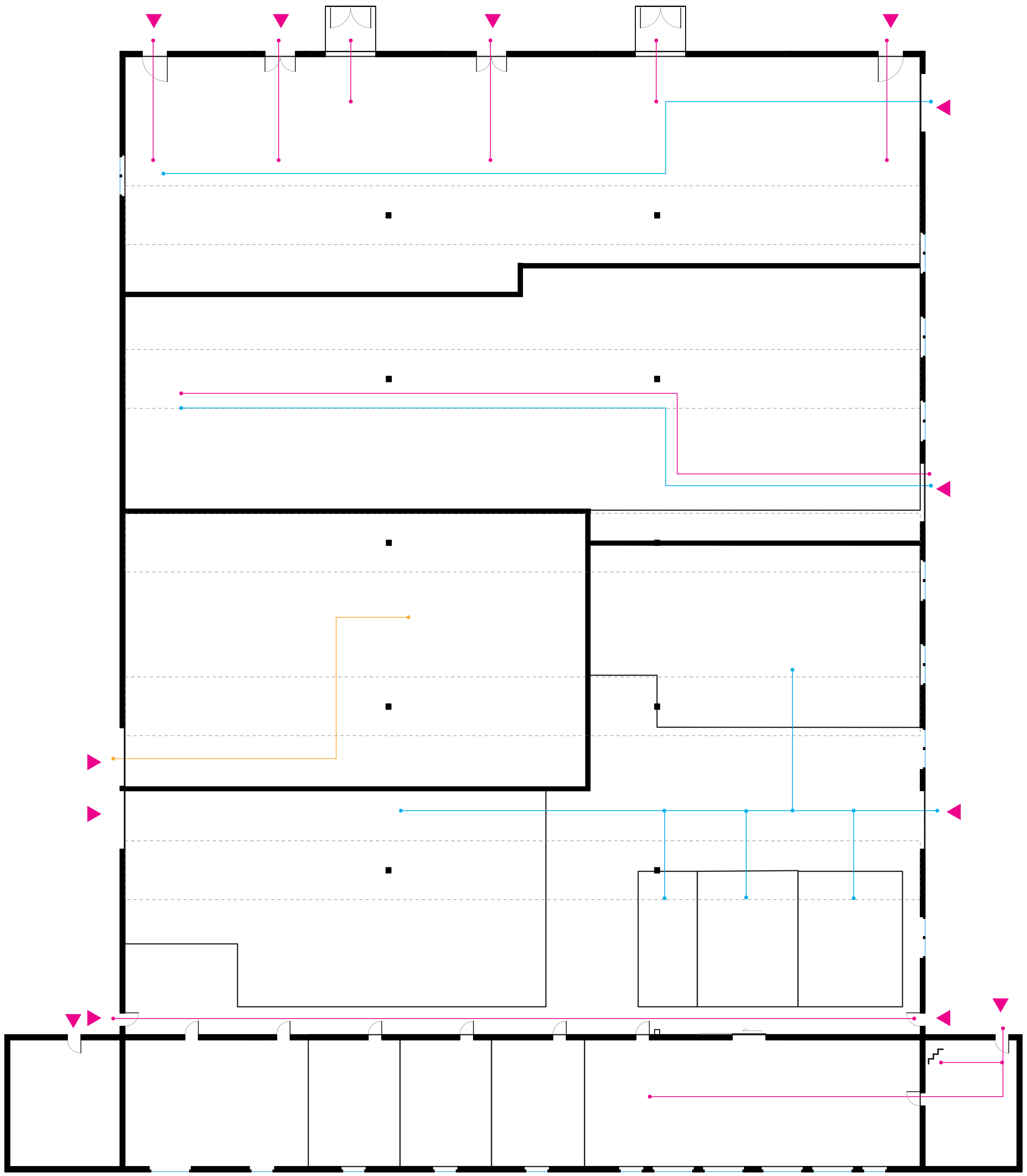
- 01 Beluqa
- 02 Jo de Gruyter
- 03 Theatre
- 04 Rene Siebum
- Nob Ruijgrok BV
- 05 Ronald Smits Photography
- Niels Hoebers Stop Motion studio
- Studio Sander Wassink
- Untiteld Projects
- 06 Werner Neumann
- 07
- 08
- 09
- 10 Portret Studio Emposse
- Mees van Het Hull
- 11 Ameli Viaux Art
- 12 Tapanta Design
- 13 Eric van Horrik Fotografie
- 14 Kim Haagen
- 15 Bart Van Uden
- 16 Tiddo Bakker
- 17 Govert Flint
- 18 Saar Scheerlings
- 19 Tom Frencken
- 20 Corradino Garofalo
- 21 Joan Velve Rafecas
- 22 Steven Banken
- 23 Floor Frigs
- 24 Jelle Mastenbroek
- 25 Agnieszka Mazur

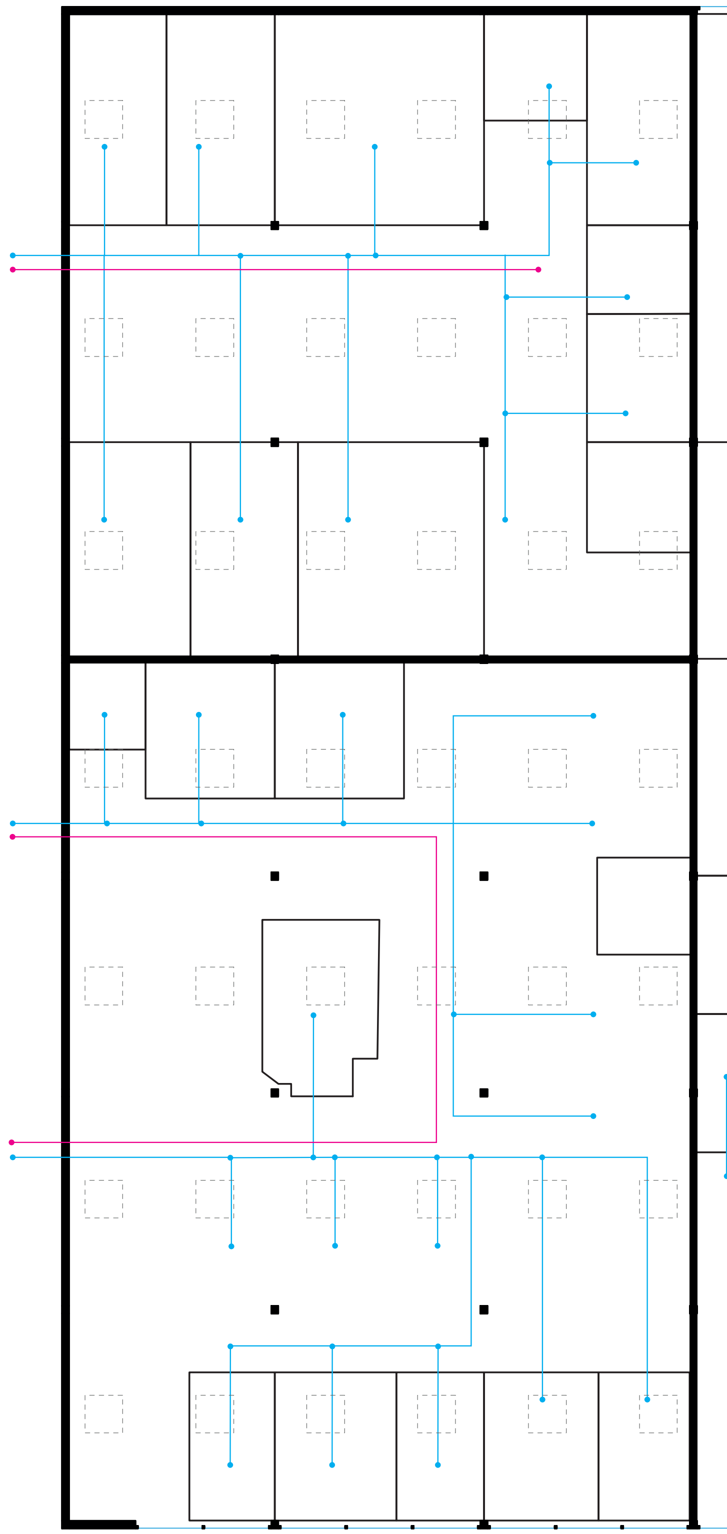
● Crafts
● Wood Working
● Service
● Fine art
● Architecture
● Design

- 54 Saskia Overzee
- 55 Visual Focus
- 56 Job van den Berg
- Studio Juul Rameau
- 57 Maro Manufacturing
- 58 Studio Harn en Helke
- 59
- 60
- 61 Bike repair
- 62 Joep Huisinga
- 63 Esther Interieur
- 64
- 65
- 66
- 67
- 68
- 69 Digifab
- 70 Interactive Matter
- 71 Restaurant
- 72 Joost Gehem
- 73
- 74 Ben Hohmann
- 75 Wickie Design
- 76 Vereniging united 4.14
- 77 Lumenso
- 78 Bloonics Bv
- 79 Dozenfabriekje
- 80 Studio Onno Adriaanse
- Studio Dag
- Paul Heijnen Studio

Maarten Coolen Creating Images
Martijn van der Ven
81 Esther Jongsma
Ann Linn Palm Hansen
Sam van Gurp
Mies Loongman
Joost Dingenman
82 Nacho Carbonell
83
84
85
86
87 Lighttown Project
88
89
90
91
92 Manon Vosters Photography
93 Vanoch Singworks
94
95
96 Theo Kuijpers
97 Atelier Dragt
98 Atelier Aroha
99 Trends and Events Consultancy
100
101 Zeilmakerij Van Hooff
102 Restaurant
103 Club-C

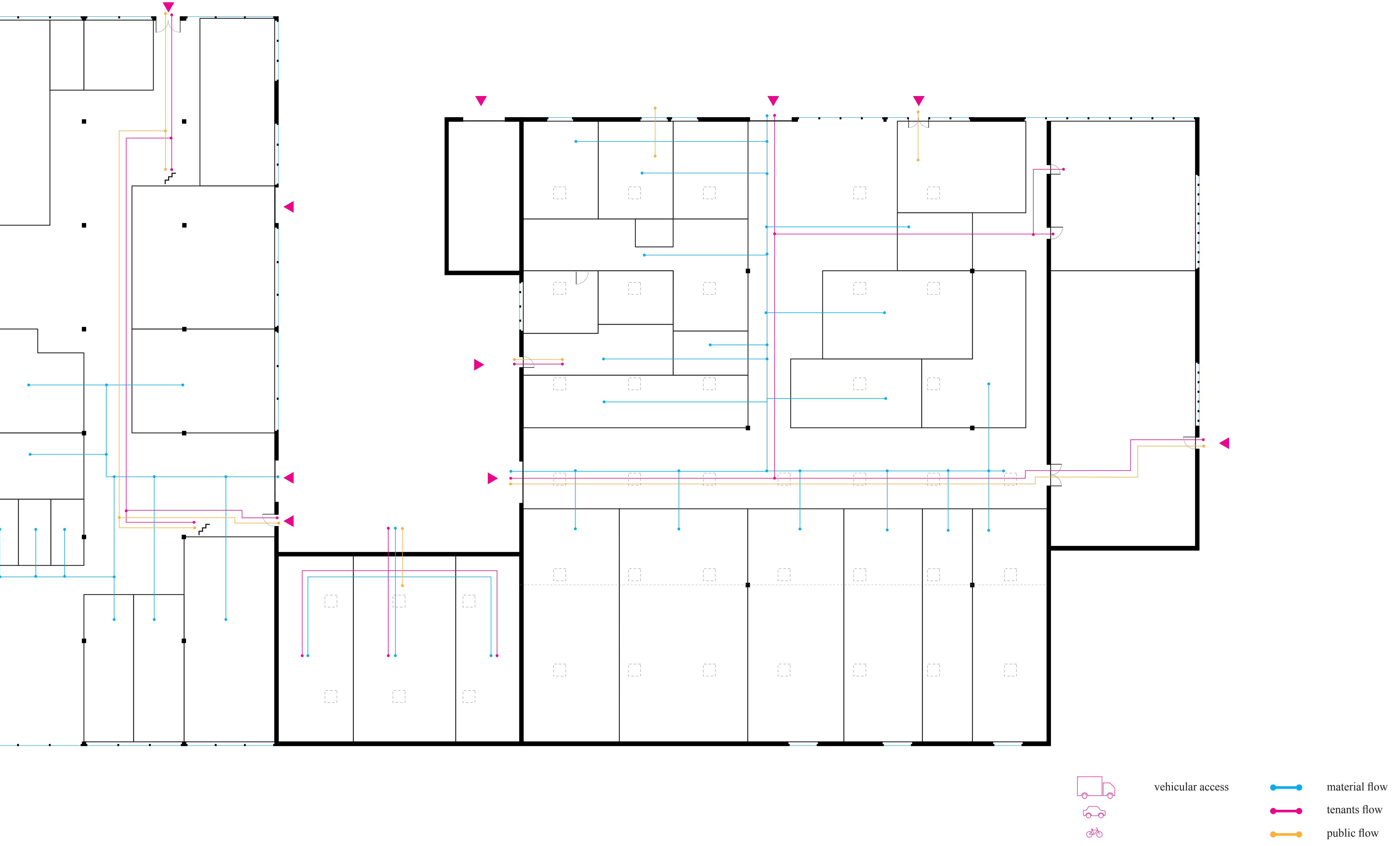
- Crafts
- Wood Working
- Service
- Fine art
- Architecture
- Design

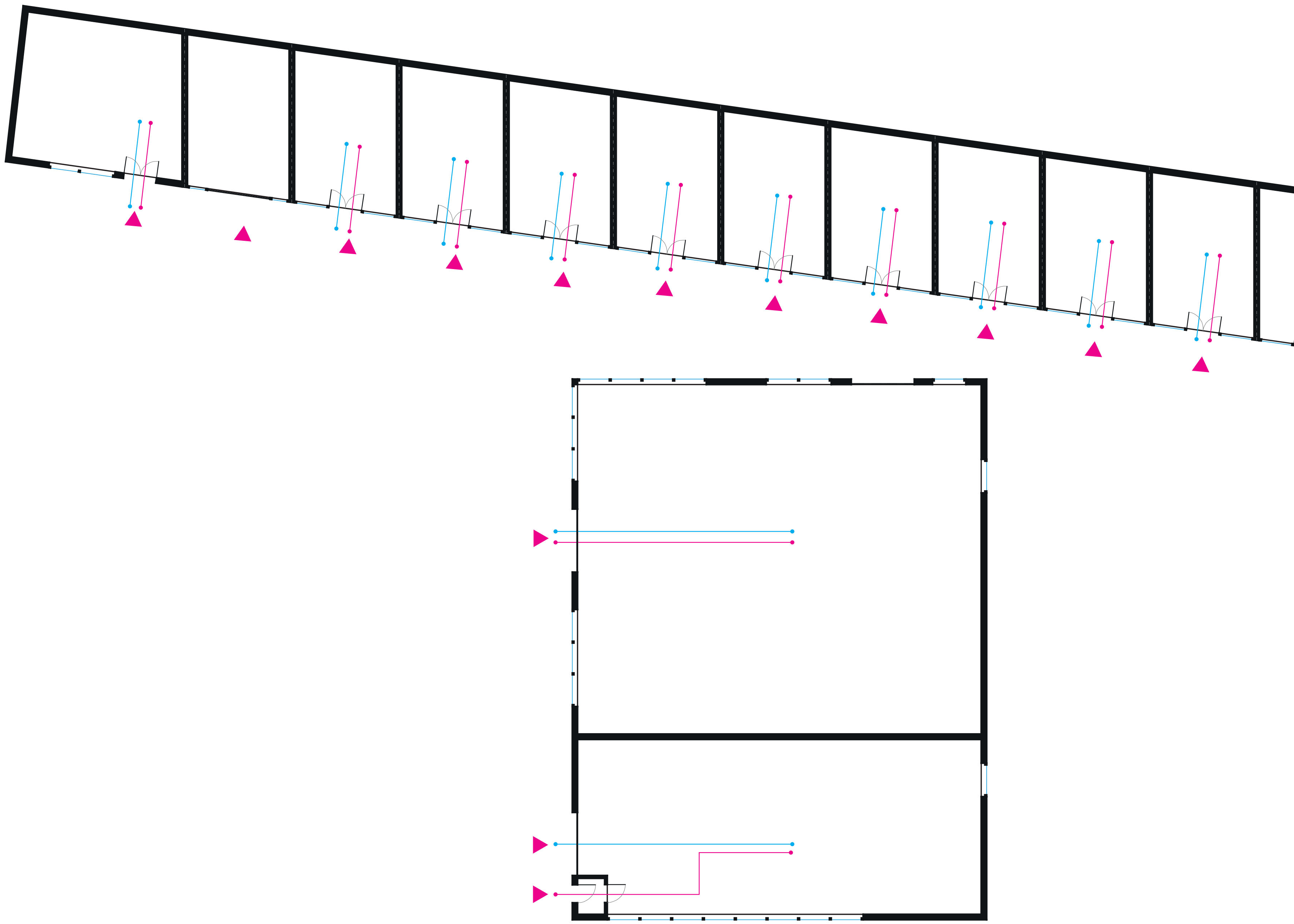




4a

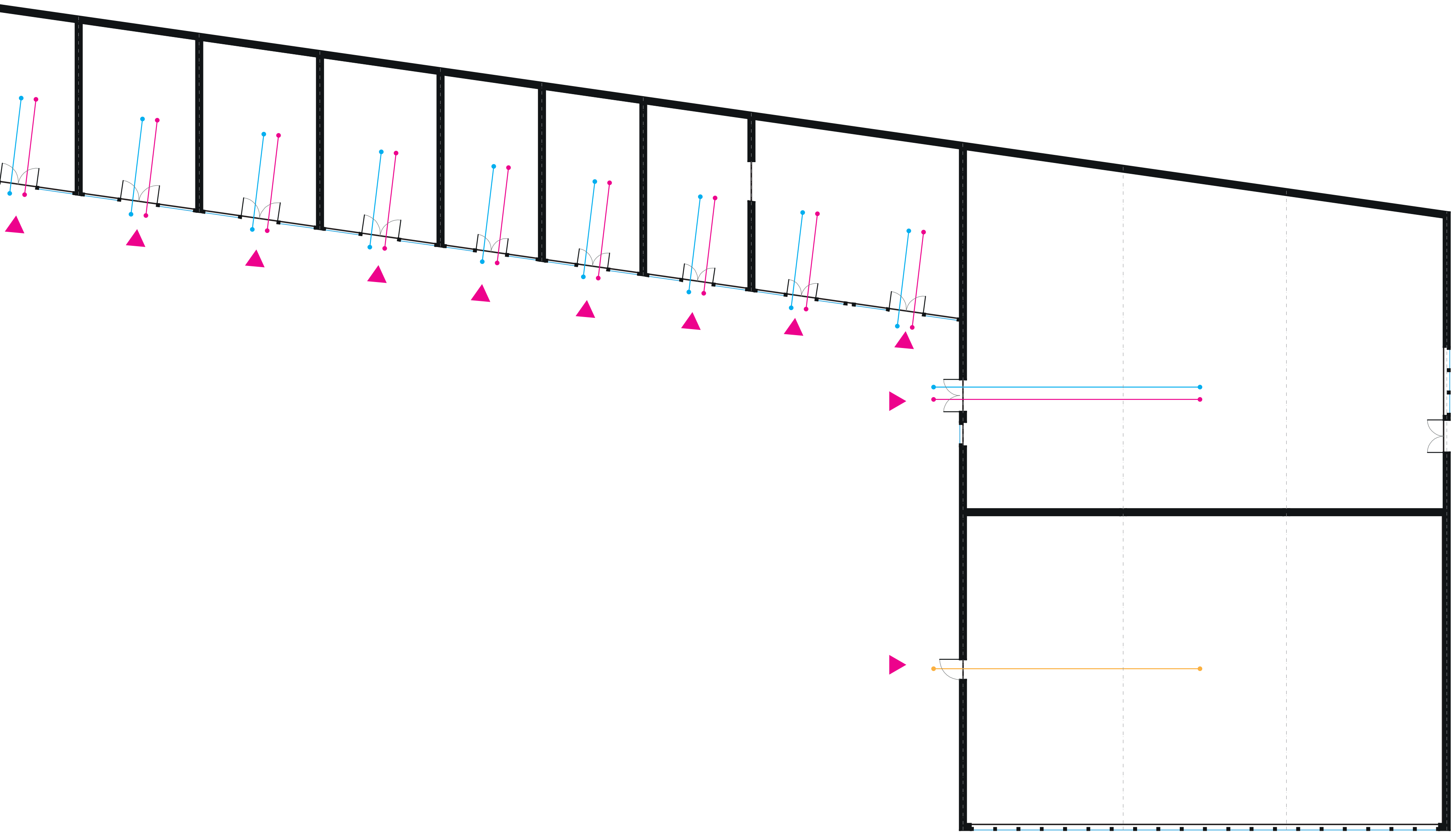
Sectie-C | **space use** | flux analisys

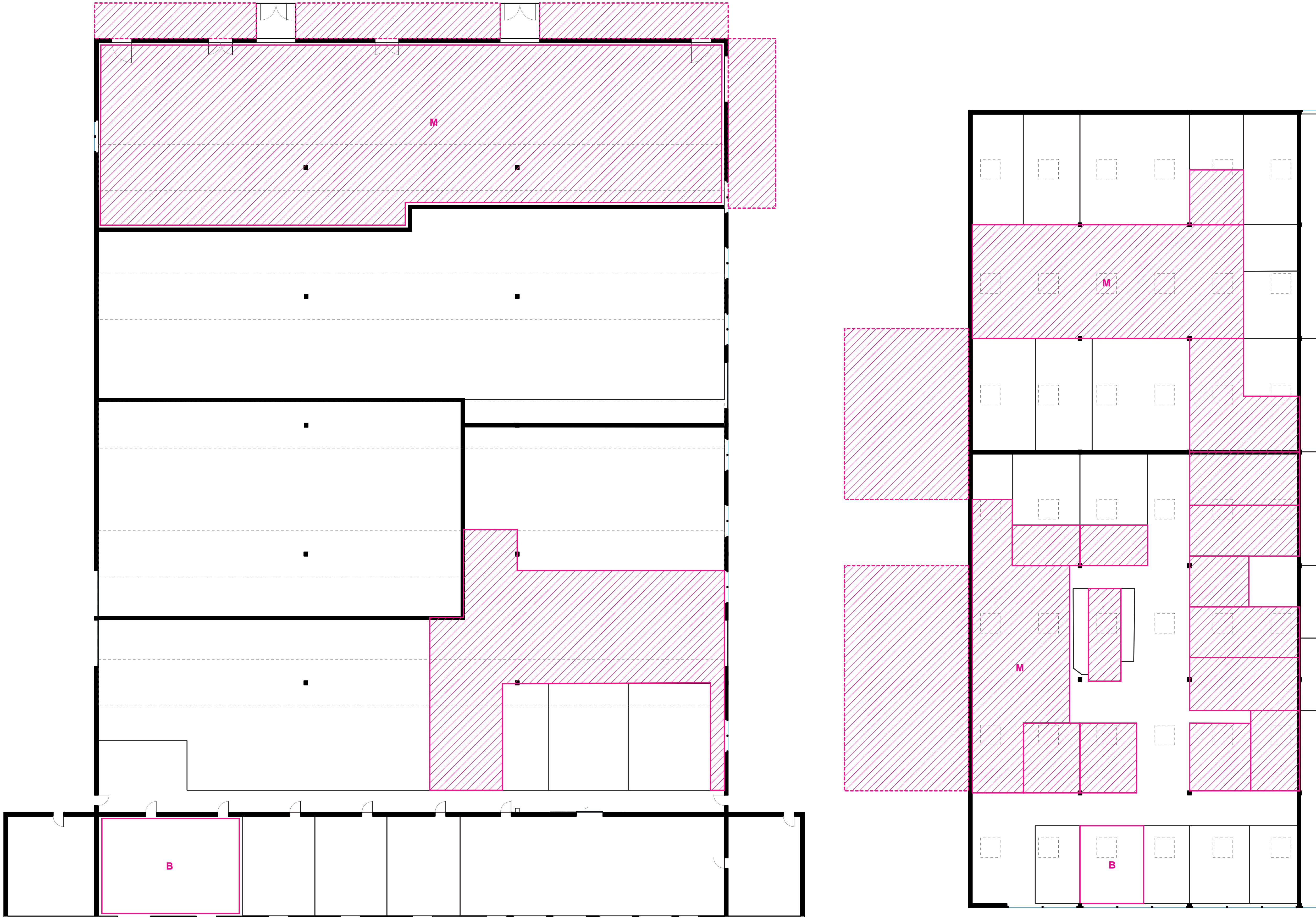

vehicular access
material flow
tenants flow
public flow



4b

Sectie-C | **space use** | flux analisys



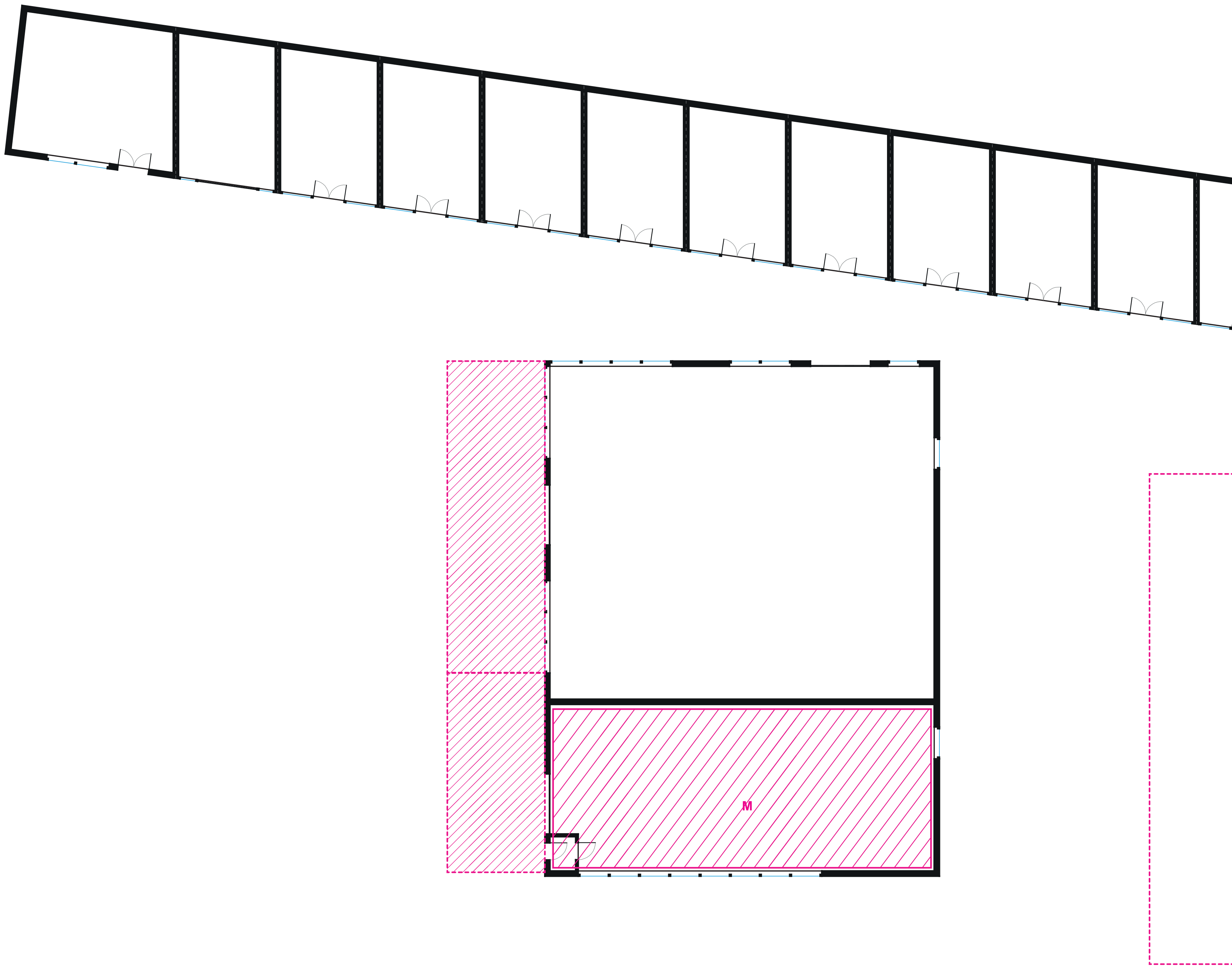


5a

Sectie-C| **space use** | common areas and services

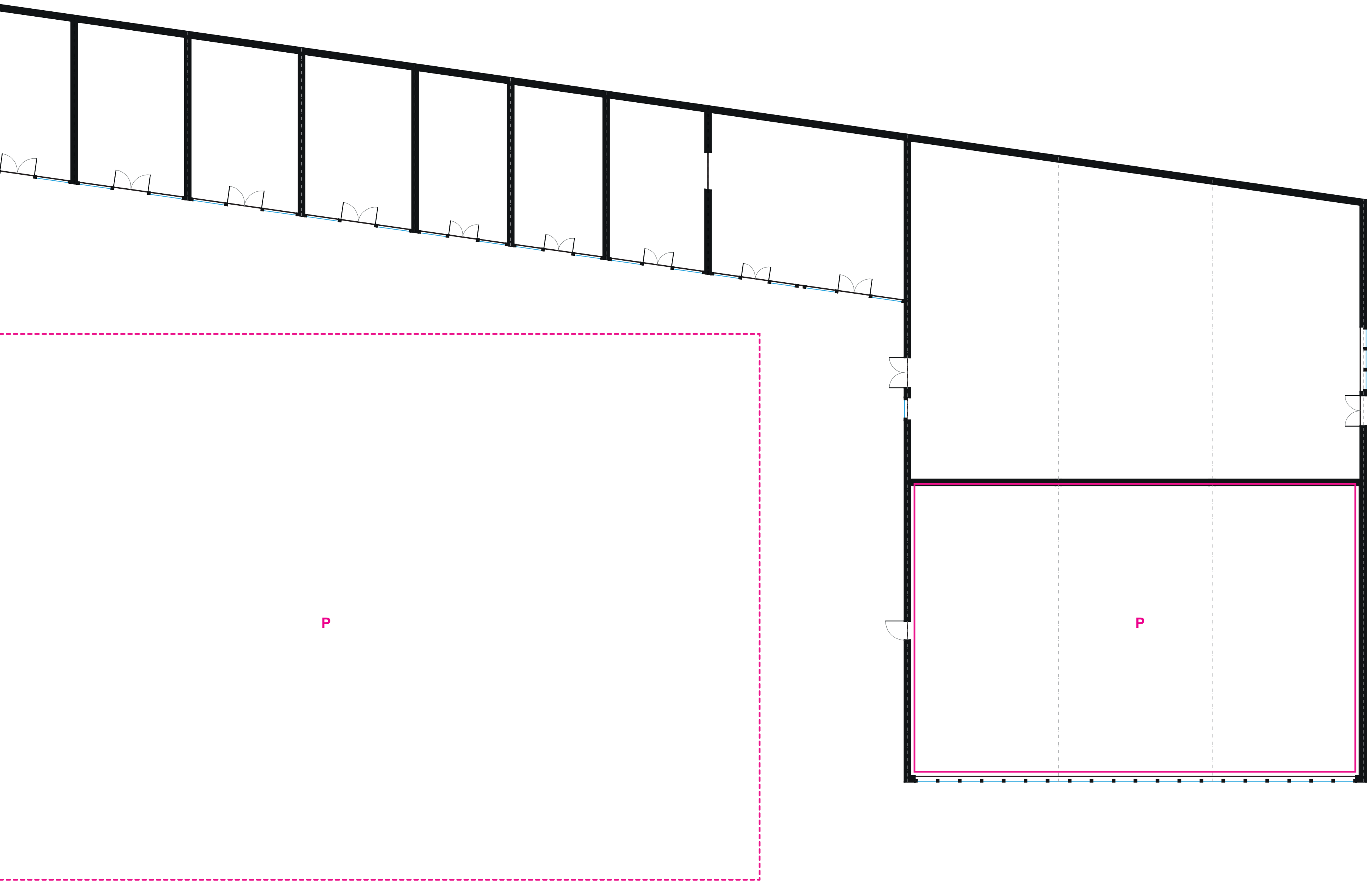
	closed space
	open space
	workspace

E	public entrance
M	shared machine
B	restroom
K	shared kitchen
P	bar / relax area



5b

Sectie-C | **space use** | common areas and services



closed space		E	public entrance
open space		M	shared machine
workspace		B	restroom
		K	shared kitchen
		P	bar / relax area

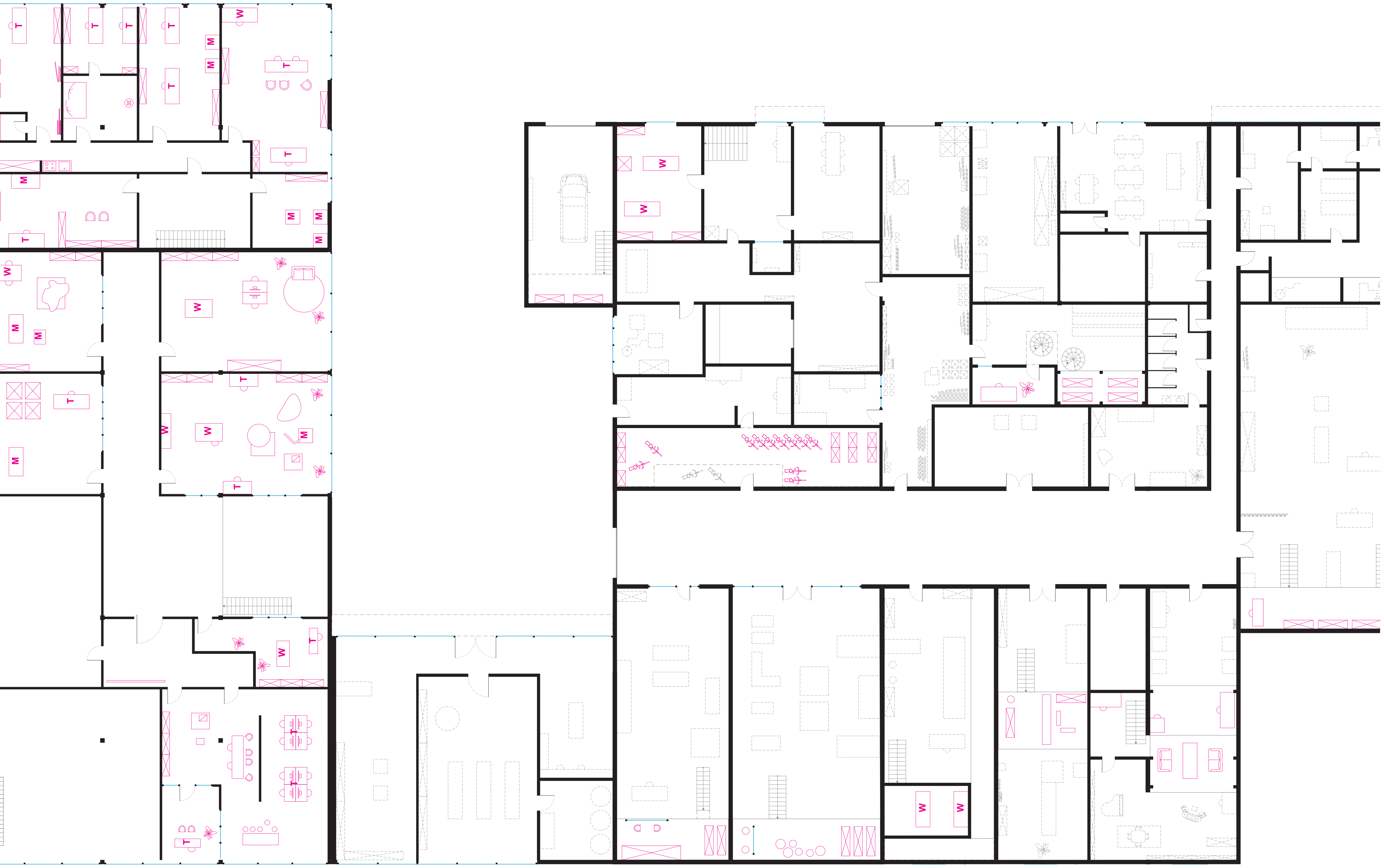
6a

Sectie-C | **space use** | Ground floor

	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table

6b

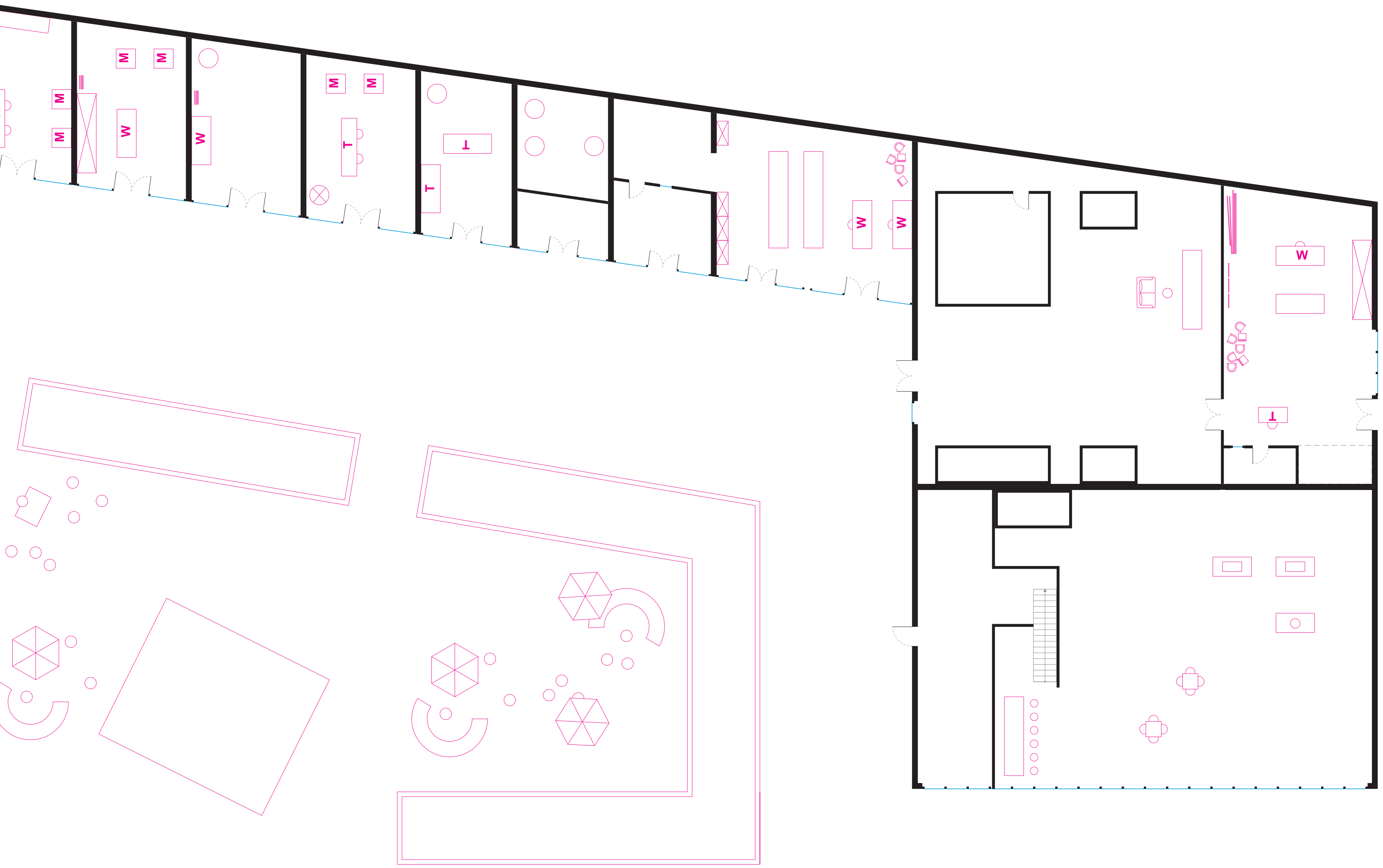
Sectie-C | **space use** | First floor



	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table

6c

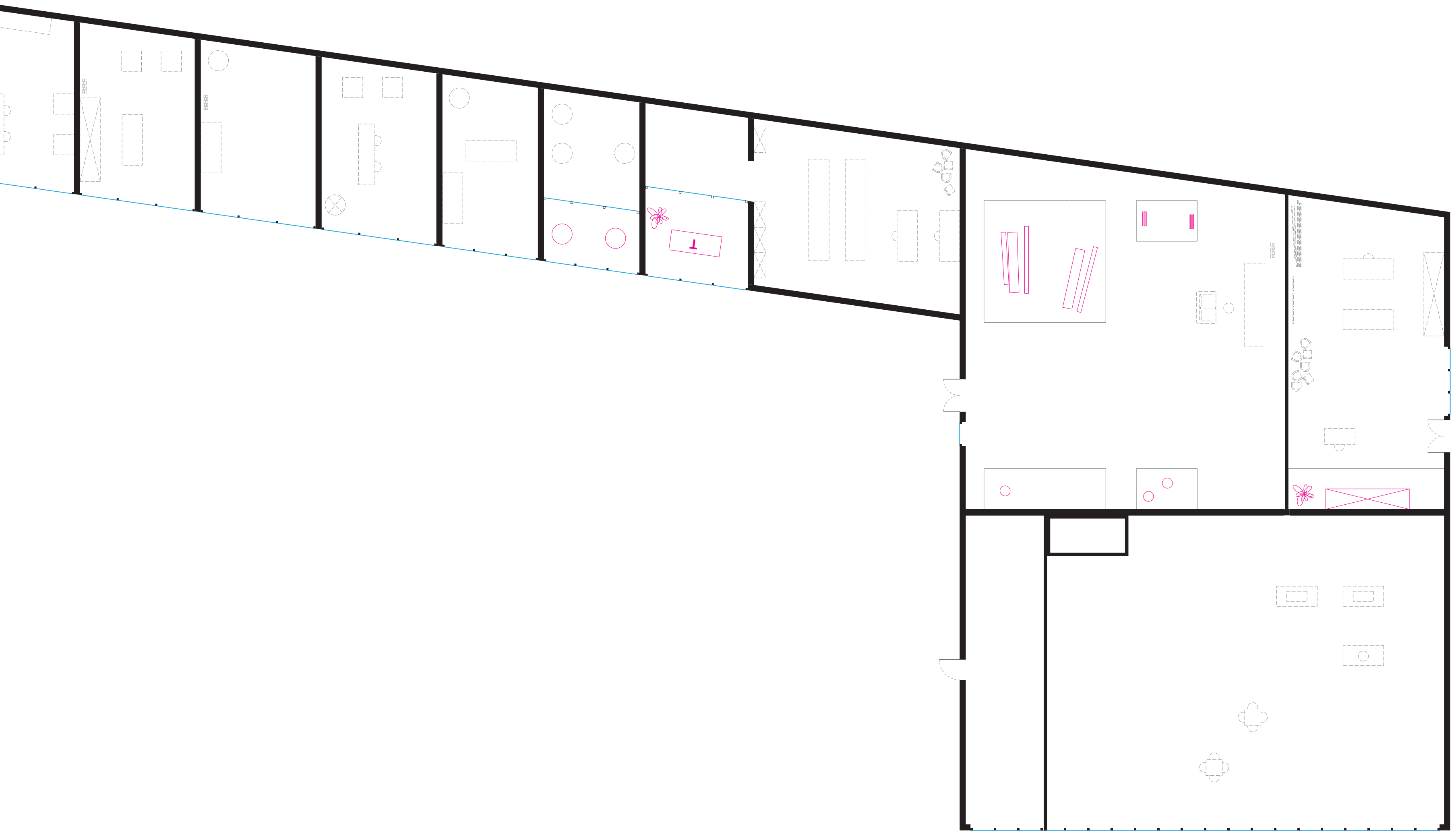
Sectie-C | **space use** | Ground floor



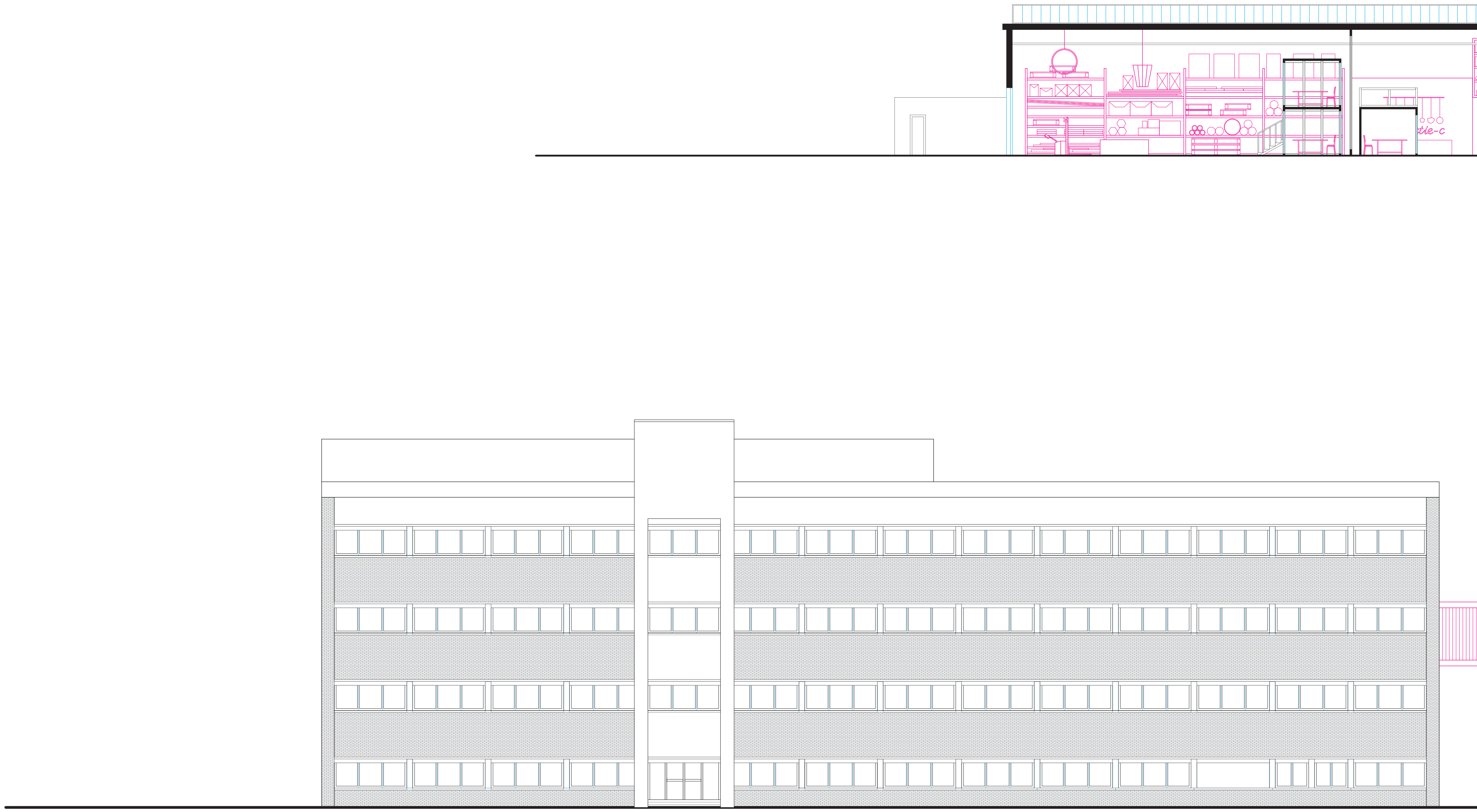
T	office desk
S	storage
K	kitchen
M	machine
W	work table

6d

Sectie-C | **space use** | Fisrt floor



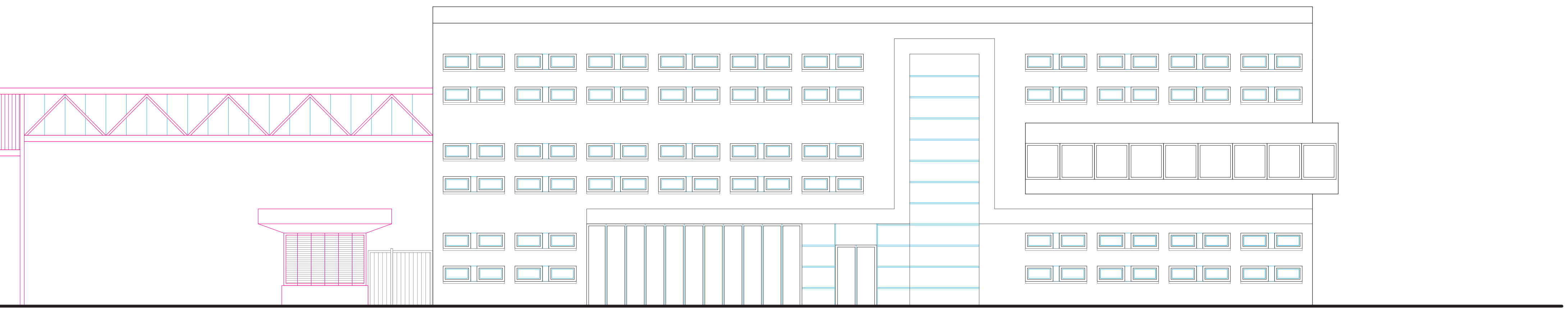
	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table



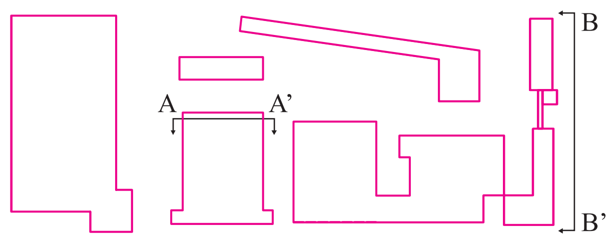
7a

Sectie-C | **material characters** |Structural section | Re-use strategy | Elevation

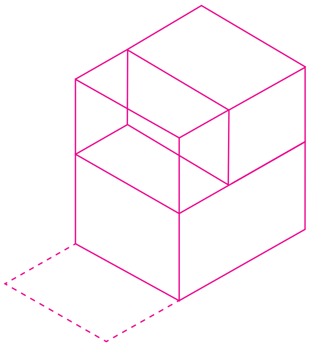
A-A’



B-B’



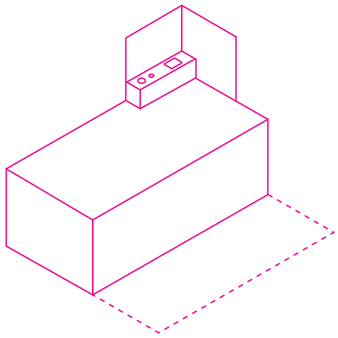
1



OFFICE/
WORKSHOP

This spatial typology is structured through the coexistence of a work space on the ground floor, where objects and prototypes are made, and an office space on the first floor where design activities and meeting take place.

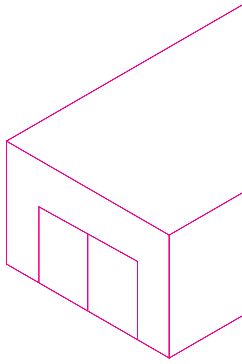
2



DOMESTIC/
WORKSHOP

This typology sees the coexistence of a work space on the ground floor with domestic and private spaces on the upper floor. The realization of the kitchen and a relaxation area define a high degree of intimacy that exists between work, personal and community activities among workers.

3



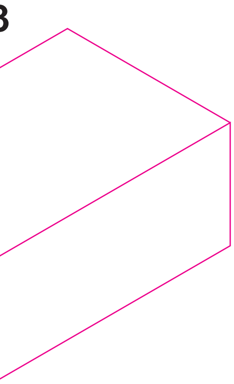
WOR

Big worksh
from the gr
companies t
taking up m
or they are
that come f
Large comp
collaborate
ones, buildi
working ec

8a

Sectie-C | **space analysis** | functional typology

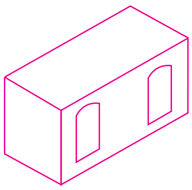
3



BIG
RKSHOP

ops derive
owth of the
that expand
nore space,
companies
rom outside.
panies often
with smaller
ng an internal
osystem.

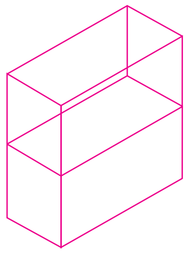
4



ATELIER

This type of space is characterized to develop on a single floor normally with a height between 3 and 4.5 m in height. The atelier is a space that contains smaller and lighter machines than the workshop and is indicated above all for artistic categories or cleaned light manufacturing process.

5



STORAGE/
WORKSHOP

This type is the most common within Keilewerf. The space on the ground floor is used for working activities as it is easy to access, while a staircase leads to the first floor where the material is stacked waiting to be worked.

Sectie- the entrance of Sectie-C with the new cafeteria and the covered bridge . Source: photo of the author, 2018

Collaboration O shared working area. Source: photo of the author, 2018

Collaboration O private workshop . Source: photo of the author, 2018

Interior organization of a carpentry. Source: photo of the author, 2018

Shared machine shop and private workspaces . Source: photo of the author, 2018

Single tenant workshop. Source: photo of the author, 2018

Collaboration O use of shared space . Source: photo of the author, 2018

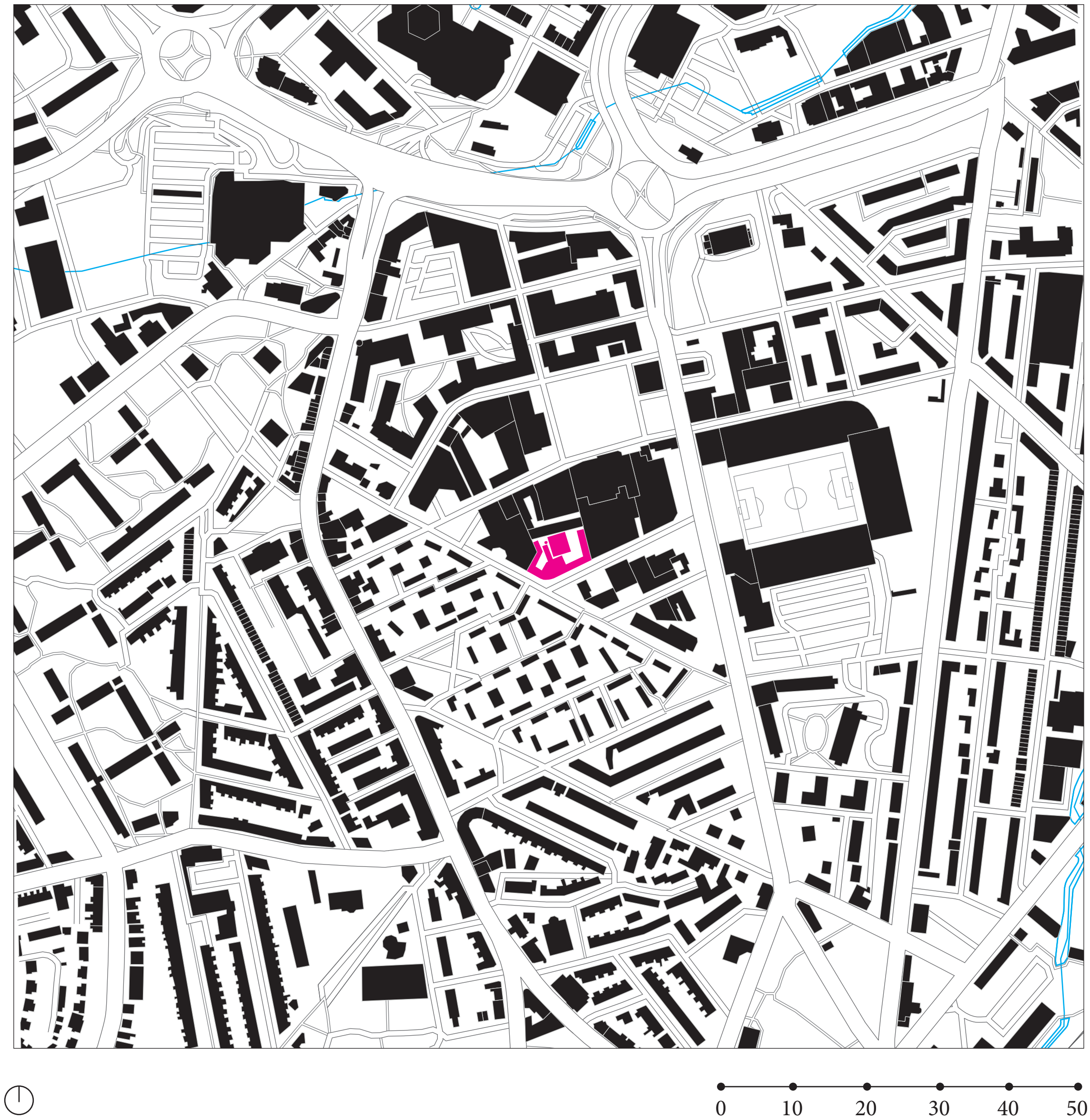
Sander Wassink atelier during the Dutch Design Week. Source: photo of the author, 2019

Interior space opened to visit during the Dutch Design Week . Source: photo of the author, 2019

Pottery company workshop. Source: photo of the author, 2019

Interior of a video company’s workshop . Source: photo of the author, 2019

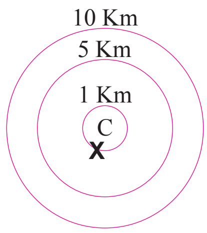
PORTLAND WORKS | Sheffield



OPENING TIME

08/19 h Tenants

09/17 h Public store

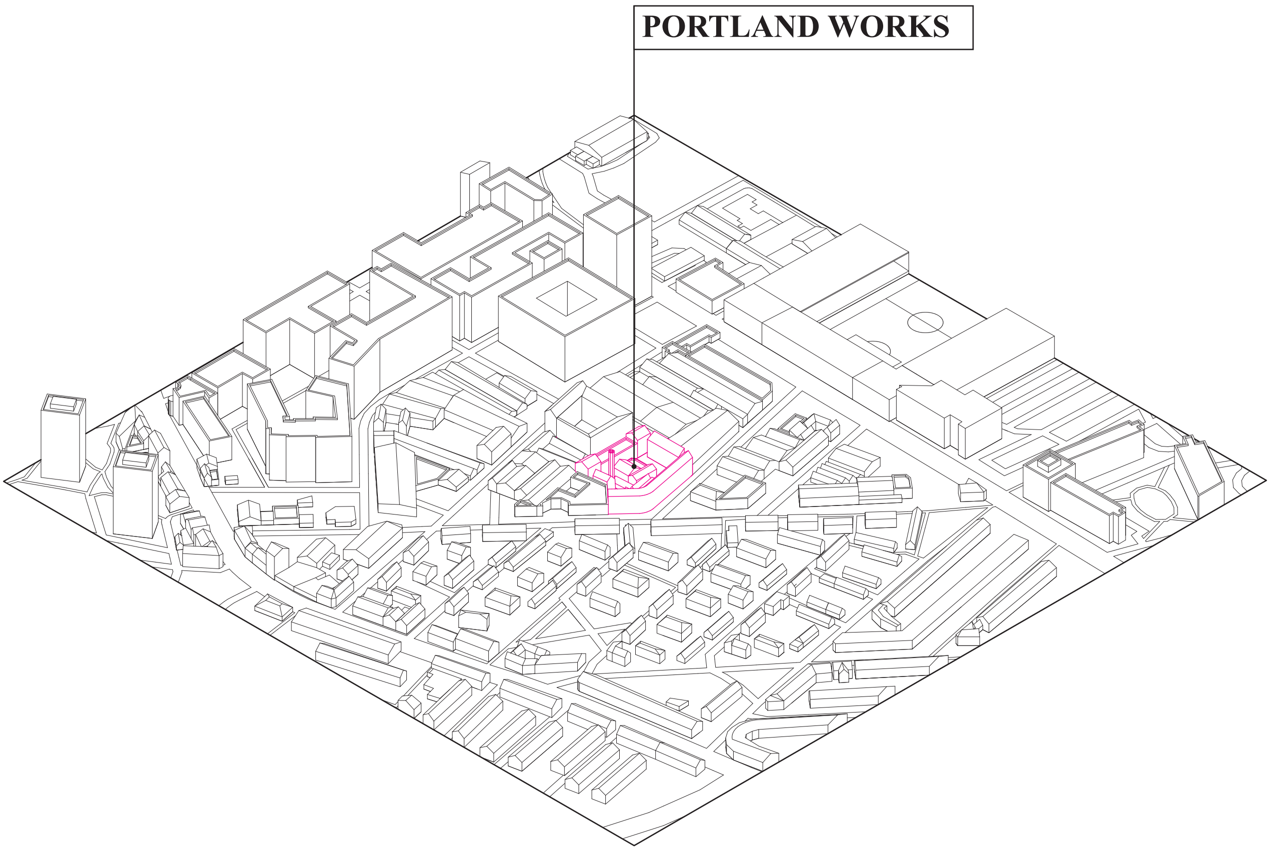


PUBLIC TRASPORT INFO

From station: 12 min/bus
8 min/bike
5 min/car

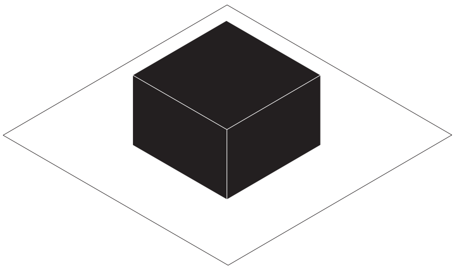
1a

Portland Works | **urban characters** | district



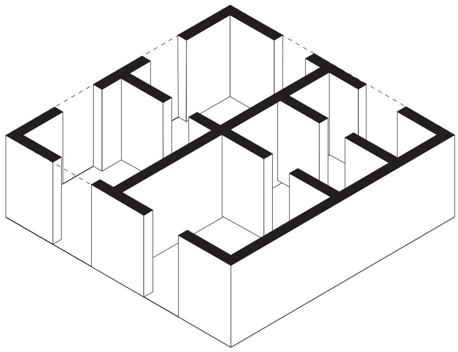
1b

Portland Works | **urban characters** | area



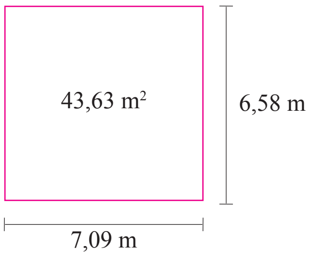
building dimensions

3500 m^2
16482 m^3

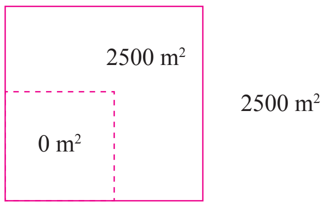


structural form

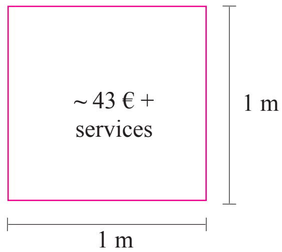
load bearing walls



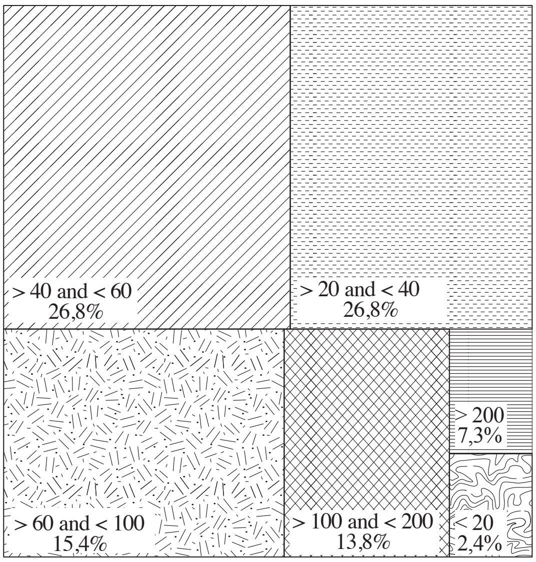
single plot average size



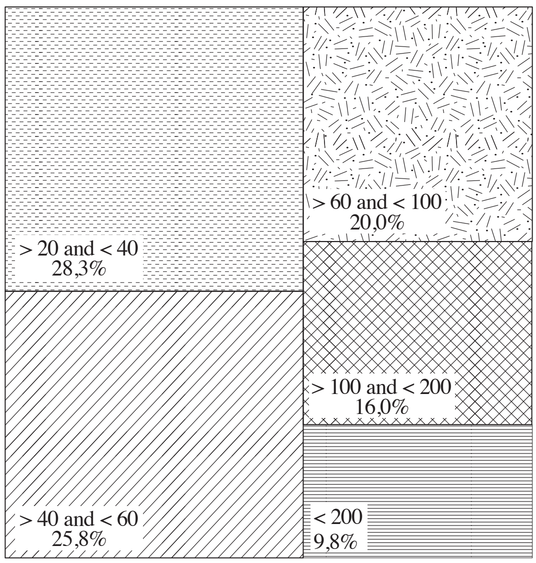
open/close area



cost x m^2



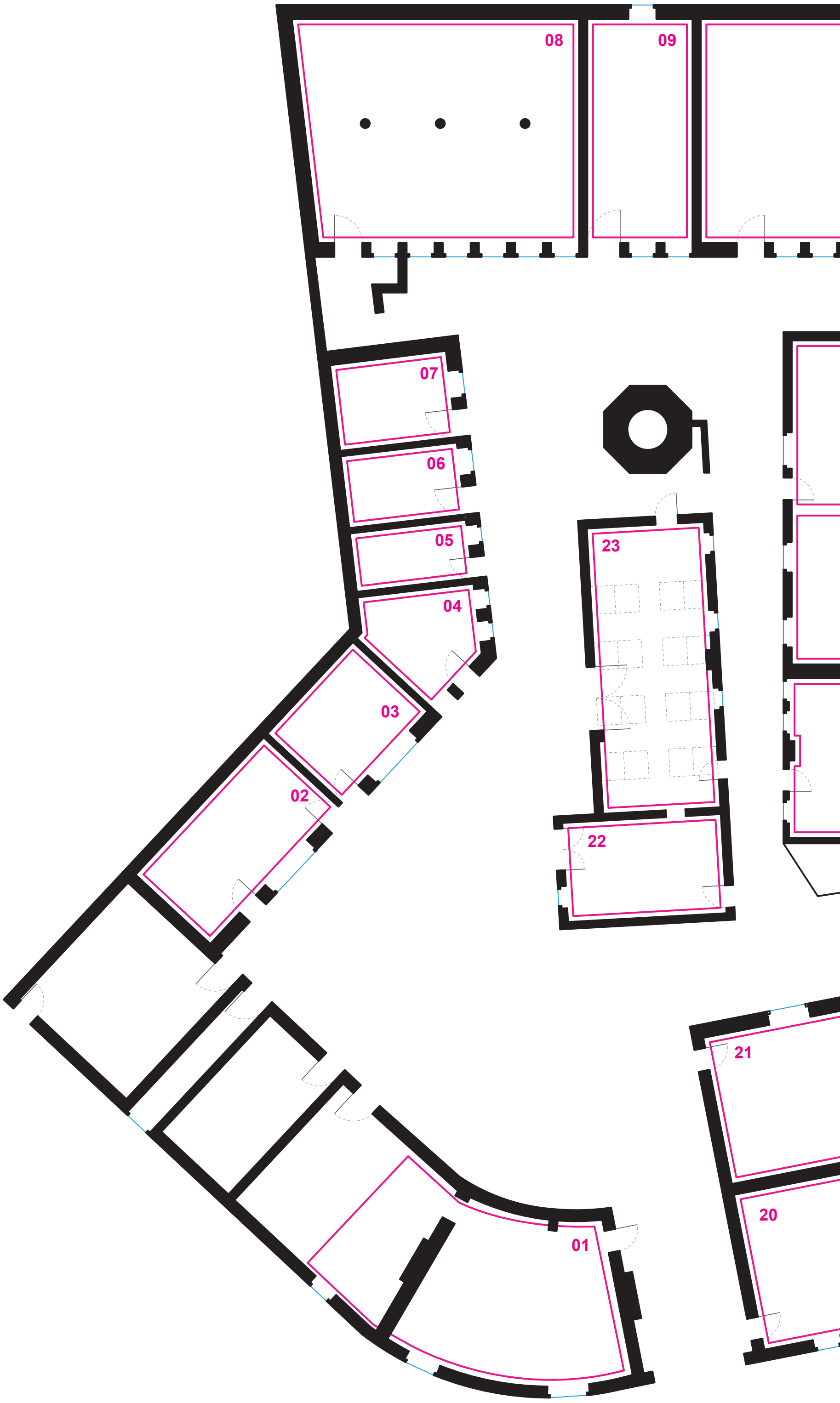
N° of space distribution



Surface category disribution

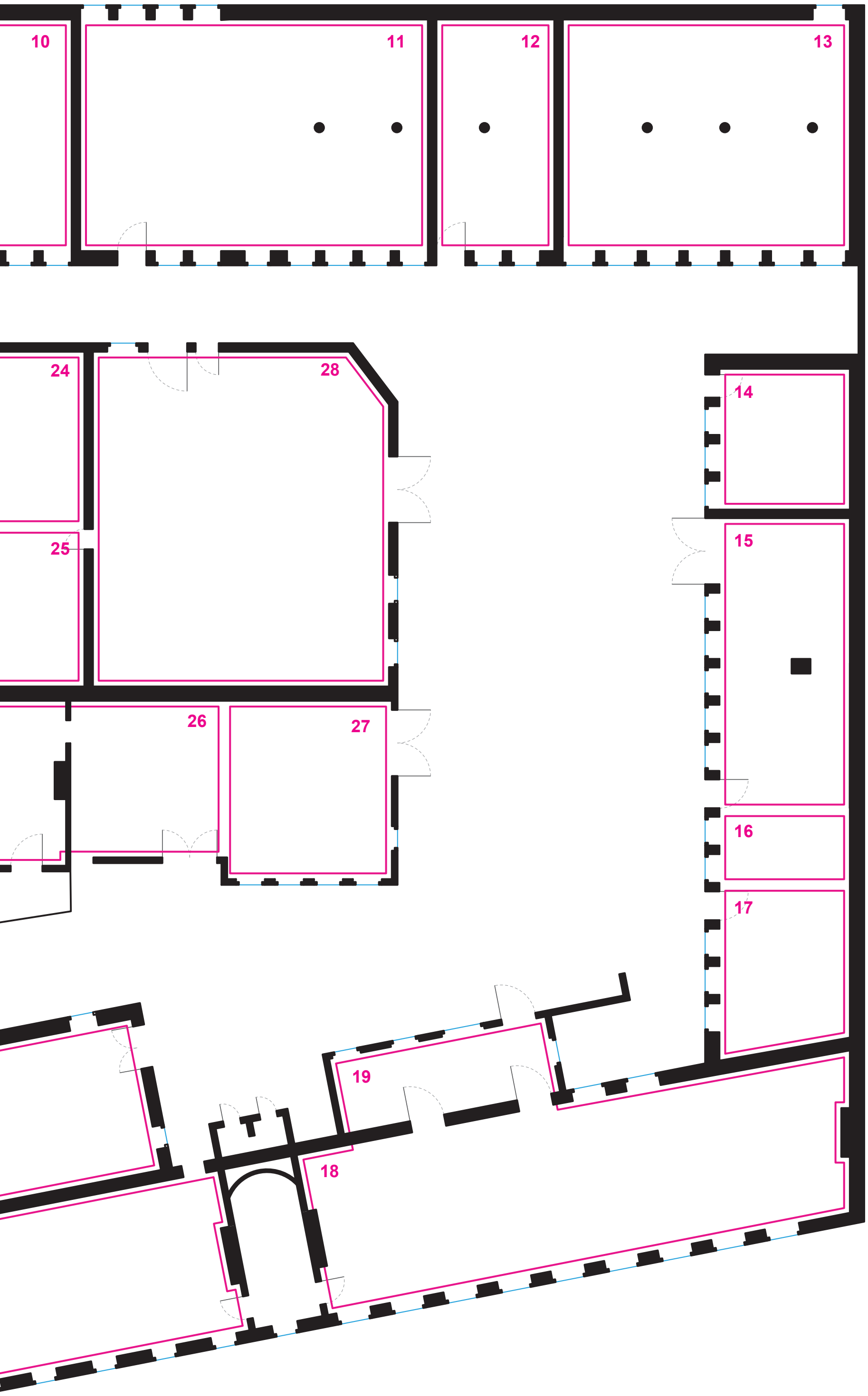
1c

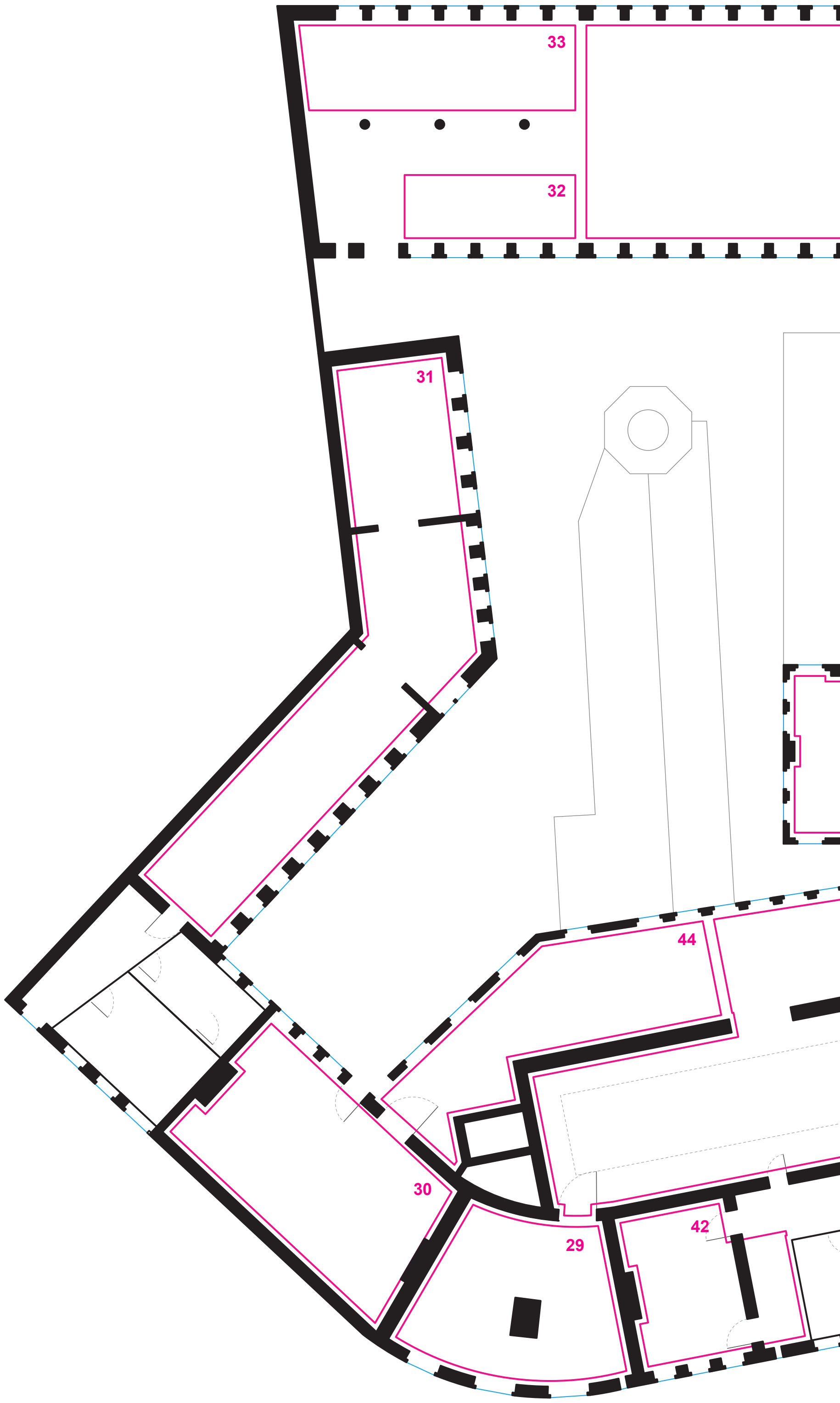
Portland Works | **dimension analysis** | data on the building



3a

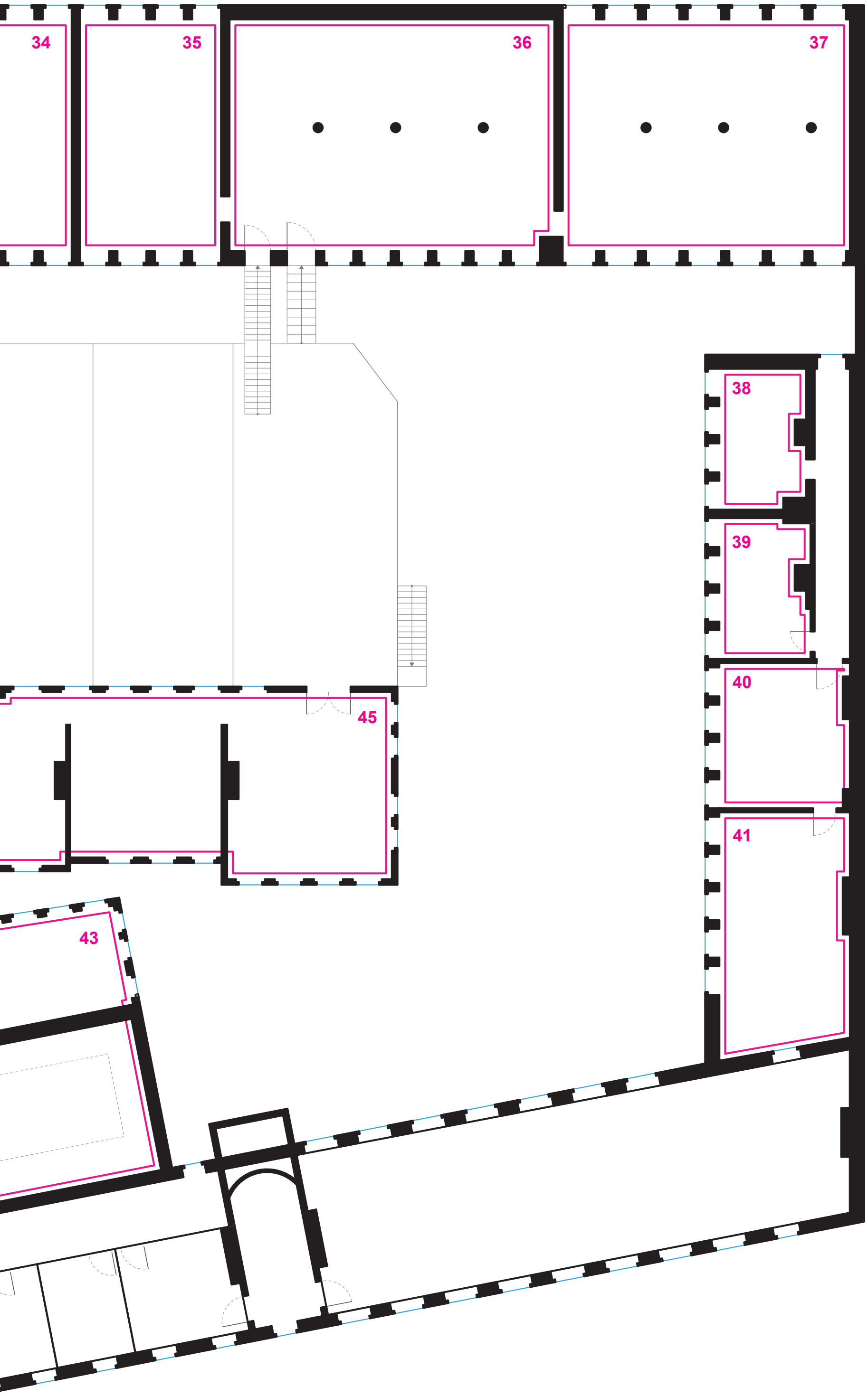
Portland Works | **space use** | plot subdivision

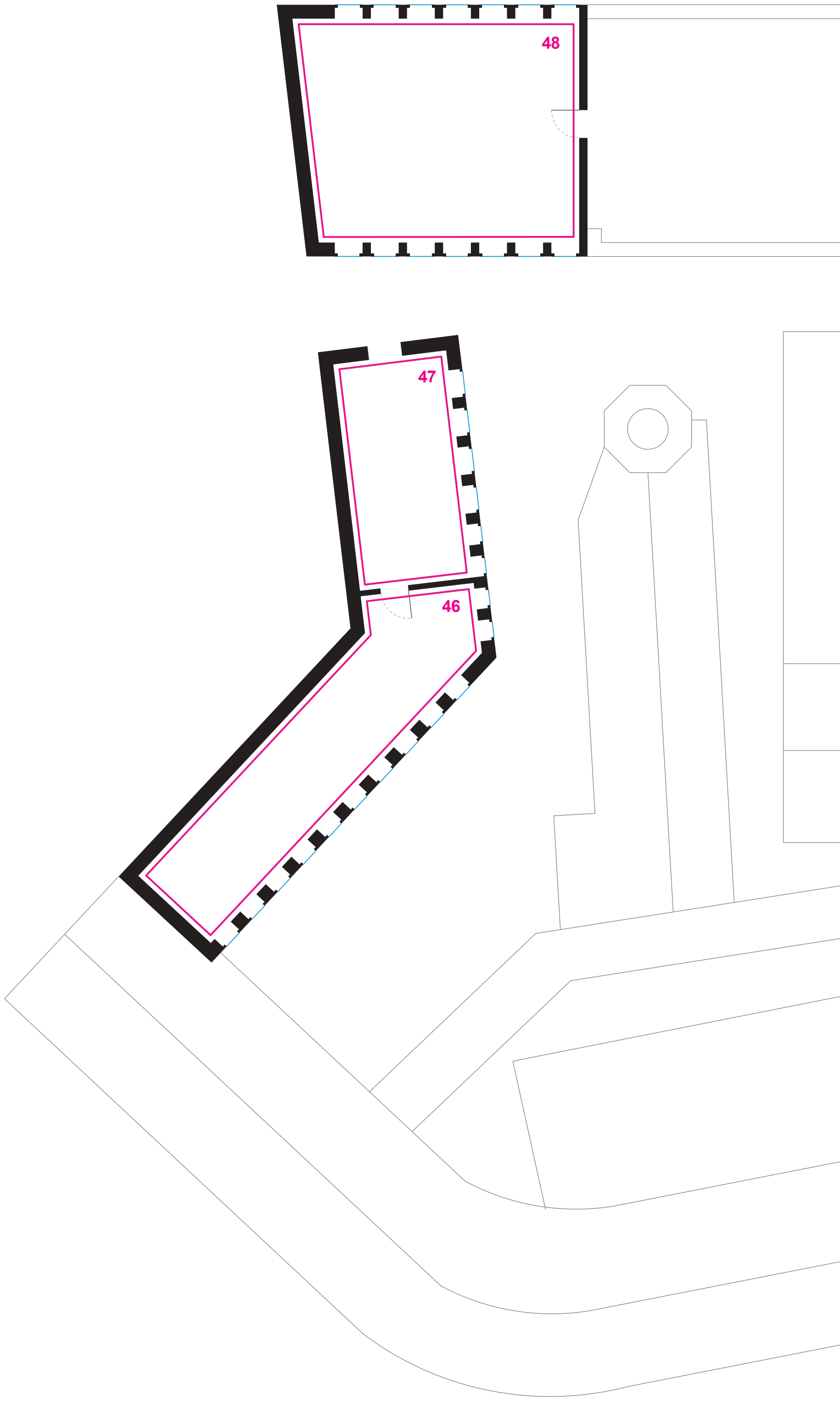

10
11
12
13
24
28
14
25
15
26
27
16
17
19
18



3b

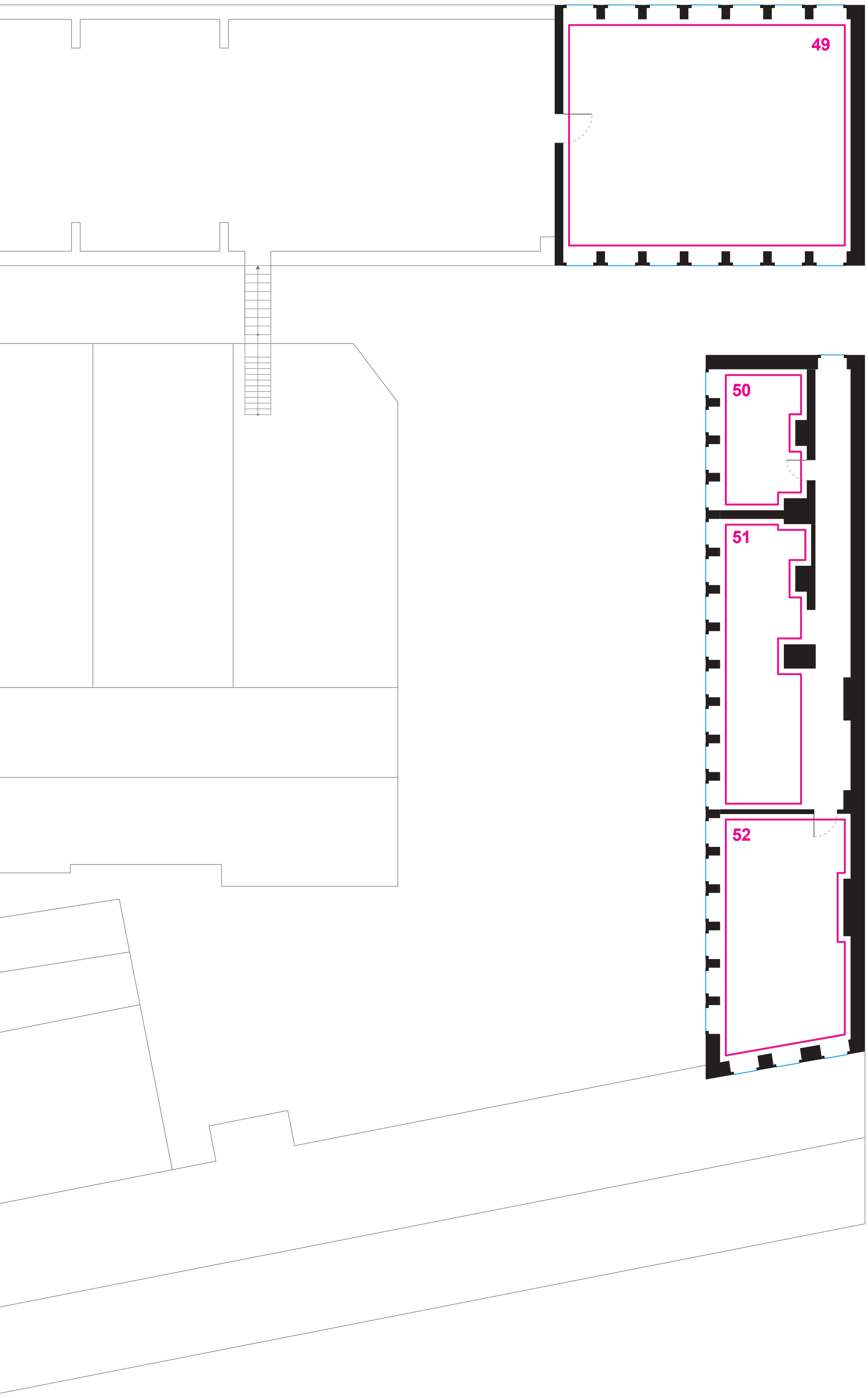
Portland Works | **space use** | plot subdivision


34
35
36
37
38
39
40
41
45
43



3c

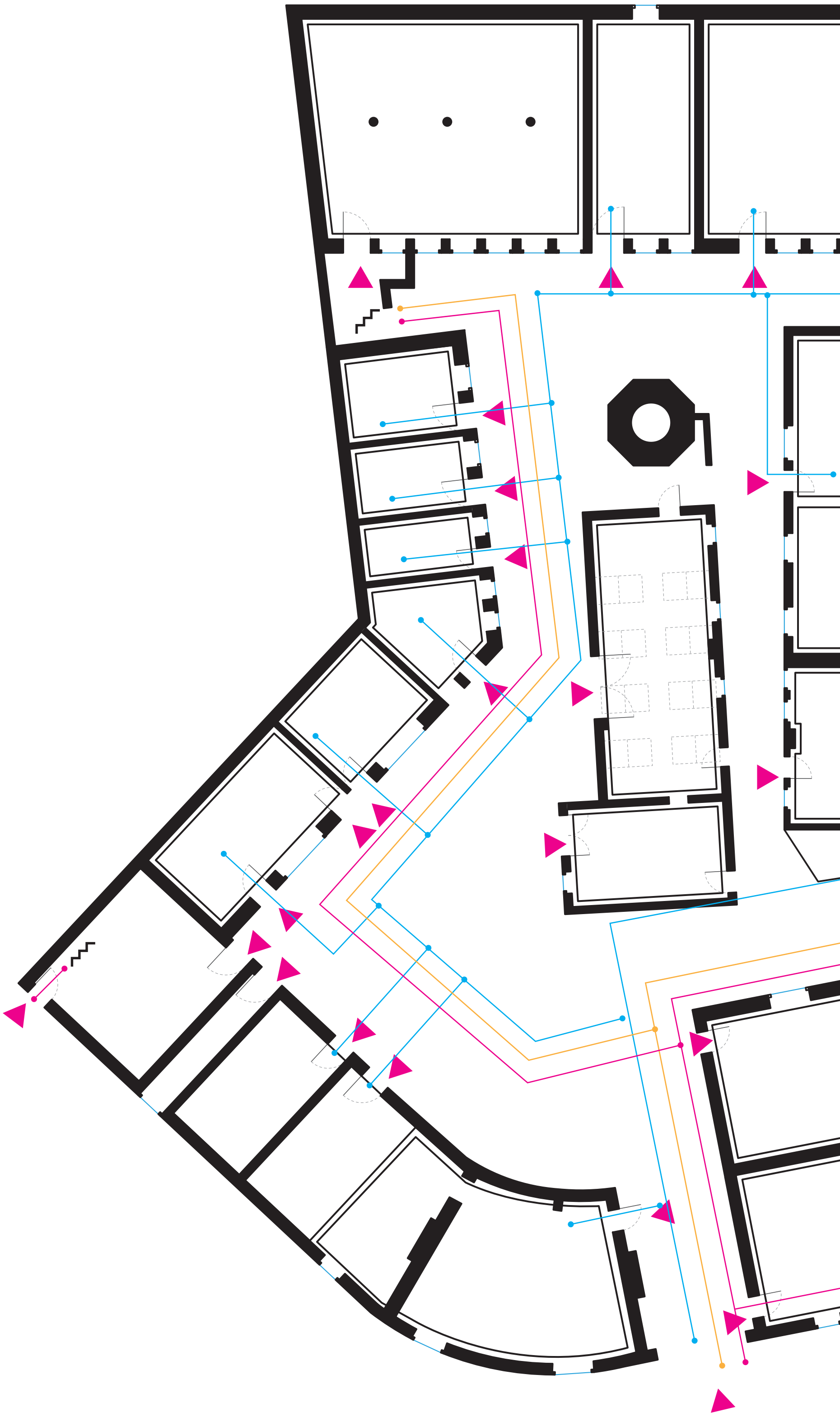
Portland Works | **space use** | plot subdivision


49
50
51
52

01	Lowtech Ltd
02	Shaw Engraving
03	Ed and Graeme, bike makers
04	
05	Storage
06	Lynthrorpe - office
07	Locksley Distilling - Gin School
08	Lynthrorpe
09	The big eyes family players
10	Andy Cole Tools
11	SquarePegs
12	Pml Silver plating - workshop
13	Pml Silver plating - workshop
14	Pml Silver plating - office
15	Pml Silver plating - workshop
16	Pml Silver plating - storage
17	Sheffield Hackspace
18	Portland Work studio
19	Storage
20	Lowtech Ltd
21	Lynthrorpe - storage
22	Michael May Knives
23	Locksley Distilling
24	
25	
26	Blacksmith

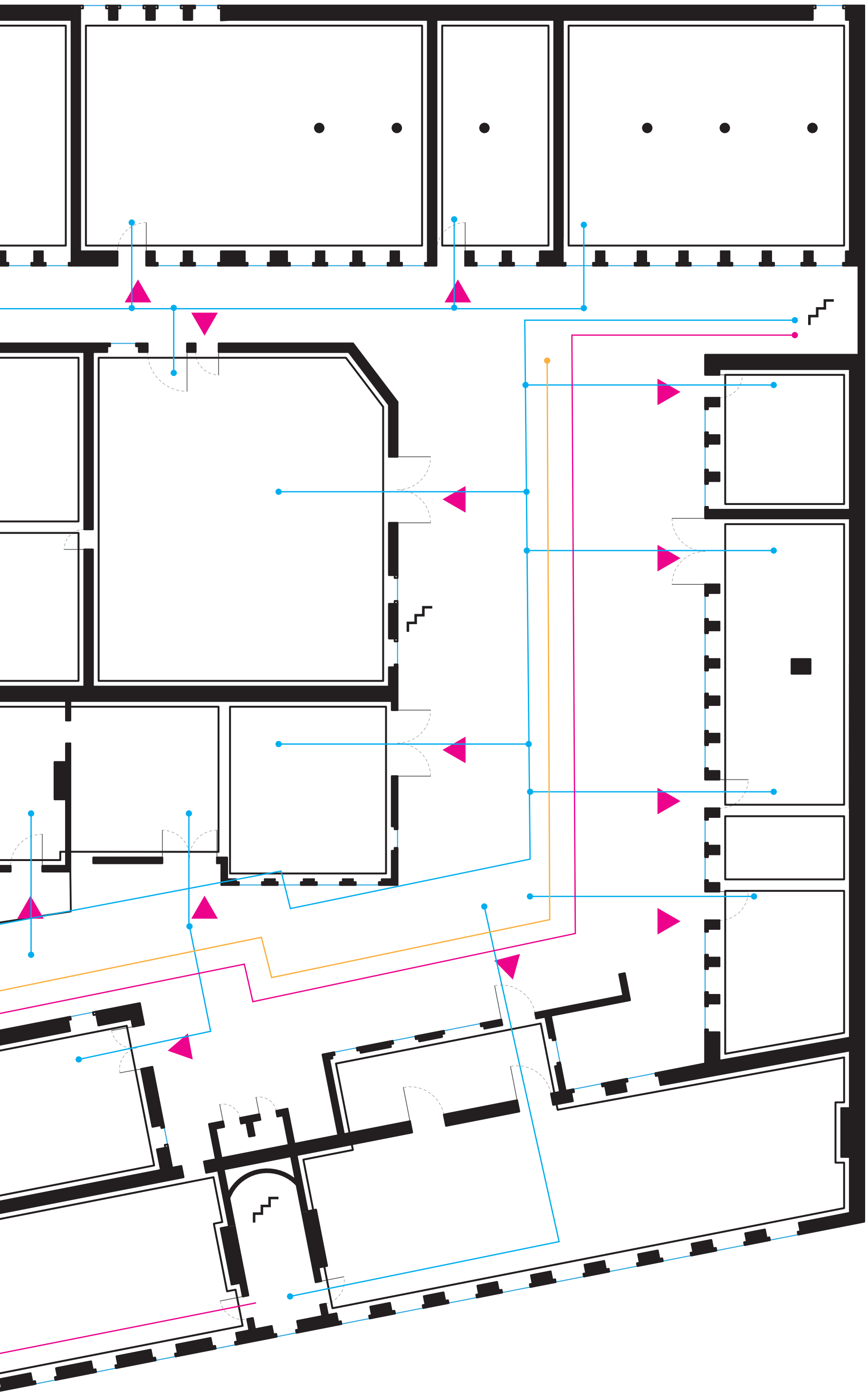
27	Storage
28	Forge
29	Lasercutting
30	Quality Cabinetry
31	Opus Indipendent
32	Daniels Brothers
33	Tietzsch Guitars
34	Singing Knives Records
35	Bailey of Sheffield
36	Bailey of Sheffield - Office
37	Locksley Distilling
38	Buffergirl Jewellery
39	God's Own Rugs
40	Wilebore hand made leather goods
41	
42	Office
43	Art center
44	Art center
45	Stuart Mitchell knives
46	
47	Dosch
48	Long Bow maker
49	
50	Linda Doughty
51	PH Engineering
52	Mary Sewell

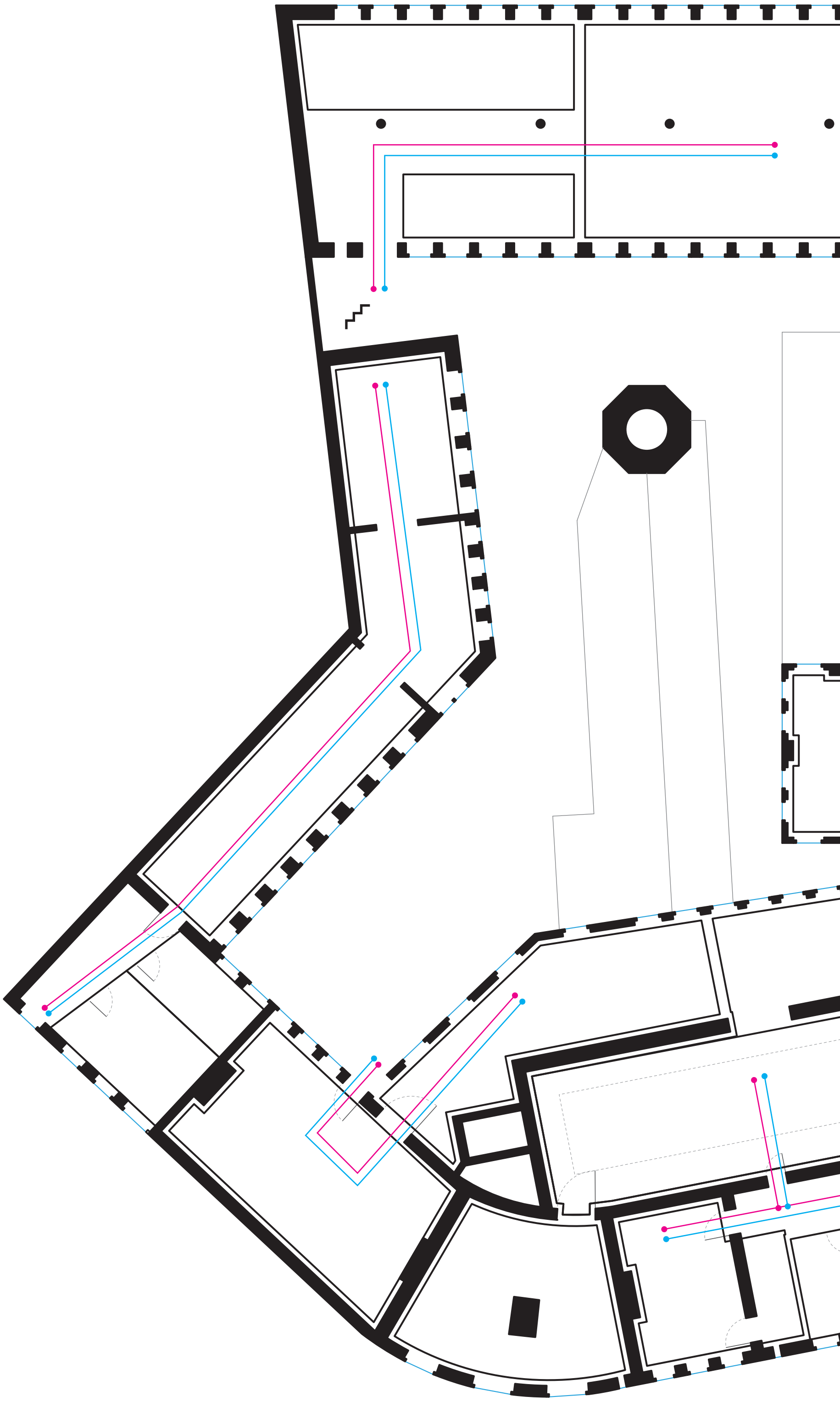
- Crafts
- Wood Working
- Service
- Fine art
- Architecture
- Design



4a

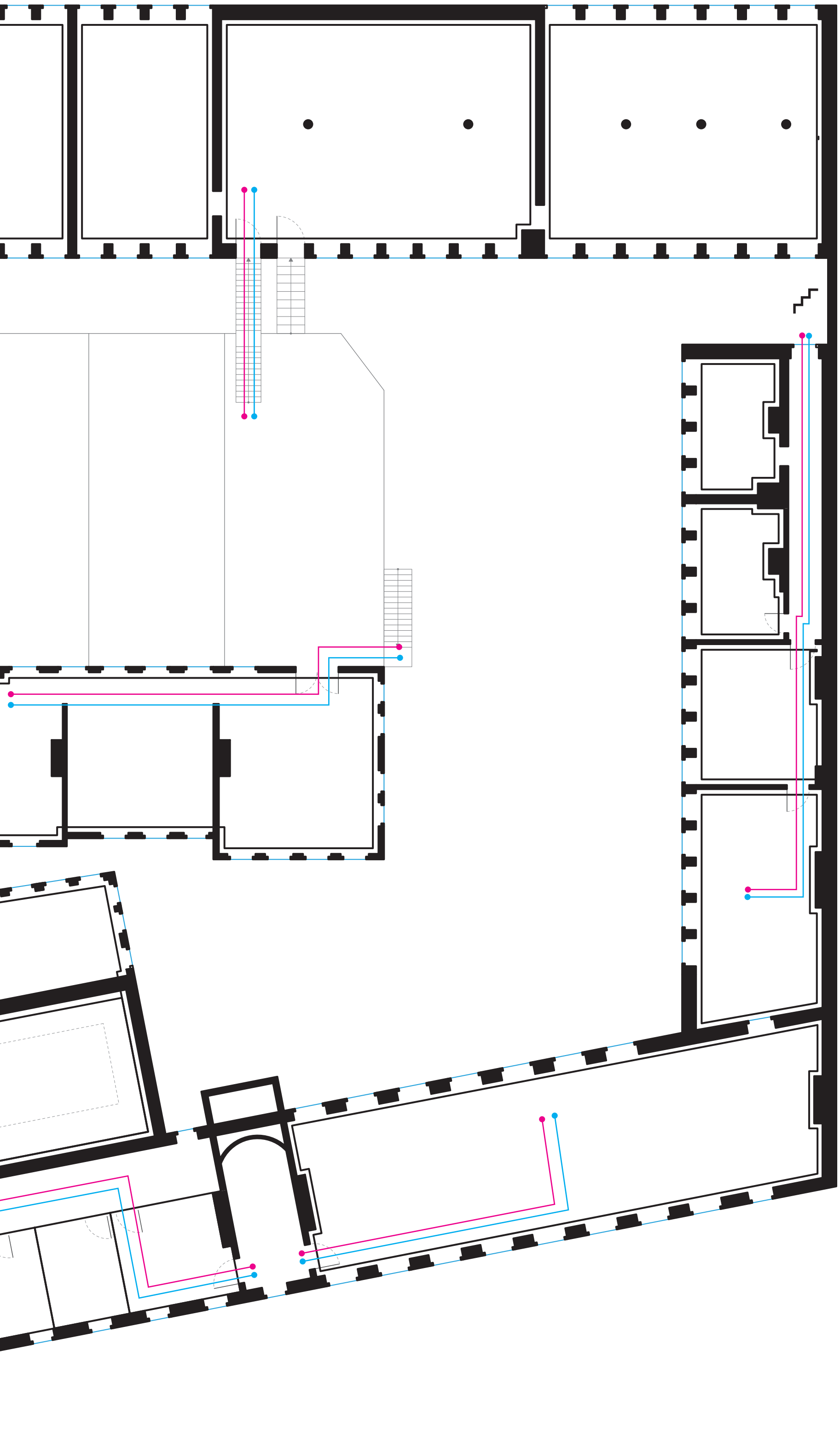
Portland Works | **space use** | activities environment

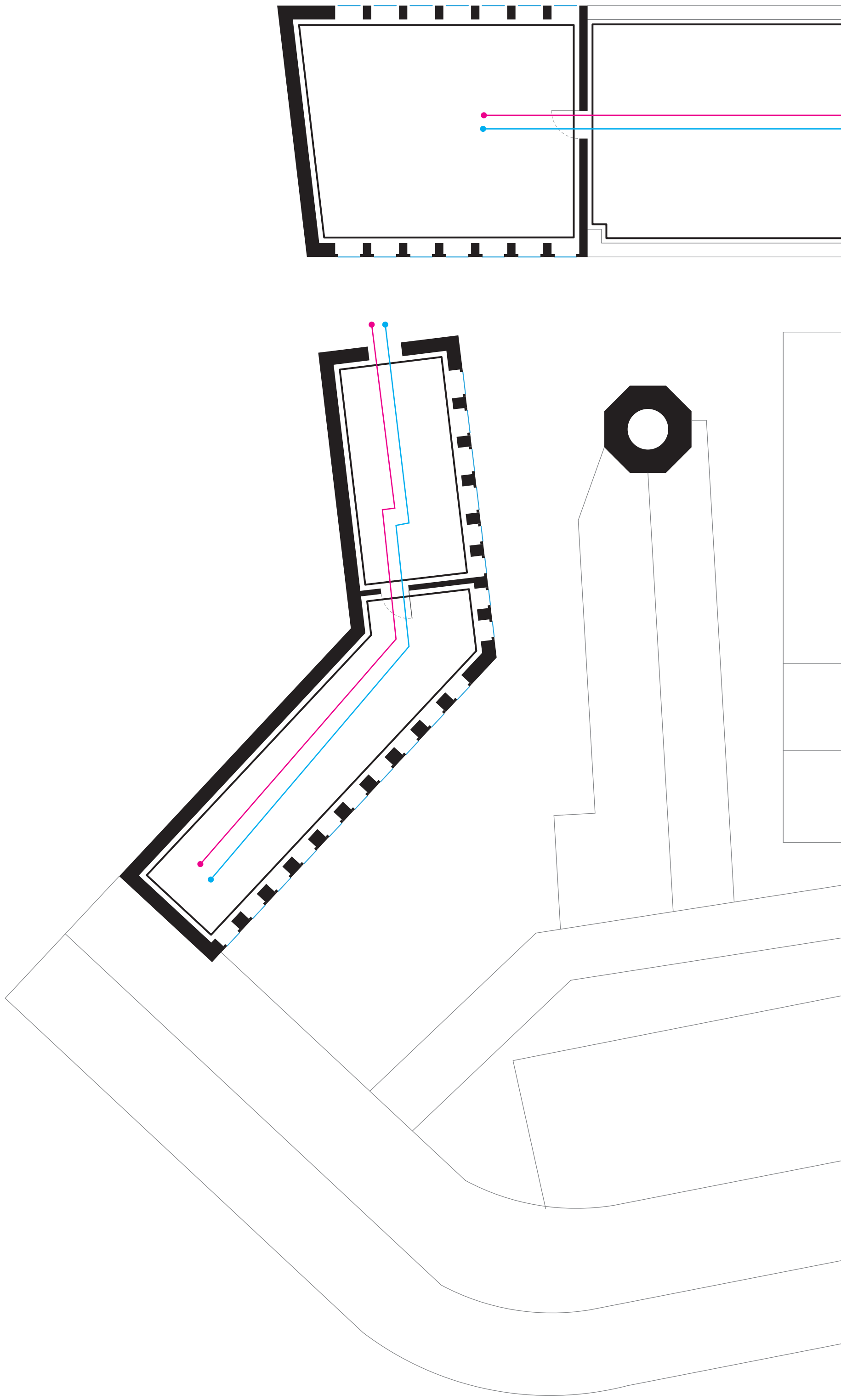




4b

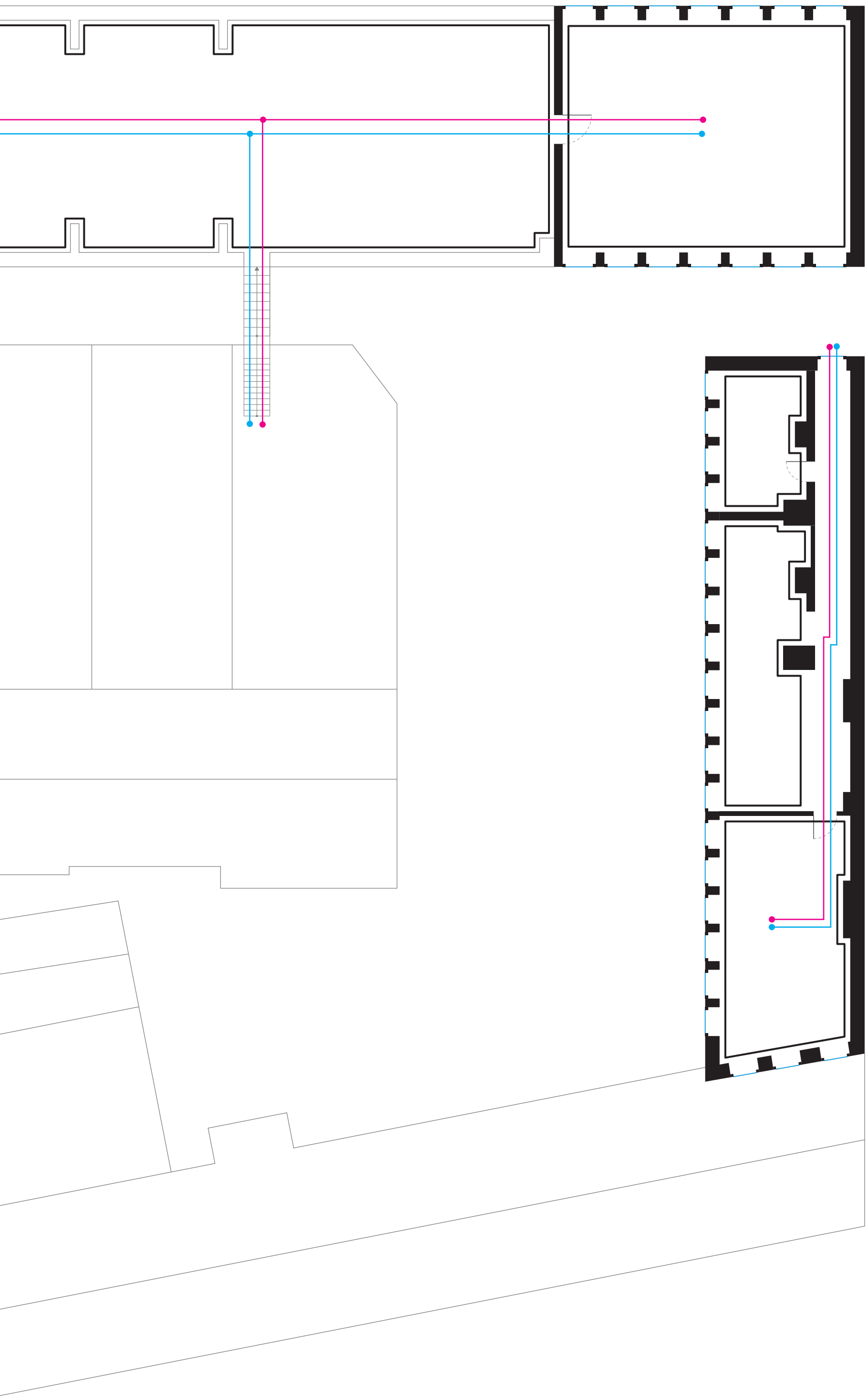
Portland Works | **space use** | flux analisys

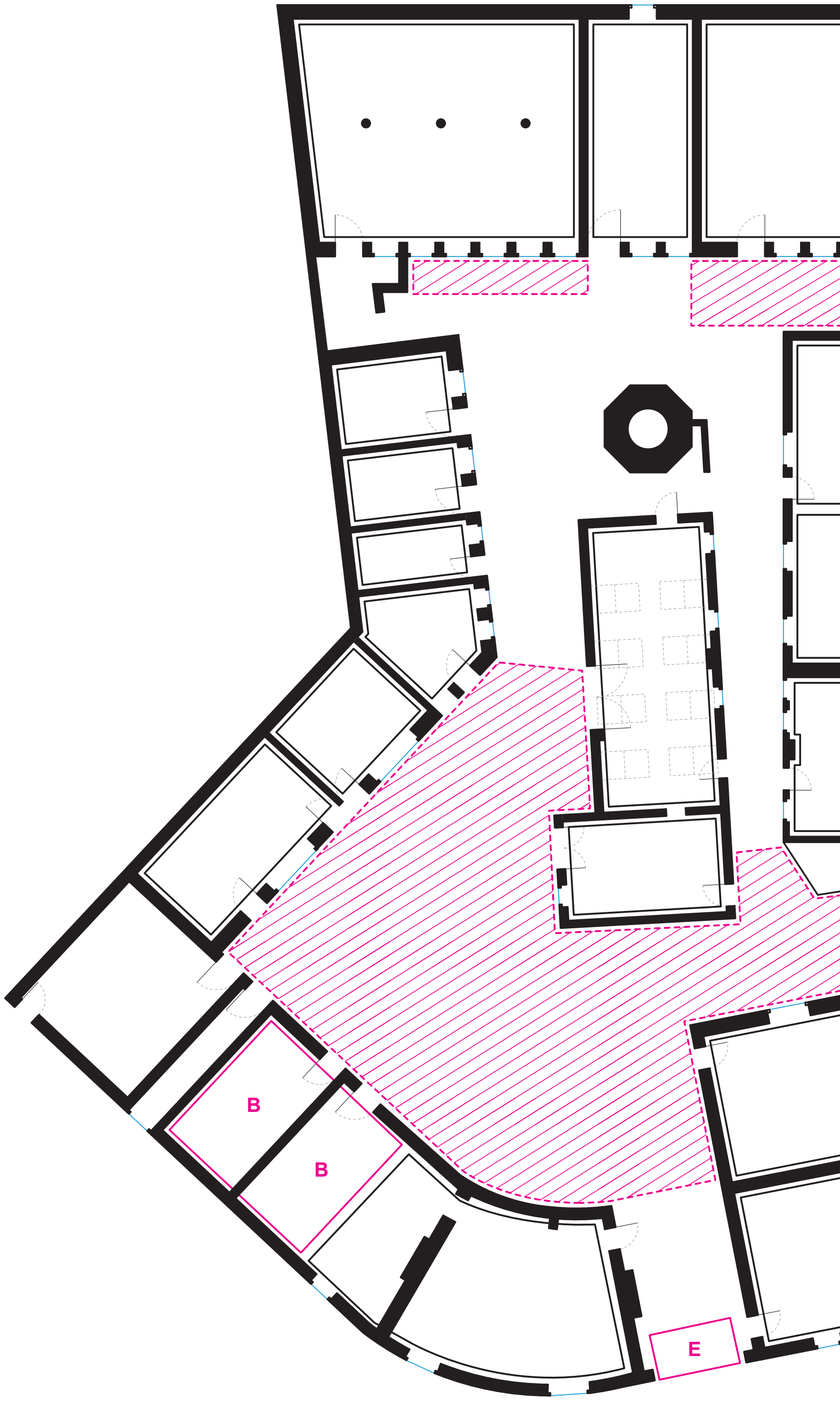




4c

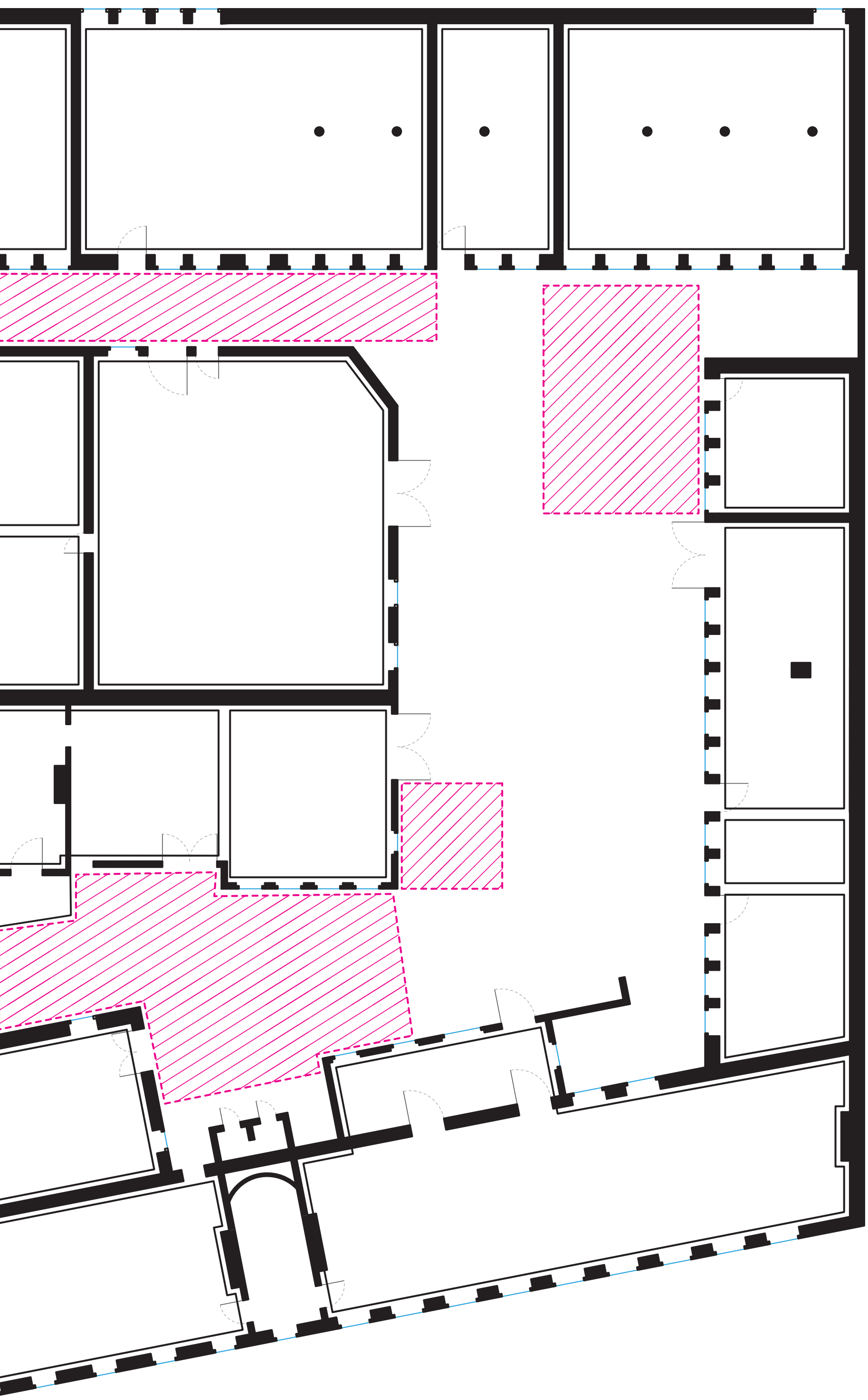
Portland Works | **space use** | flux analisys





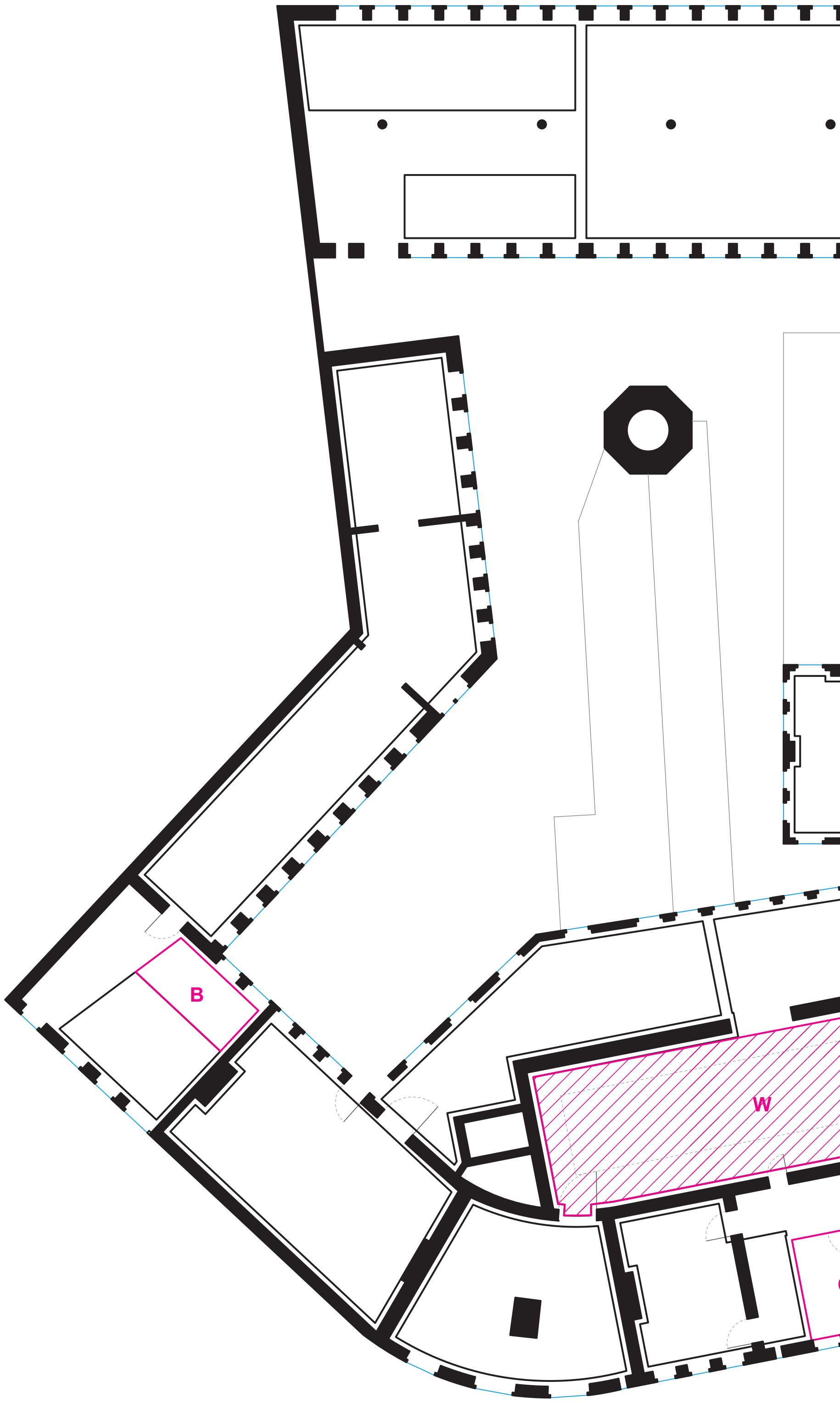
5a

Portland Works | **space use** | common areas and services



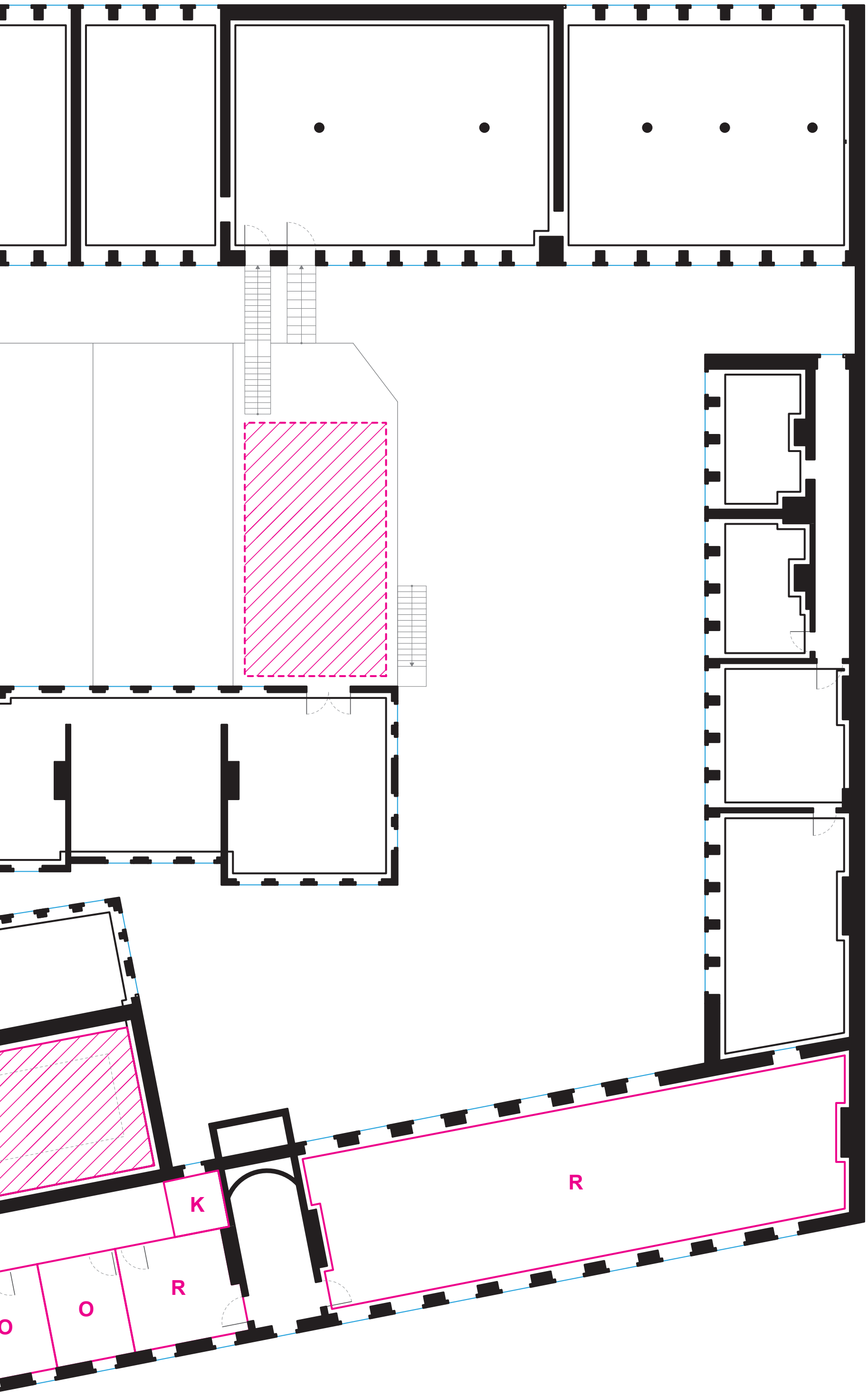
closed space
open space
workspace

E public entrance
O office
B restroom
K shared kitchen
W shared showcase
R meeting room

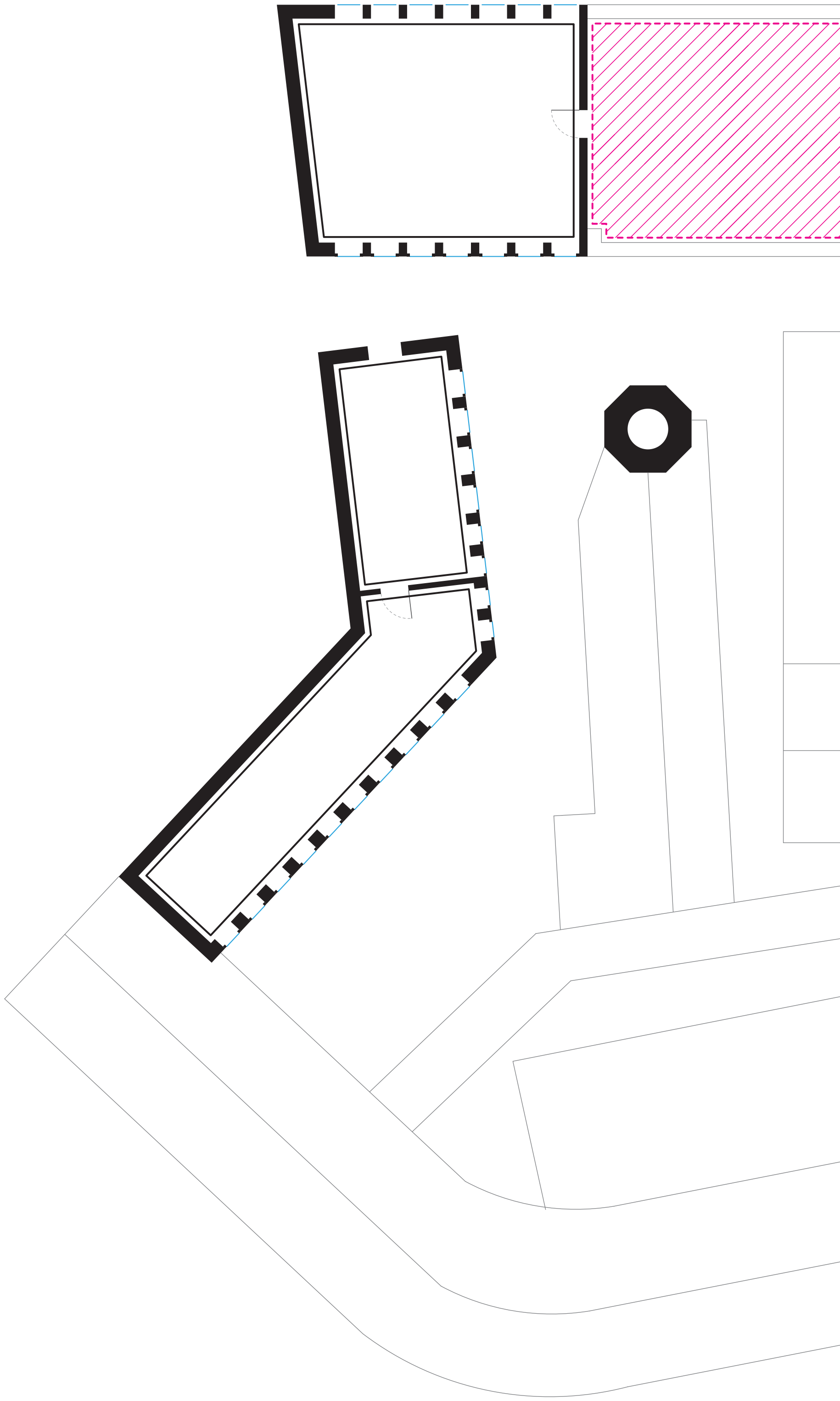


5b

Portland Works | **space use** | common areas and services

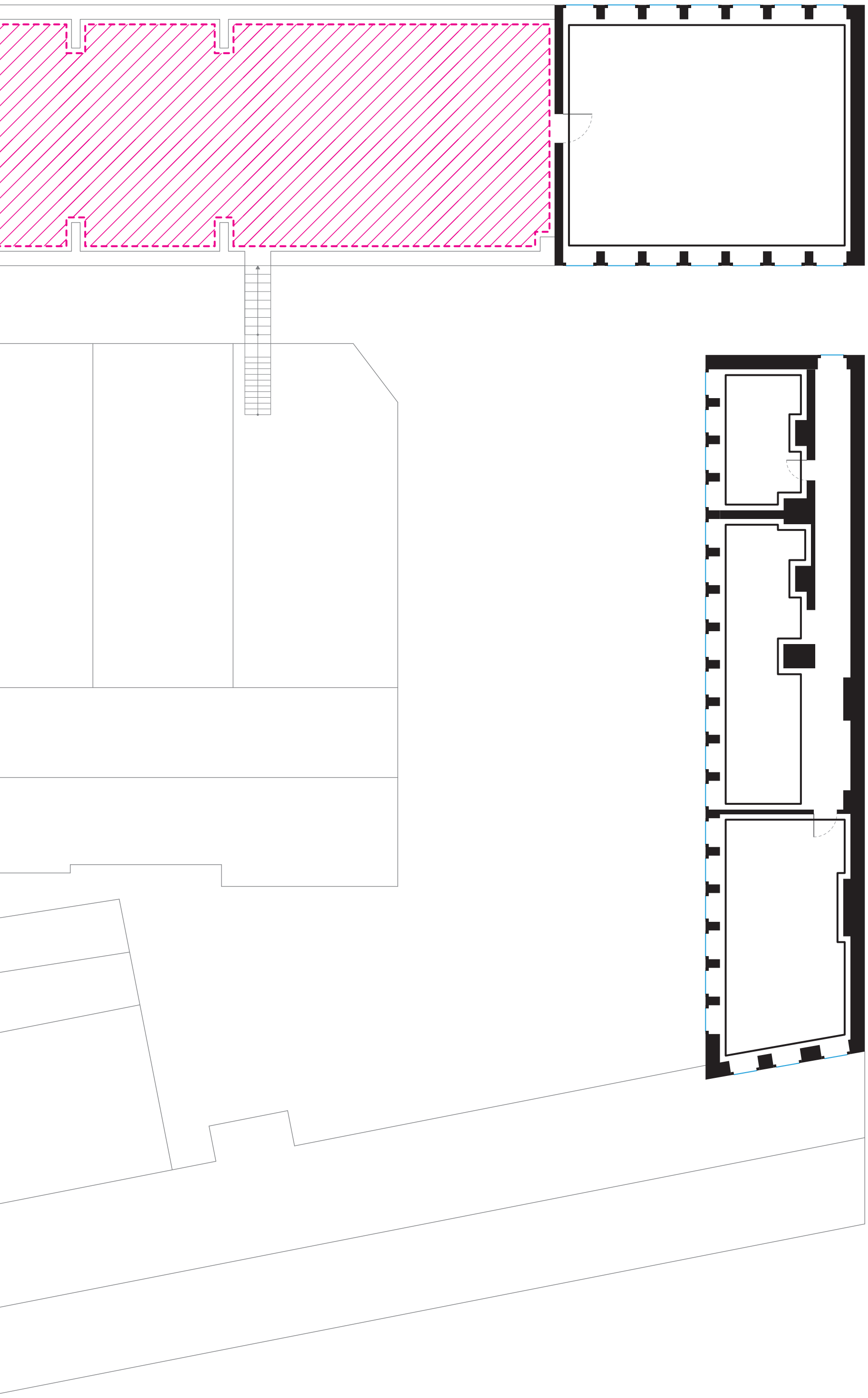


	closed space	**E**	public entrance
	open space	**O**	office
	workspace	**B**	restroom
		K	shared kitchen
		W	shared showcase
		R	meeting room



5c

Portland Works | **space use** | common areas and services



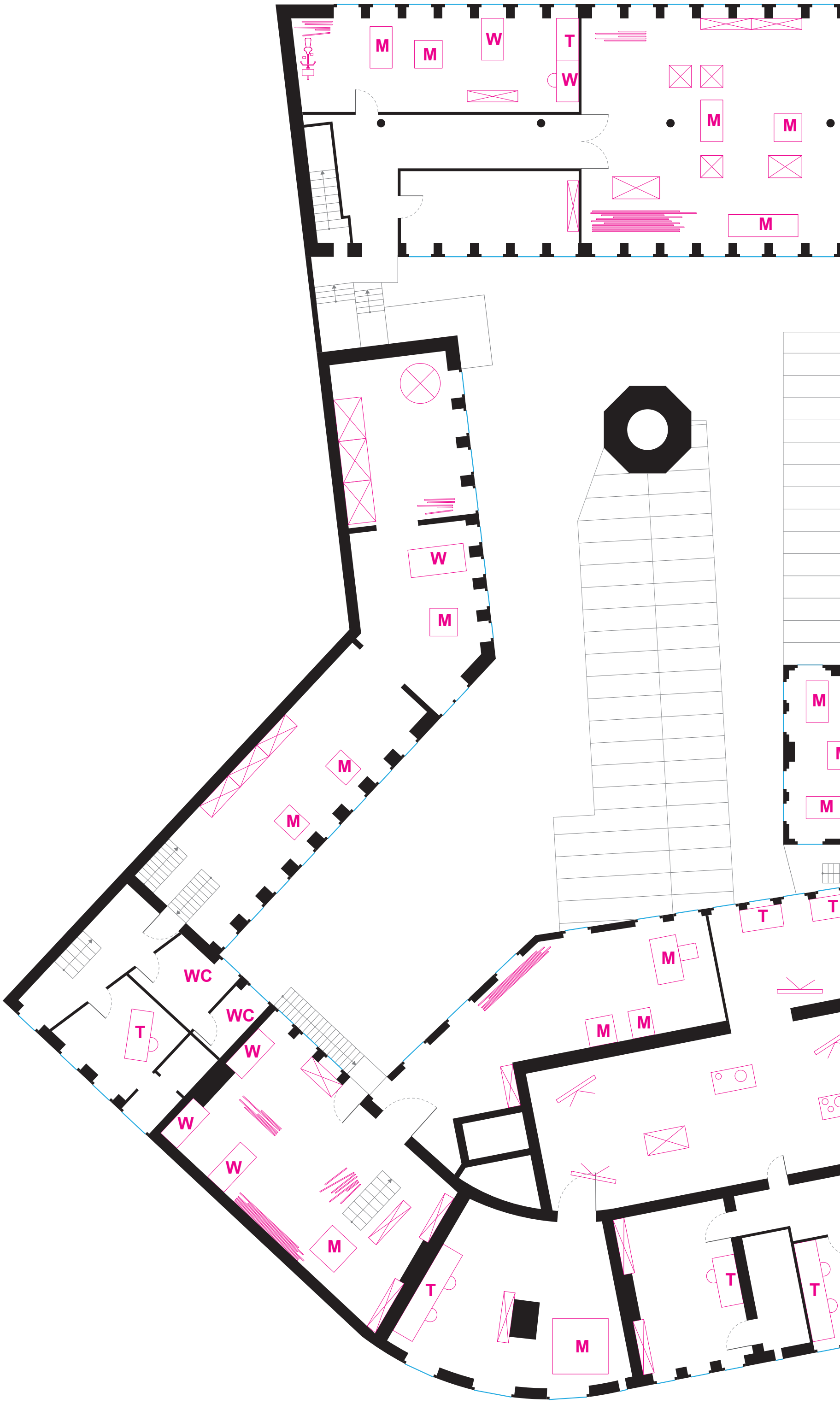
	closed space
	open space
	workspace

E	public entrance
O	office
B	restroom
K	shared kitchen
W	shared showcase
R	meeting room

6a

Portland Works| **space use** | Ground floor

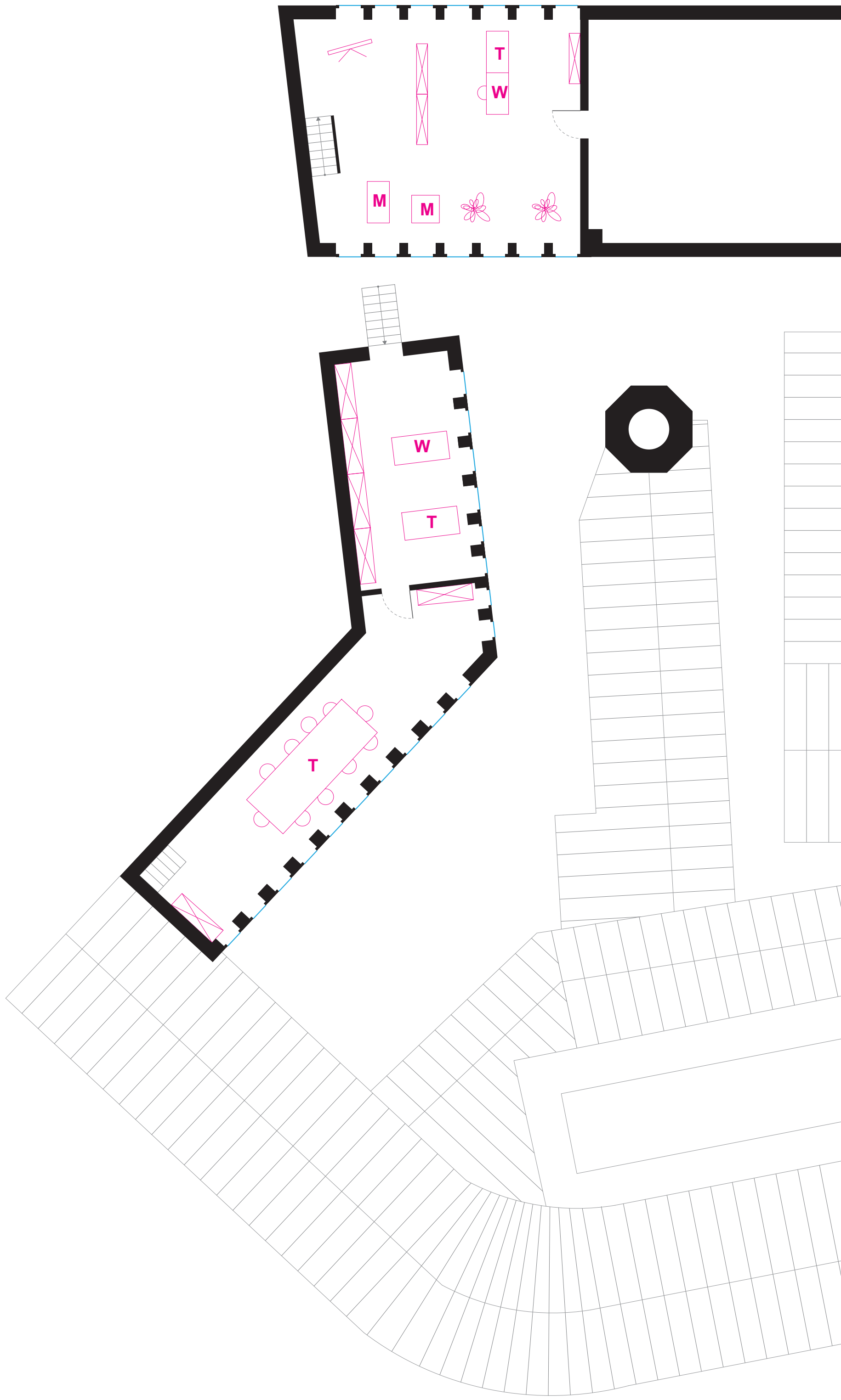

T office desk
S storage
K kitchen
M machine
W work table



6b

Portland Works| **space use** | First floor

	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table



6c

Portland Works| **space use** | Second floor

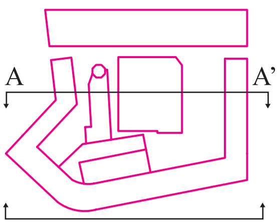
	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table

7a

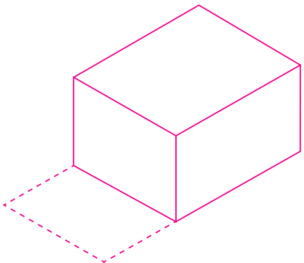
Portland Works| **material characters** |Structural section | Re-use strategy | Elevation

A-A'

B-B'



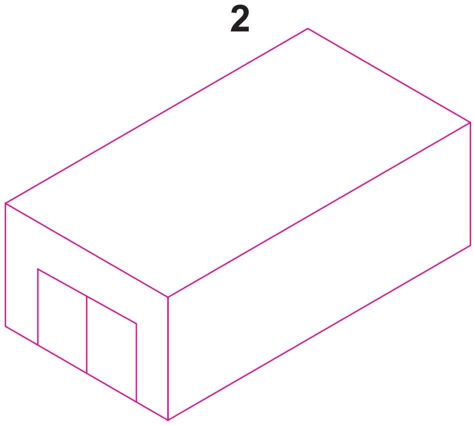
1



WORKSHOP

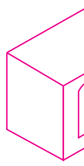
This spatial typology is structured through the coexistence of a work space on the ground floor, where objects and prototypes are made, and an office space on the first floor where design activities and meeting take place.

2



BIG WORKSHOP

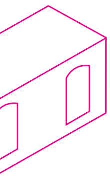
Big workshops derive from the growth of the companies that expand taking up more space, or they are companies that come from outside. Large companies often collaborate with smaller ones, building an internal working ecosystem.



AT

This type o
characteriz
on a single
with a heig
3 and 4.5 m
The atelier
that contai
lighter mac
workshop a
ted above a
categories
manufactur

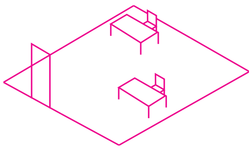
3



TELIER

of space is
zed to develop
floor normally
ght between
n in height.
is a space
ns smaller and
chines than the
and is indica-
all for artistic
or cleaned light
ring process.

4



OFFICE

These spaces are organized according to the main rules for the organization of office spaces; they mainly contain clean work areas and simple furnishings. They are often placed alongside production areas separated by an opaque or transparent wall. Sometimes the two space are localized in different areas of the building.

Exterior view of the entrance to Portland Works. Source: photo of the author, 2019

View of the building and the entrance to the ateliers on the third floor from the terrace. Source: photo of the author, 2019

View of the building and the stair system for access to individual workshops. Source: photo of the author, 2019

External work area. Source: photo of the author, 2019

Interior of the silver plating workshop. Source: photo of the author, 2019

the blacksmith's workshop and the furnace. Source: photo of the author, 2019

Interior of a knife maker workshop. Source: photo of the author, 2019

nterior of the distillery. Source: photo of the author, 2019

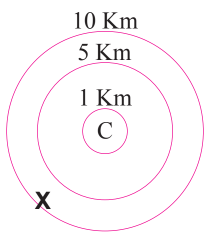
Renovations by volunteers from the Portland Works Preservation Committee. Source: photo of the author, 2019

Renovations by volunteers from the Portland Works Preservation Committee. Source: photo of the author, 2019

LES ATELIER DE RENENS | Renens

OPENING TIME

8/20 h Tenants

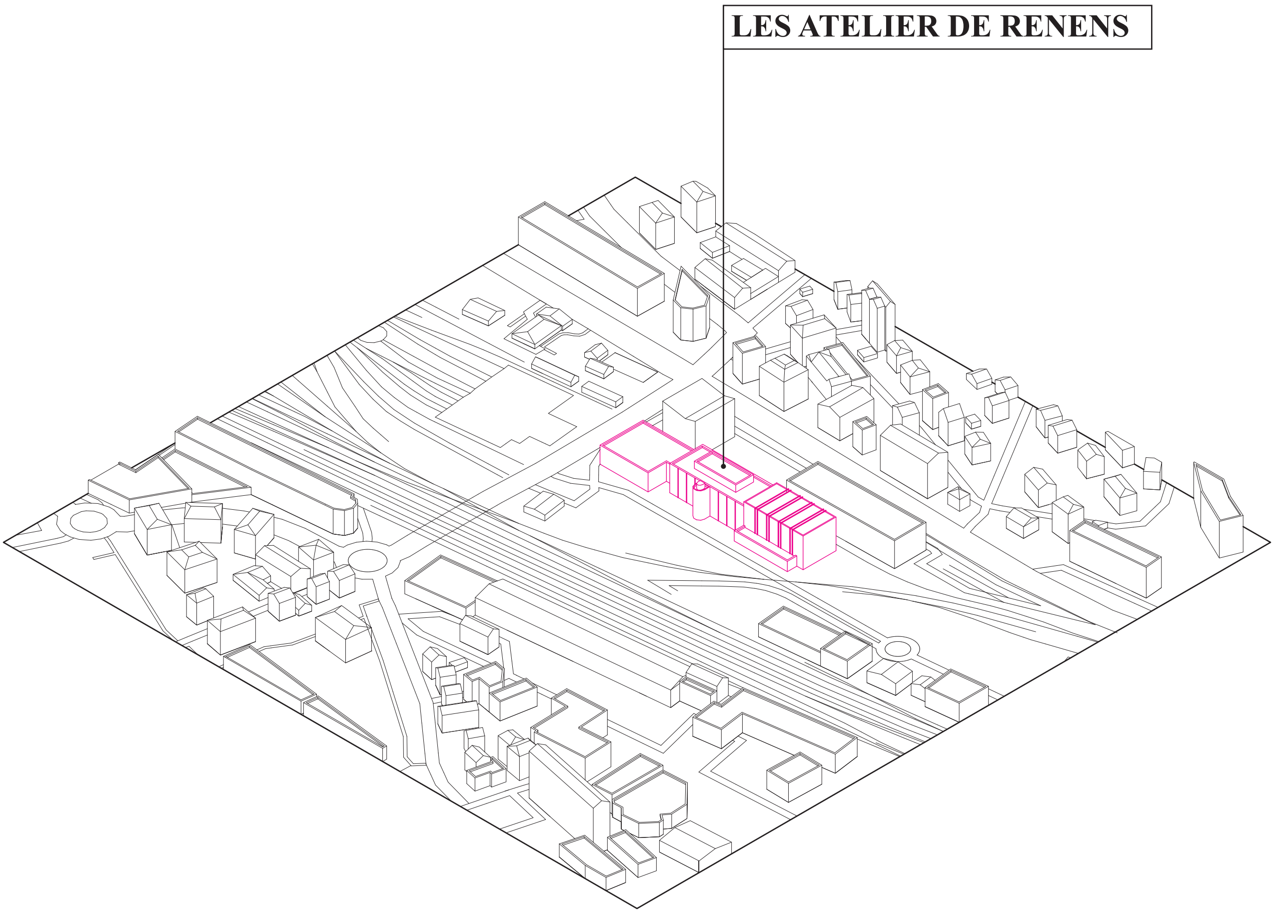


PUBLIC TRASPORT INFO

From station: 24min/bus
(Lausanne) 22 min/bike
9 min/car

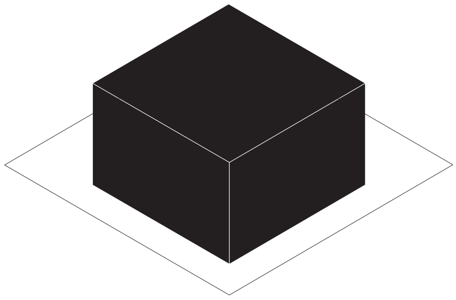
1a

Les Atelier de Renens | **urban characters** | district



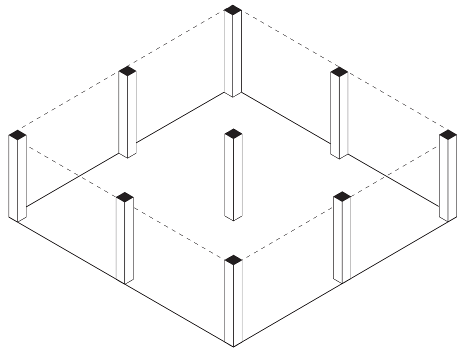
1b

Les Atelier de Renens | **urban characters** | area



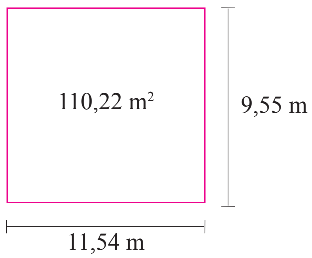
building dimensions

12.459 m²
48462 m³

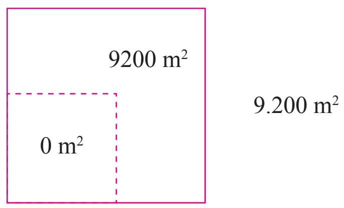


structural form

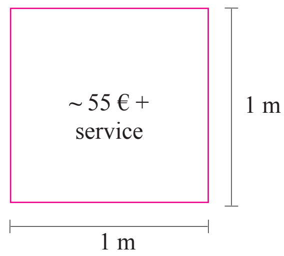
frame construction



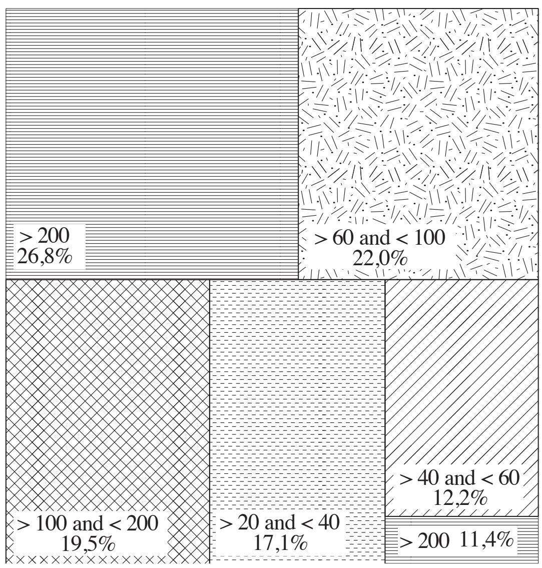
single plot average size



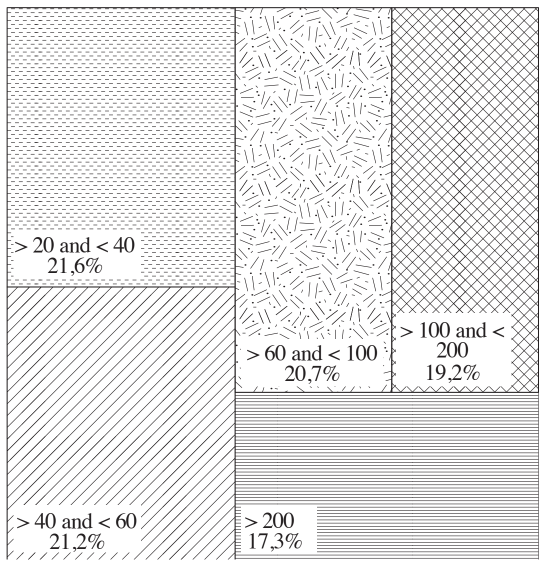
open/close area



cost × m² × y



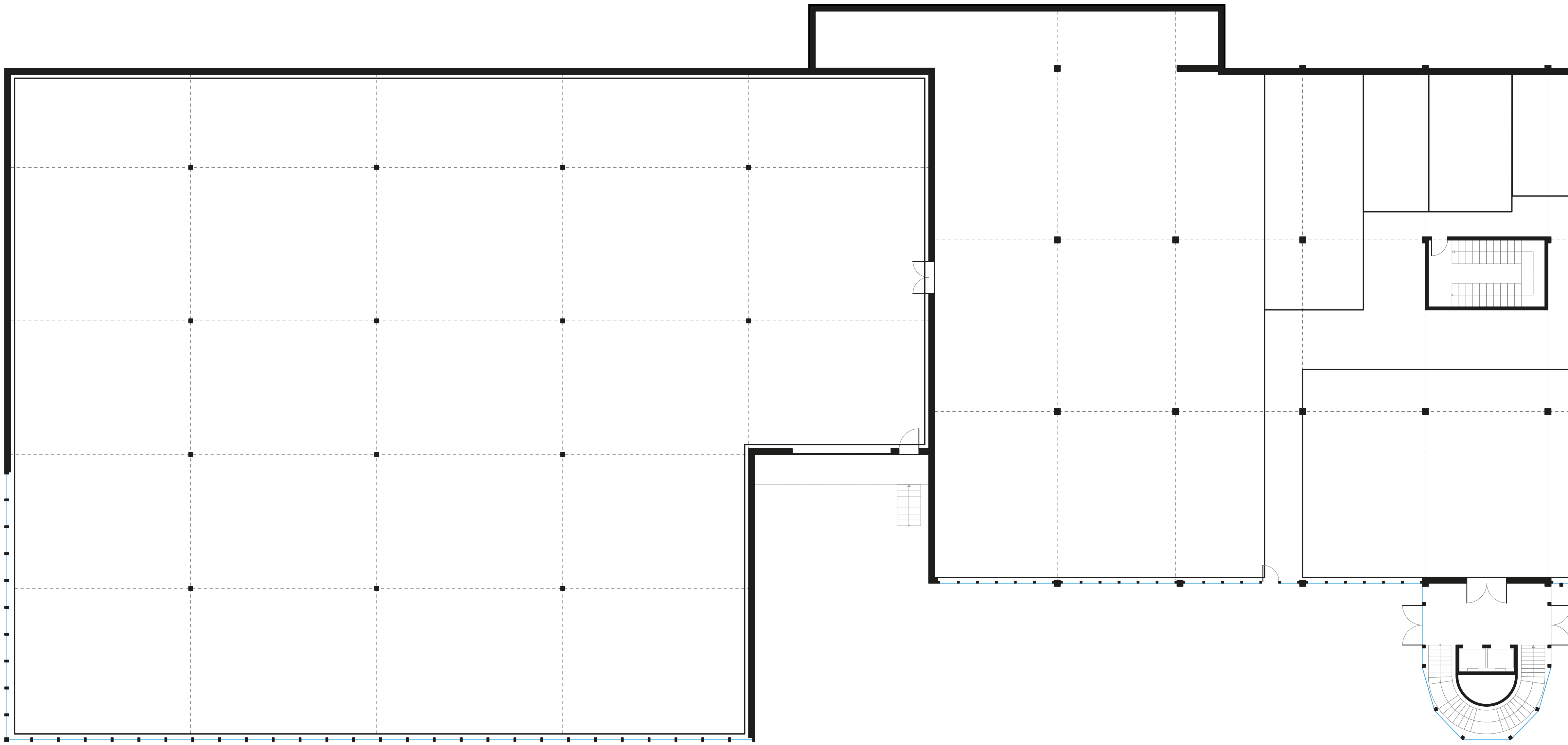
N° of space distribution



Surface category disribution

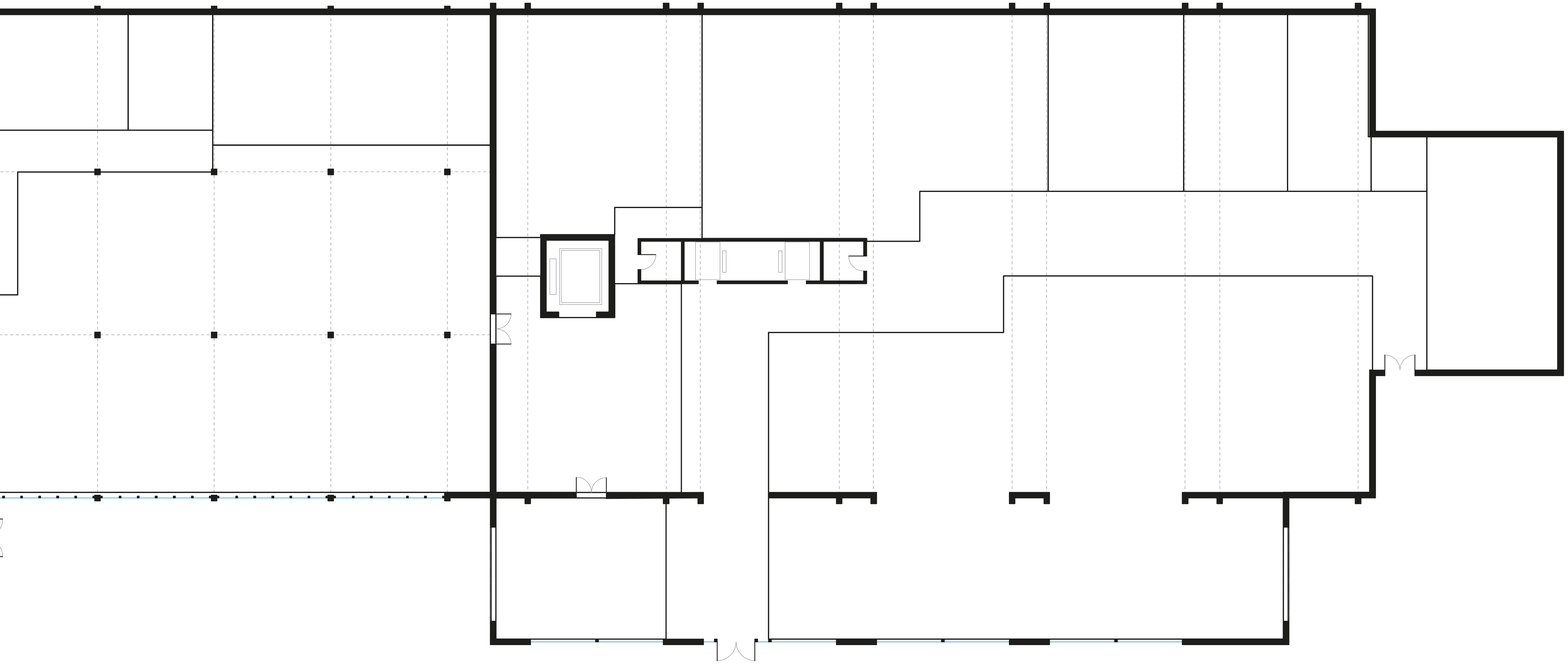
1c

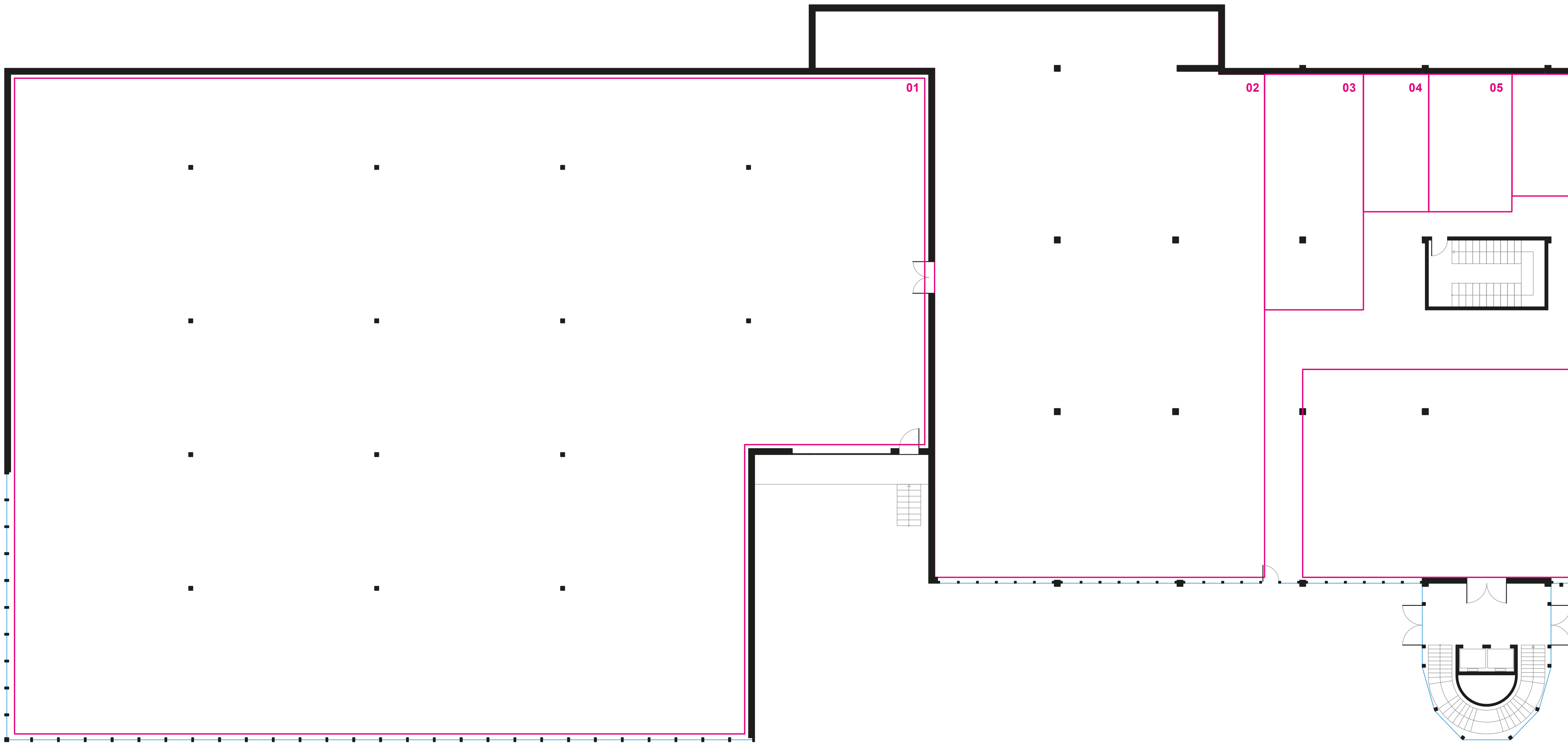
Les Atelier de Renens | **dimension analysis** | data on the building



2a

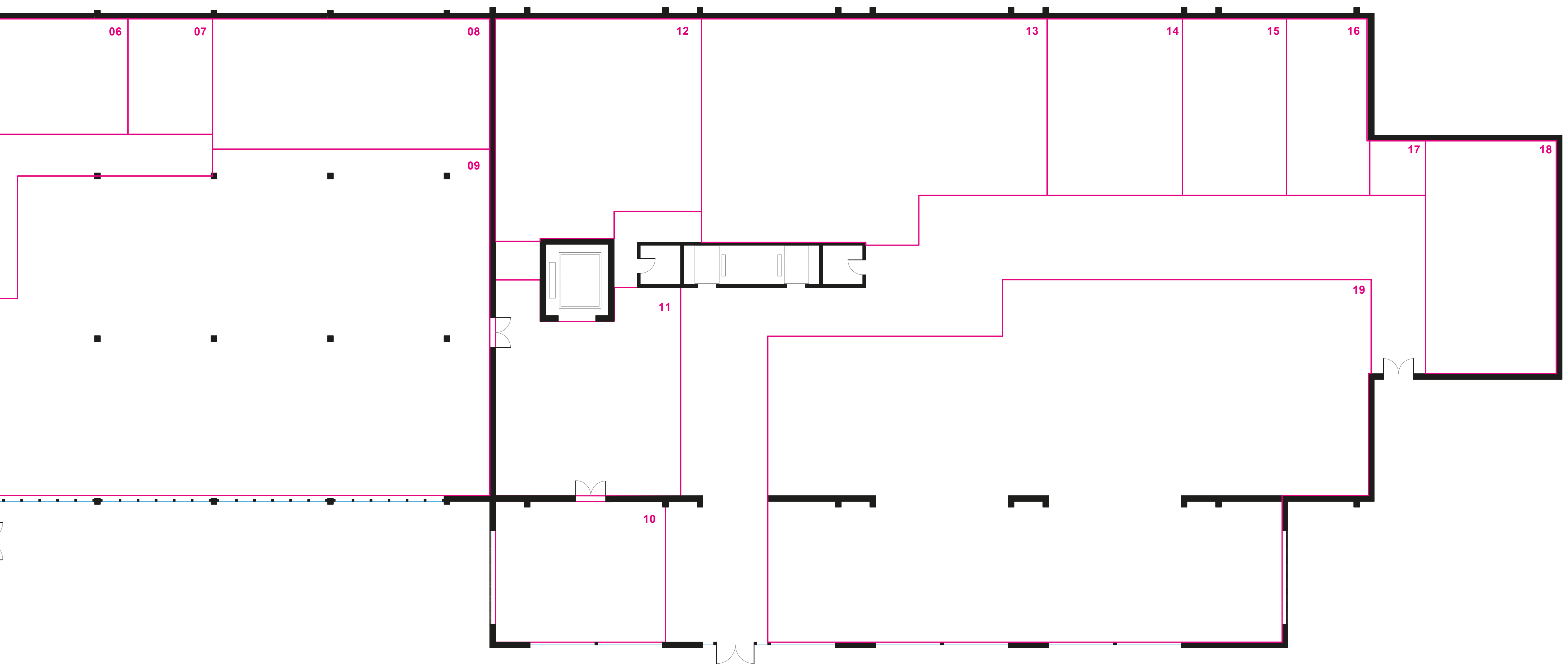
Les Atelier de Renens | **architectural characters** | structure plan

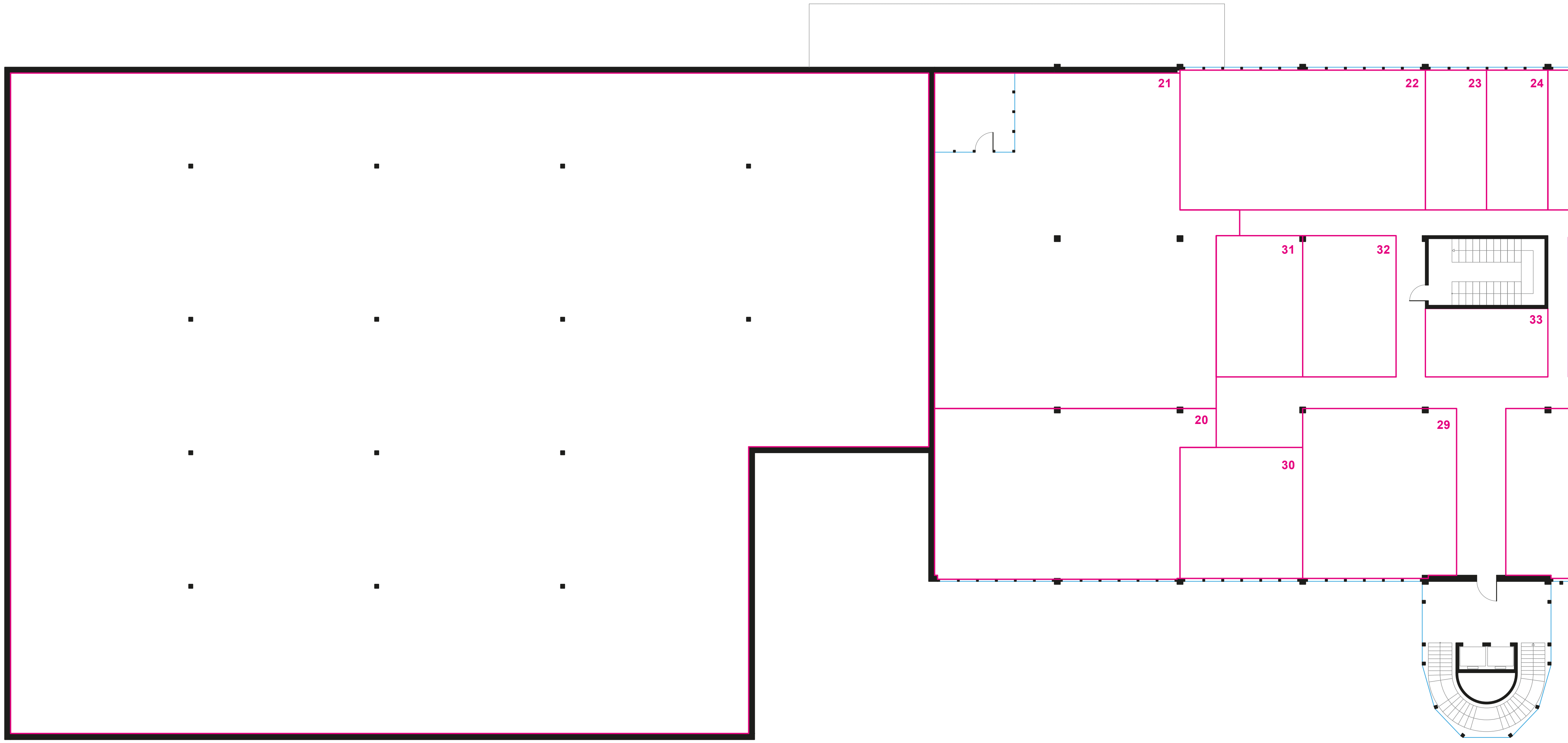




3a

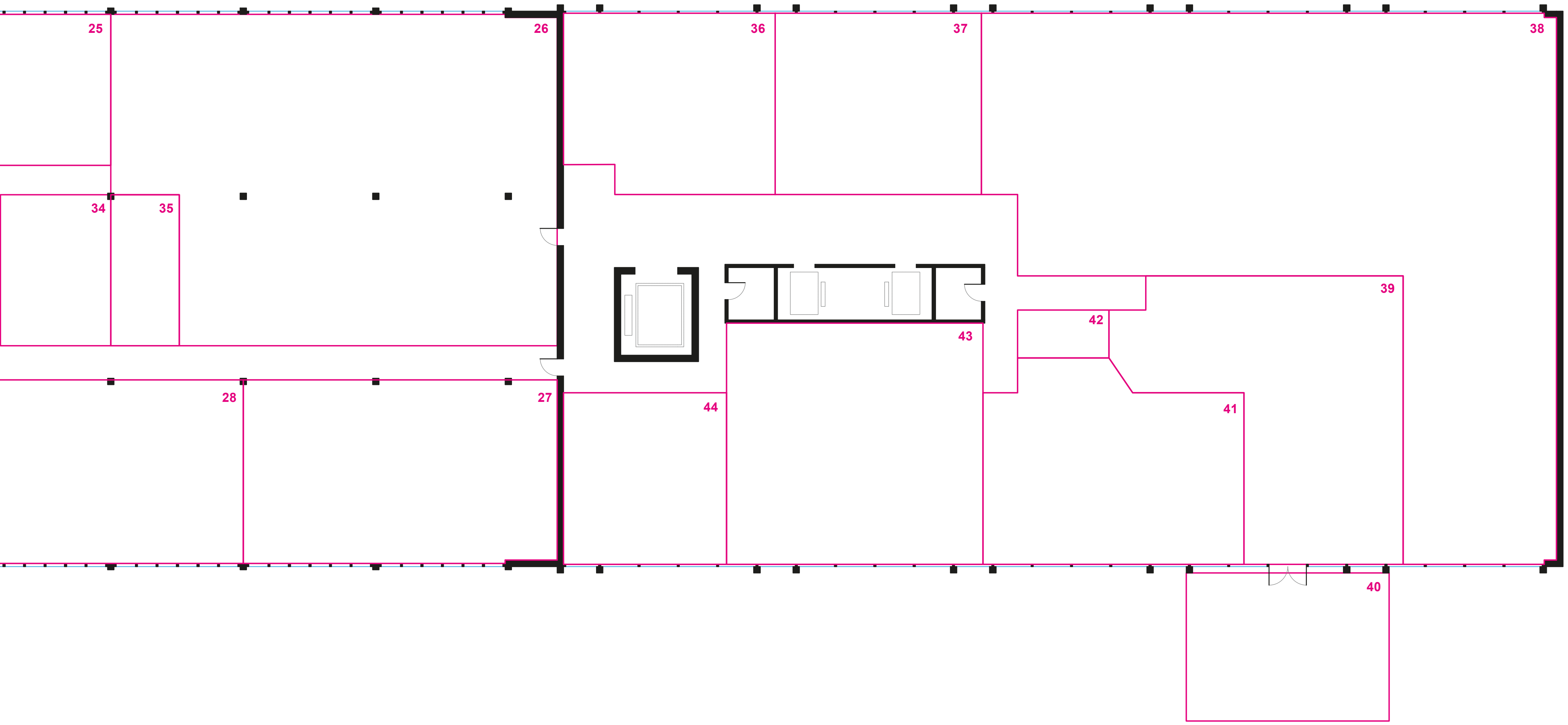
Les Atelier de Renens | **space use** | plot subdivision

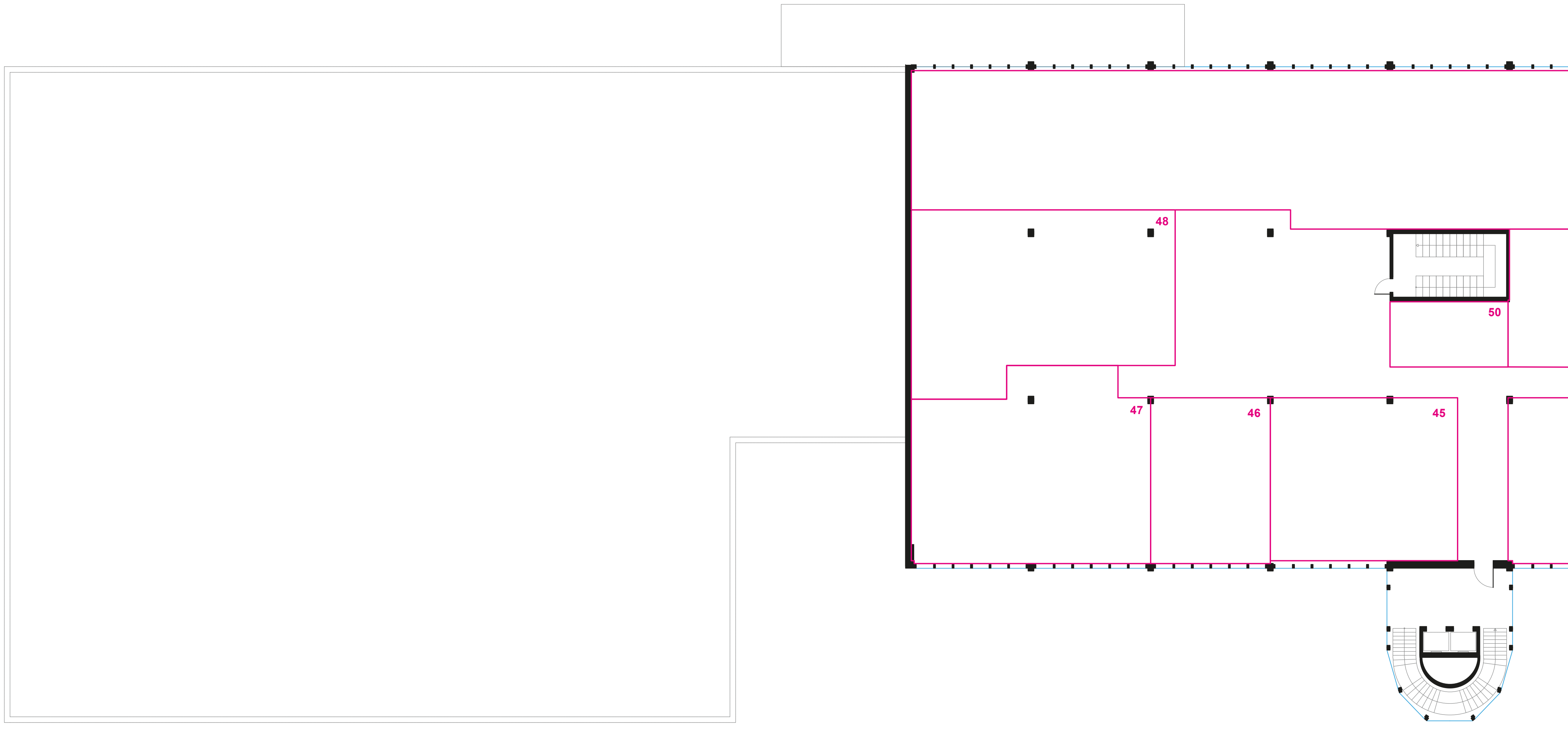

06
07
08
09
12
13
14
15
16
17
18
19
11
10



3b

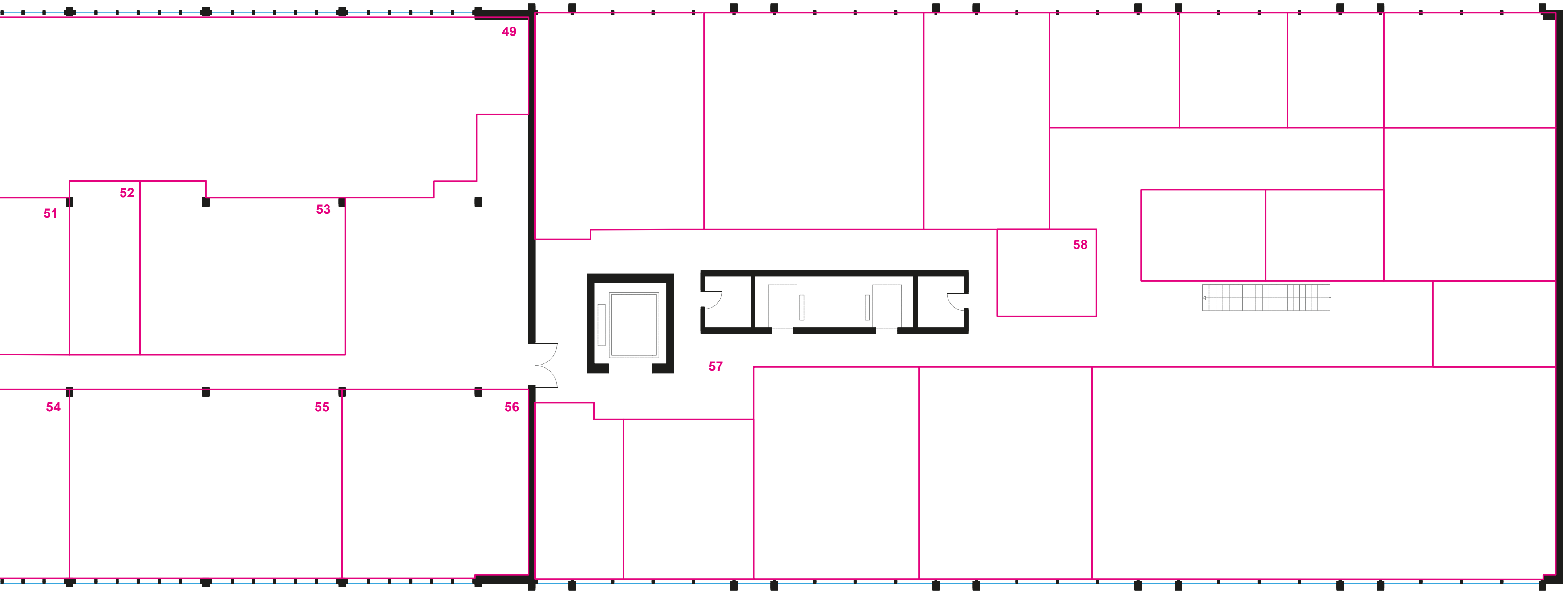
Les Atelier de Renens | **space use** | plot subdivision

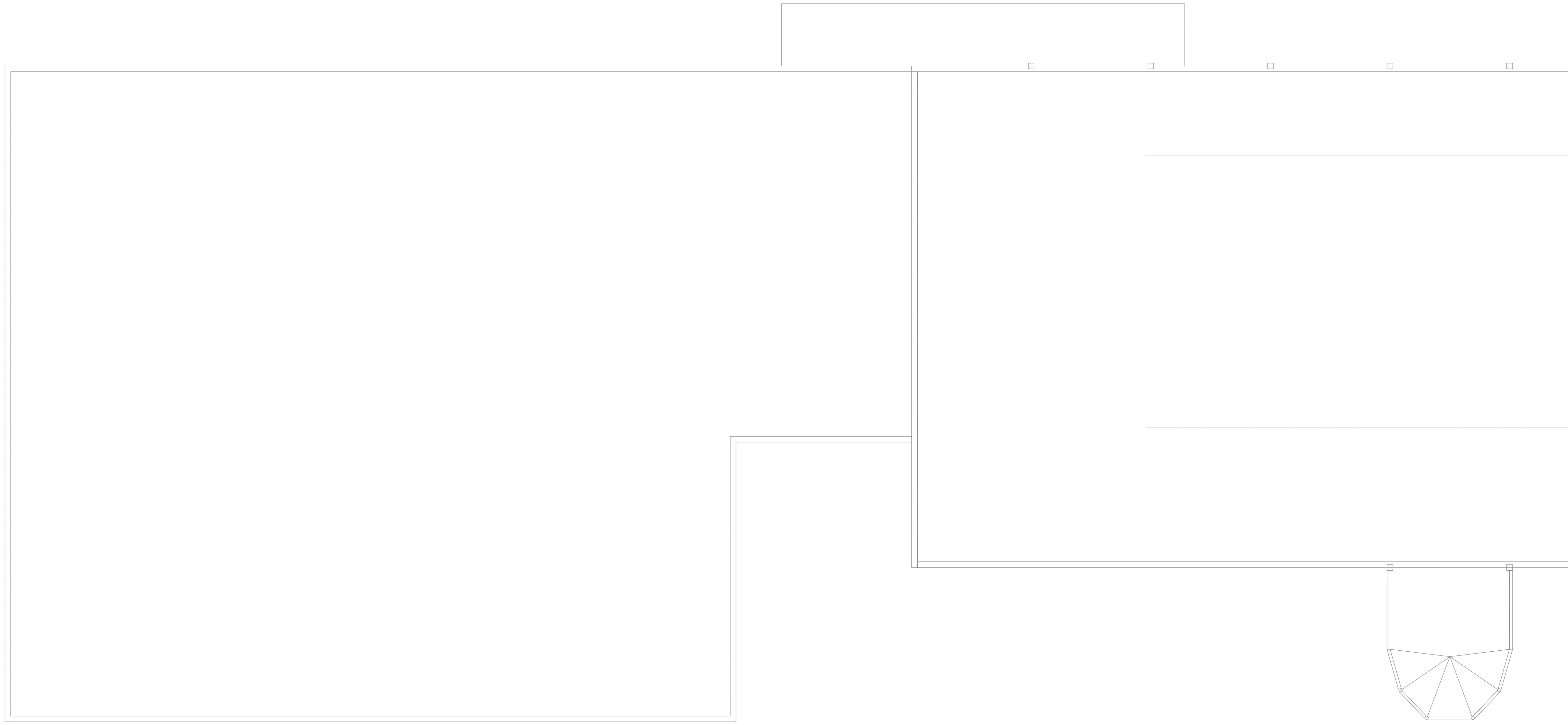

25
26
36
37
38
34
35
39
42
43
28
27
44
41
40



3c

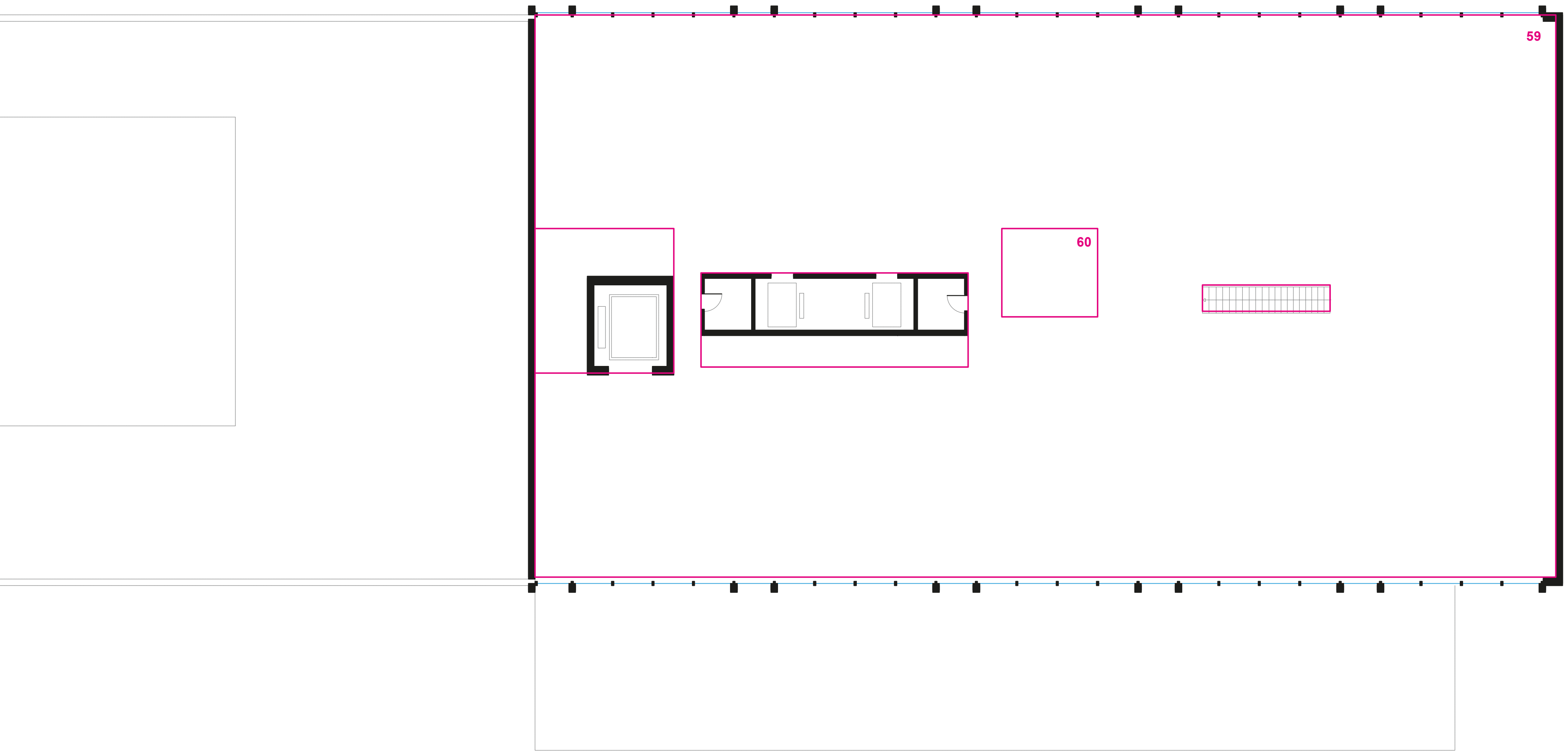
Les Atelier de Renens | **space use** | plot subdivision


49
52
51
53
58
57
54
55
56



3d

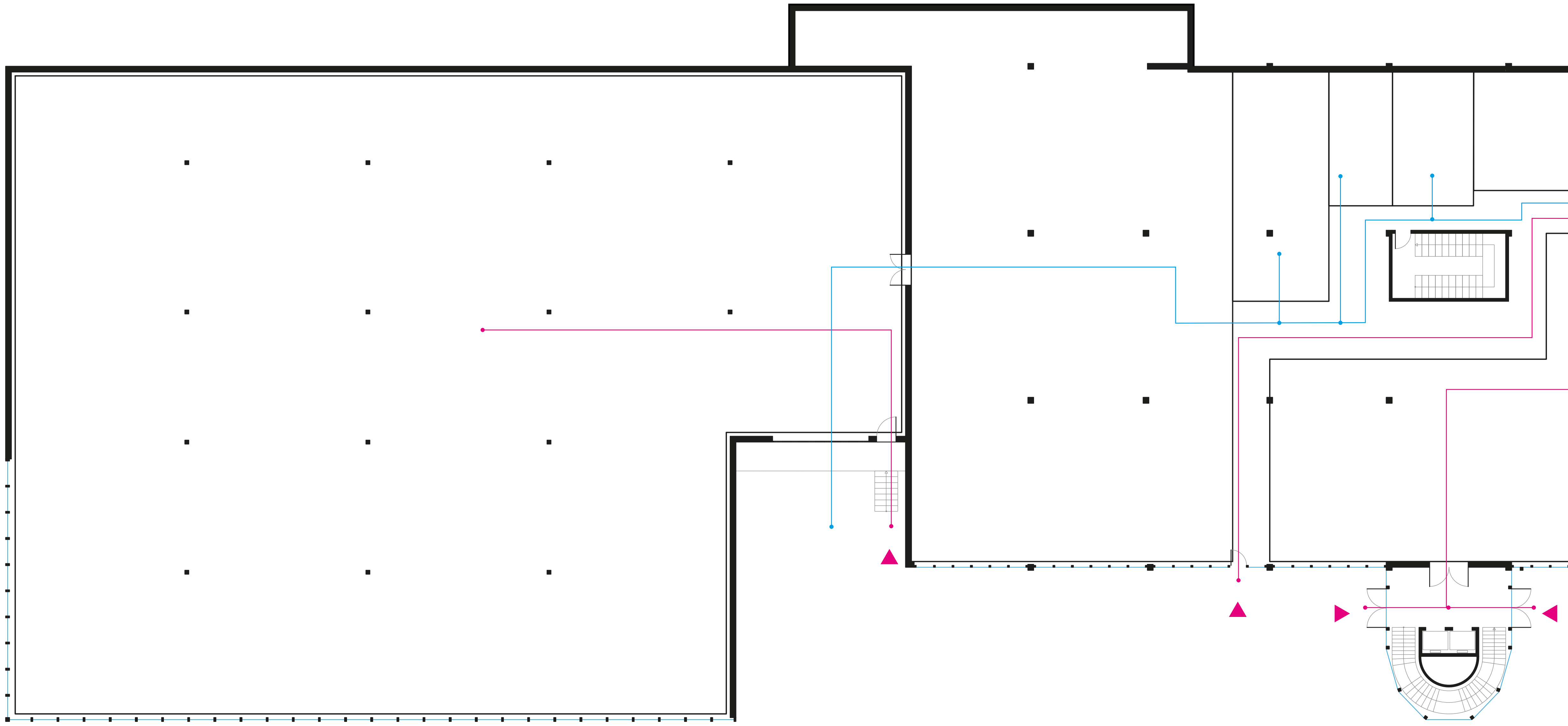
Les Atelier de Renens | **space use** | plot subdivision


59
60

- 01 La Nébuleuse - Production
- 02 Maker Space
- 03 Fragmenting
- 04 North Thin Ply Technologies
- 05 North Thin Ply Technologies
- 06 North Thin Ply Technologies
- 07 North Thin Ply Technologies
- 08 North Thin Ply Technologies
- 09 North Thin Ply Technologies
- 10 loading dock
- 11 loading dock
- 12 Storage
- 13 Uban Kombucha - Storage
- 14 Uban Kombucha - Storage
- 15 Uban Kombucha - Storage
- 16 Uban Kombucha - Storage
- 17 Uban Kombucha - Storage
- 18 Uban Kombucha - Storage
- 19 Uban Kombucha - Production
- 20 Bullard Technology Center (Darix Sarl)
- 21 Switzerland Global Enterprise
- 22 Rayform
- 23 Storage
- 24 Storage
- 25 Cafet' Mobilet - Storage
- 26 Cafet' Mobilet
- 27 Fixme Hackerspace - Fablab
- 28 Association Mobsya
- 29 Mobilet' - Atelier Multimedia
- 30 Alpha Colony

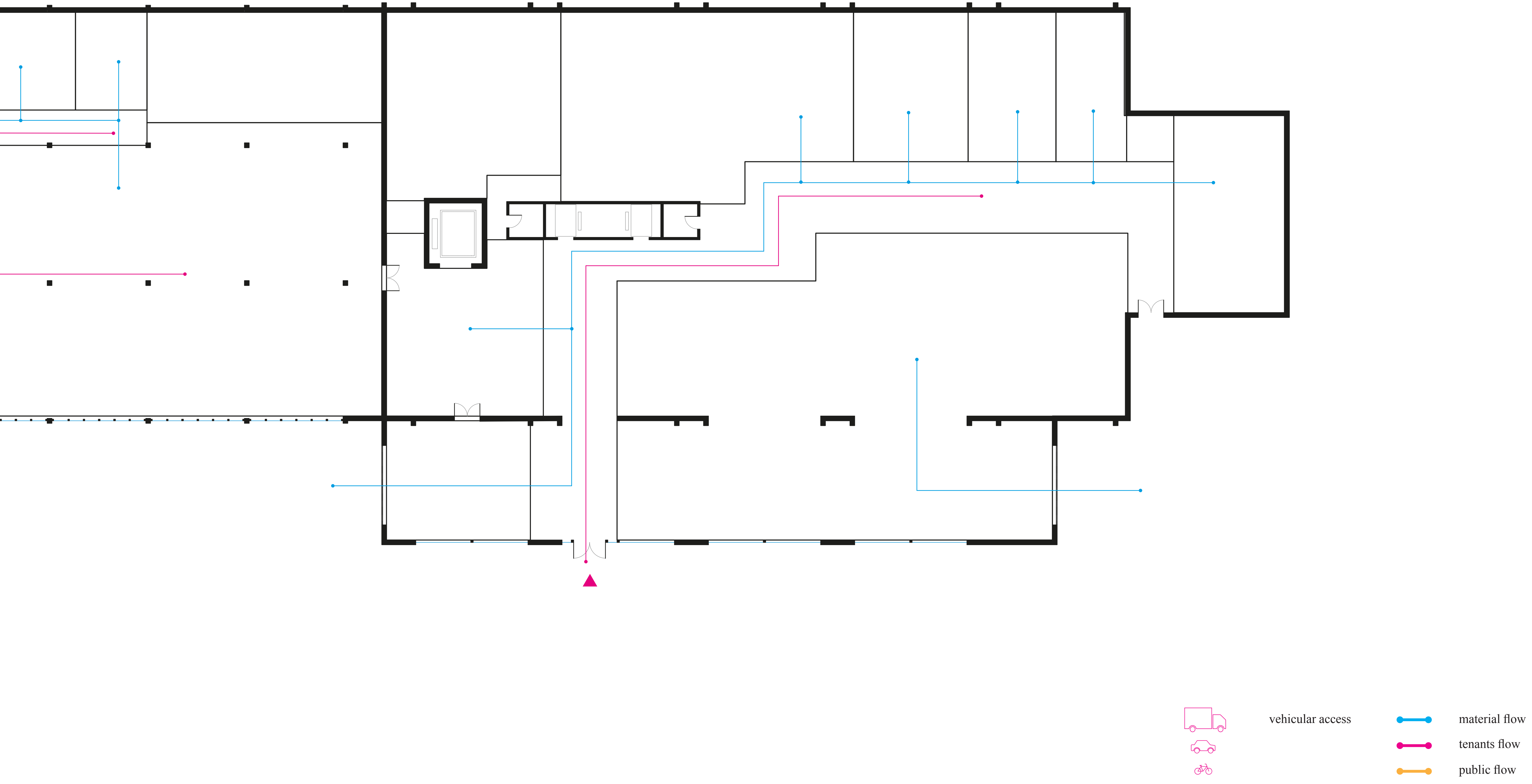
●	31	Storage
●	32	Server
●	33	Bathroom
●	34	Server
●	35	Storage
●	36	Stulz David
●	37	Ateliers A
●	38	La Nébuleuse - Production
●	39	La Nébuleuse - bar
●	40	La Nébuleuse - bar terrace
●	41	La Nébuleuse - Office
○	42	Bathroom
●	43	karmic Sarl
●		Micropat sa
●	44	Swiss Koo s.a.
●	45	Element-R
●	46	Petermann Bedat Sarl
●	47	Dominique Renaud sa
●	48	Mobilet' - Atelier Ica
●	49	Hes-so Master Innokick
○	50	Bathroom
○	51	Server
●	52	Storage
	53	
●	54	See Your Box
●	55	Swiss Code sa
●	56	Int Studio
●	57	Universitè
○	58	Bathroom
●	59	Masschallenge Switzerland
○	60	Bathroom

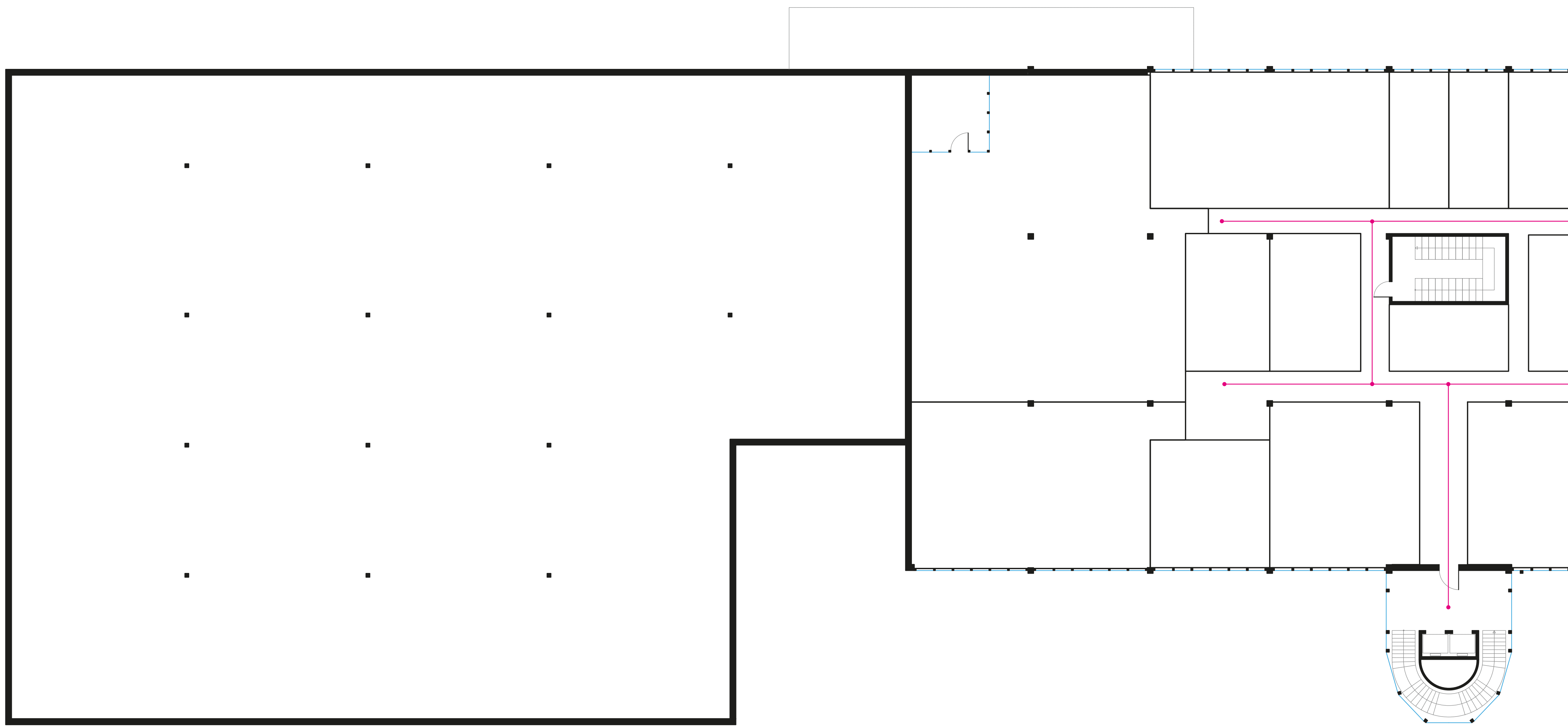
● Crafts
● Manufacturing
● Service
● Fine art
● Architecture
● Design



4a

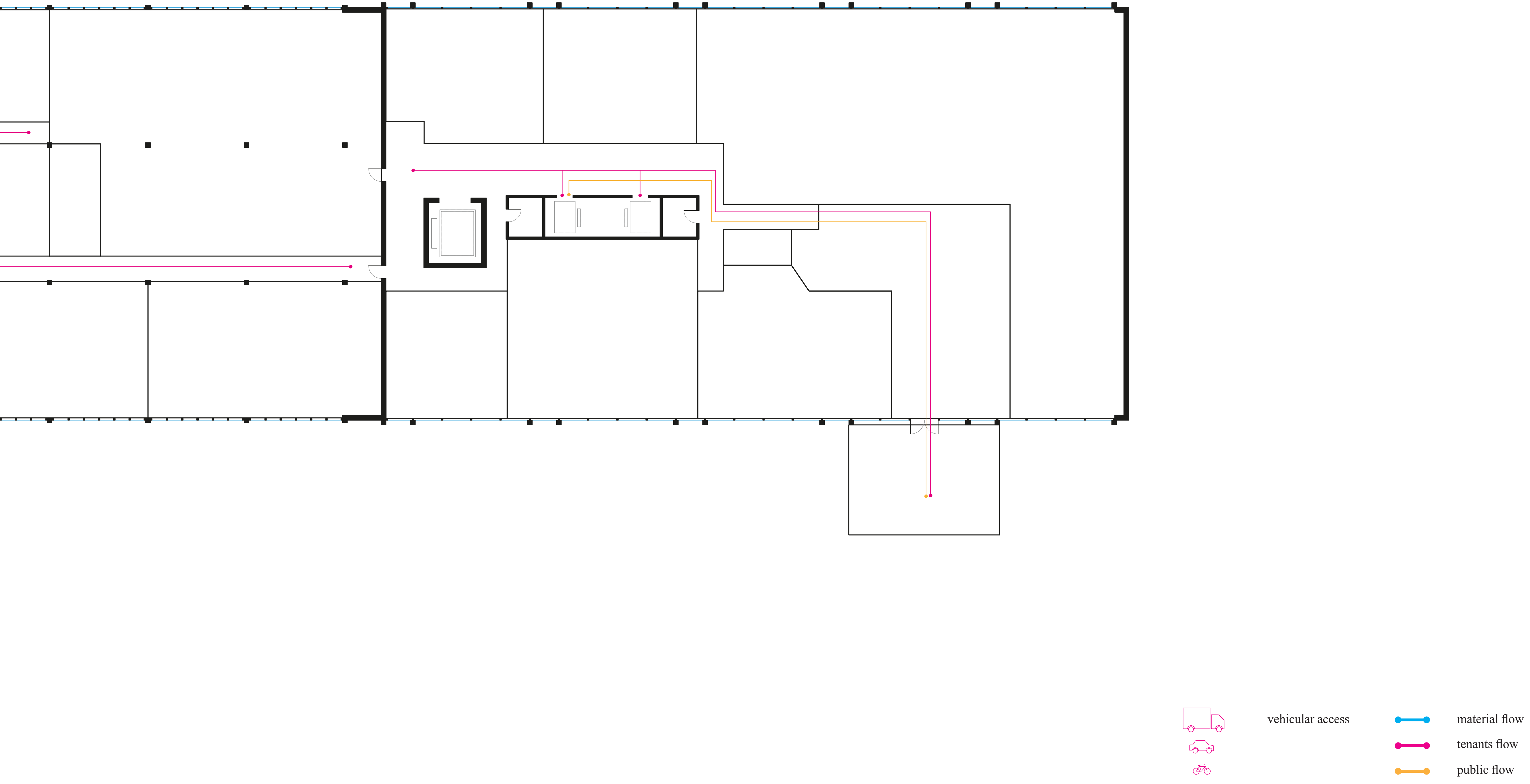
Portland Works | **space use** | flux analisys

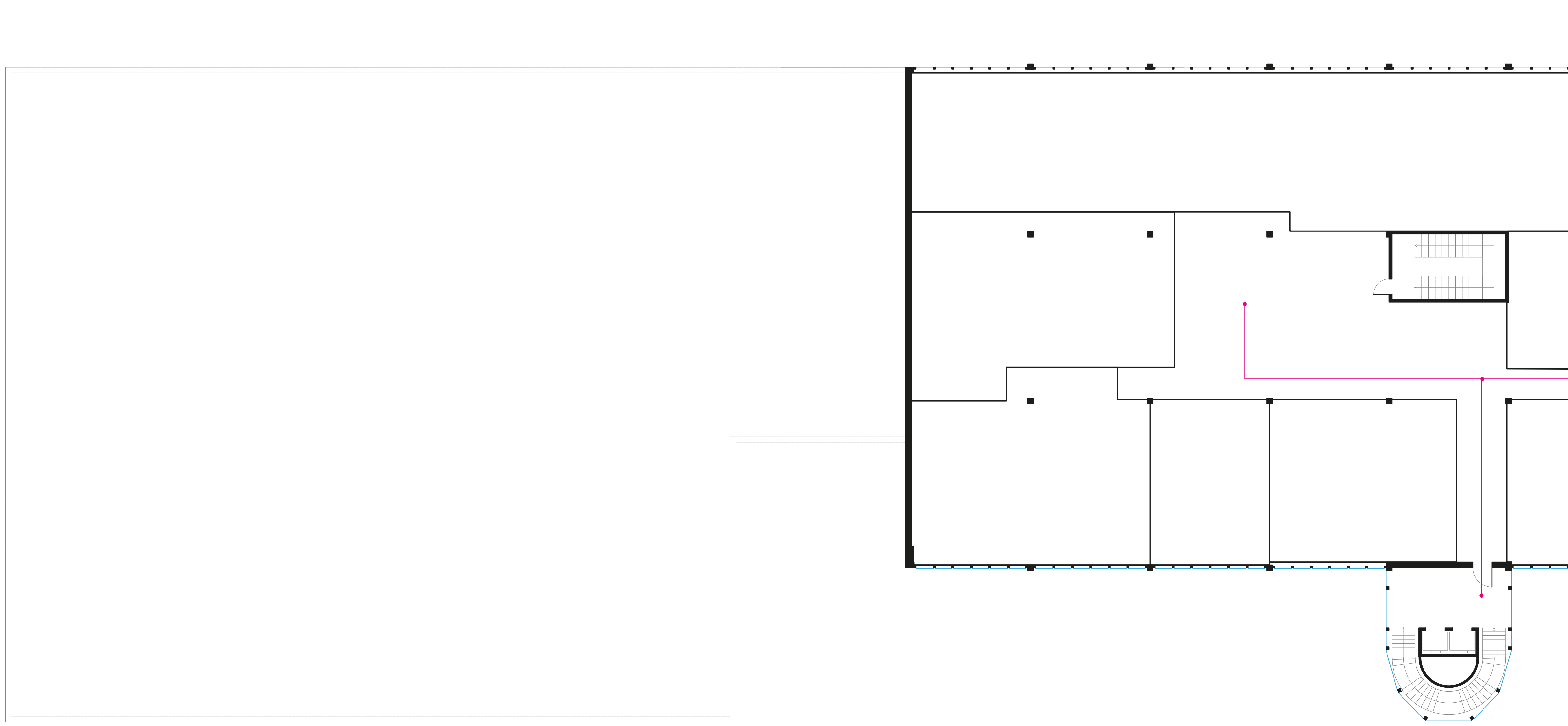

vehicular access
material flow
tenants flow
public flow



4b

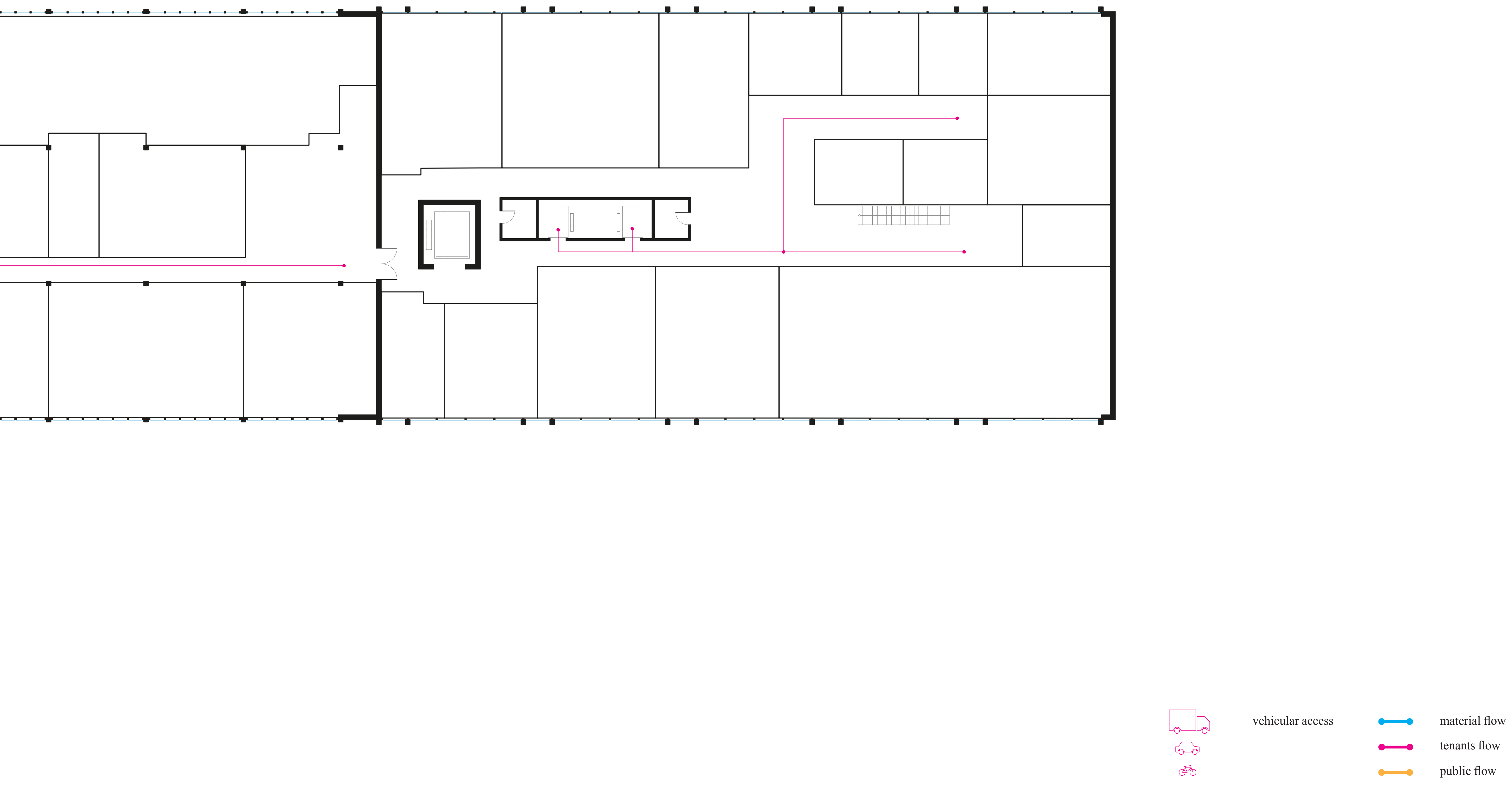
Portland Works | **space use** | flux analisys

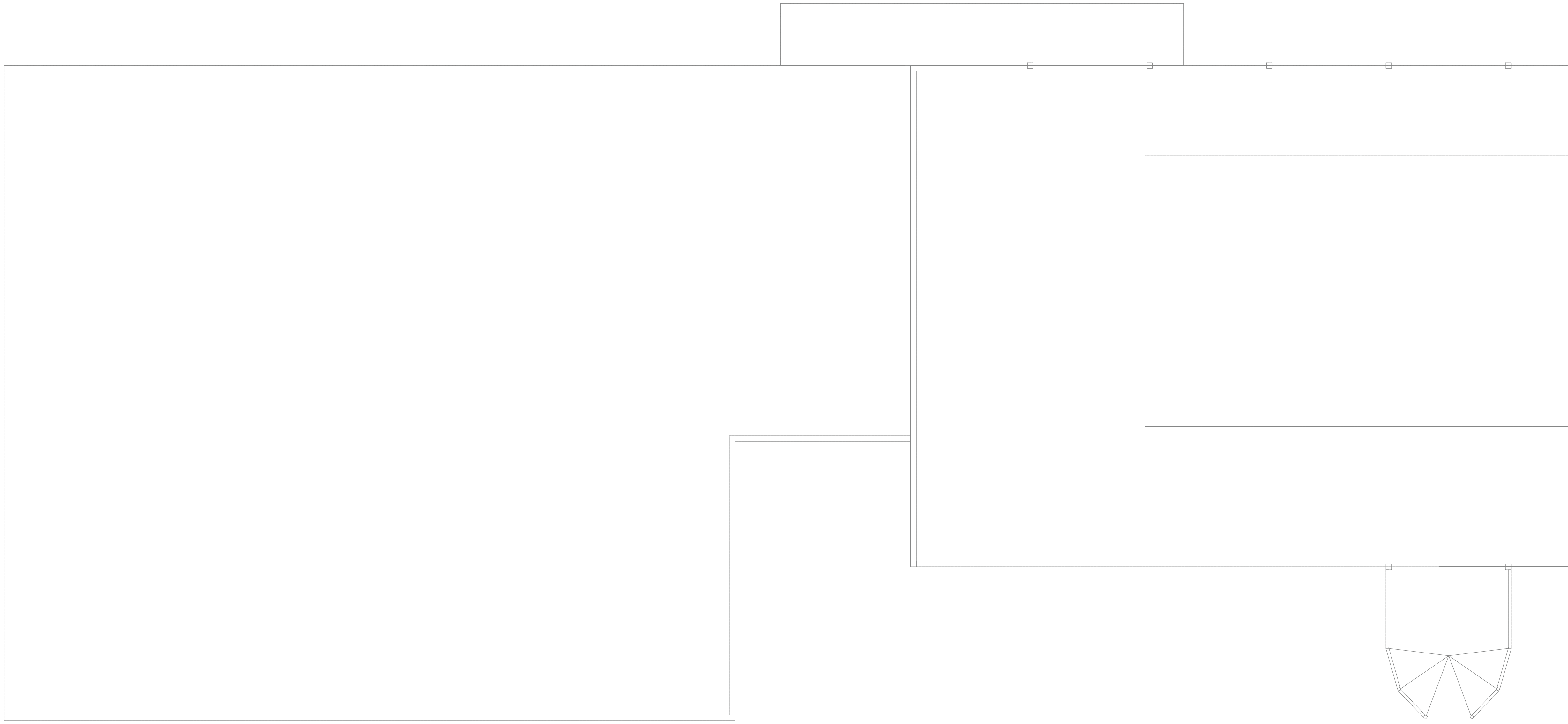

vehicular access
material flow
tenants flow
public flow



4c

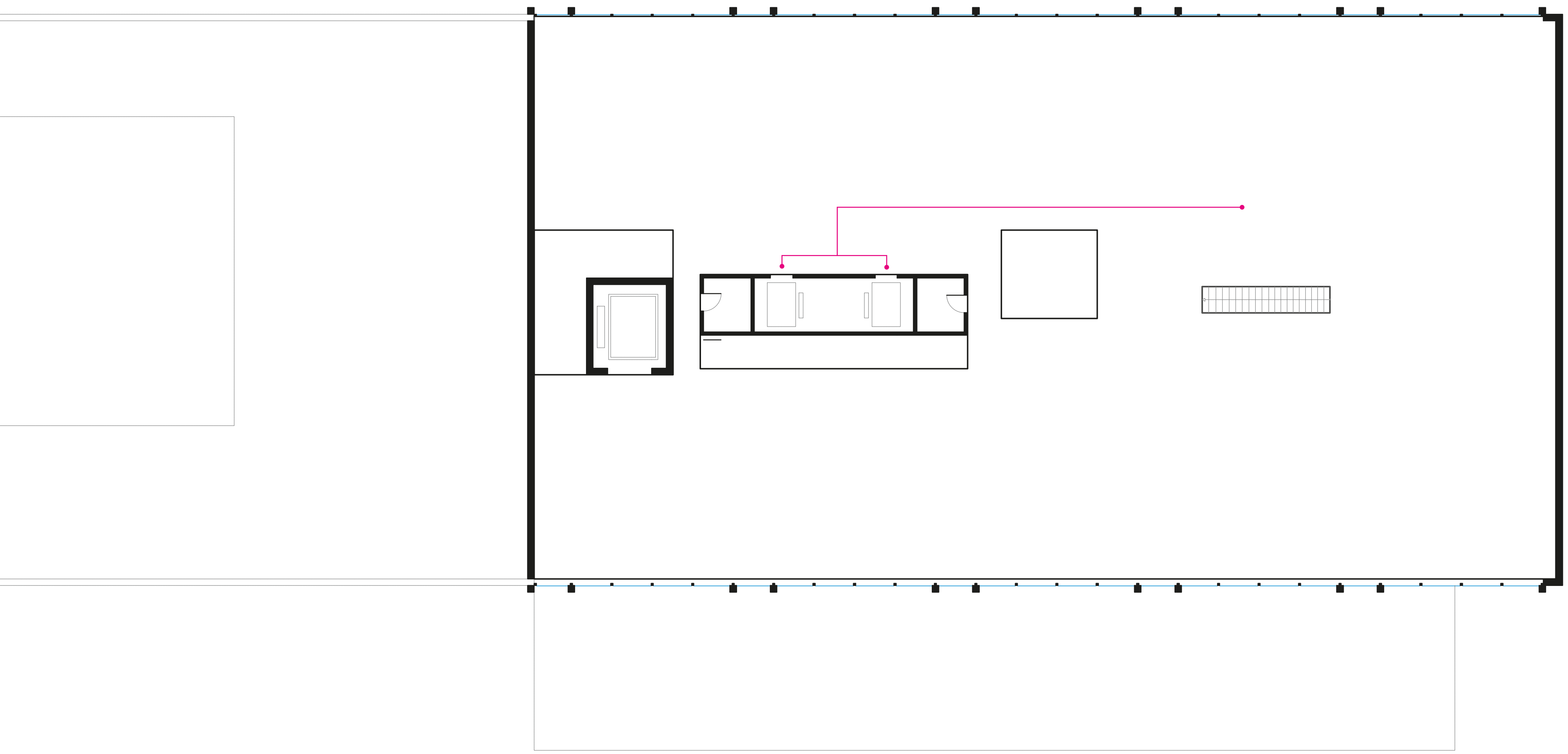
Portland Works | **space use** | flux analisys

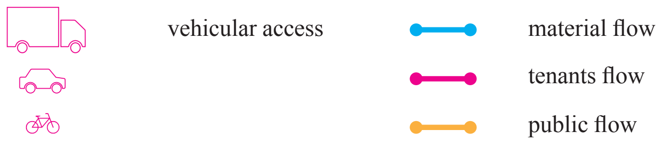

vehicular access
material flow
tenants flow
public flow

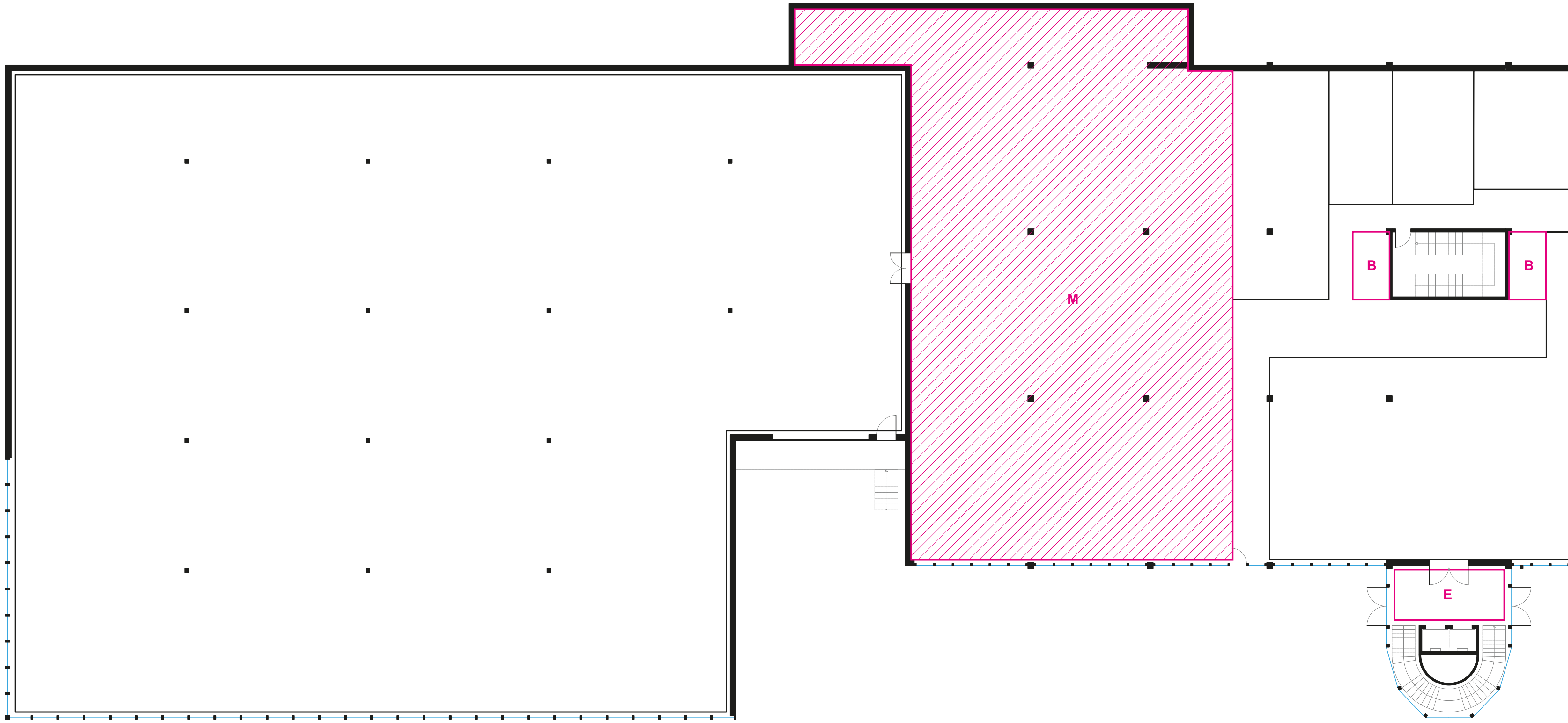


4c

Portland Works | **space use** | flux analisys

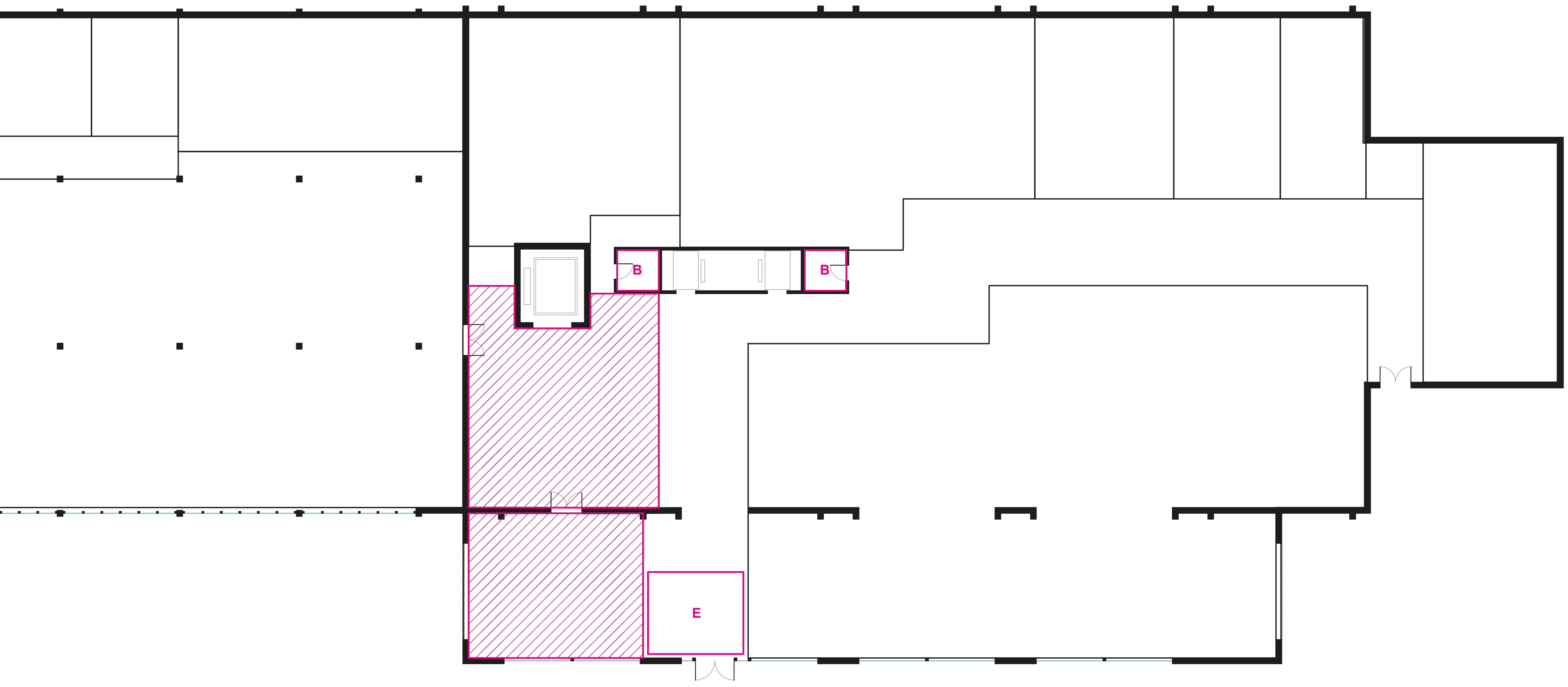



vehicular access
material flow
tenants flow
public flow

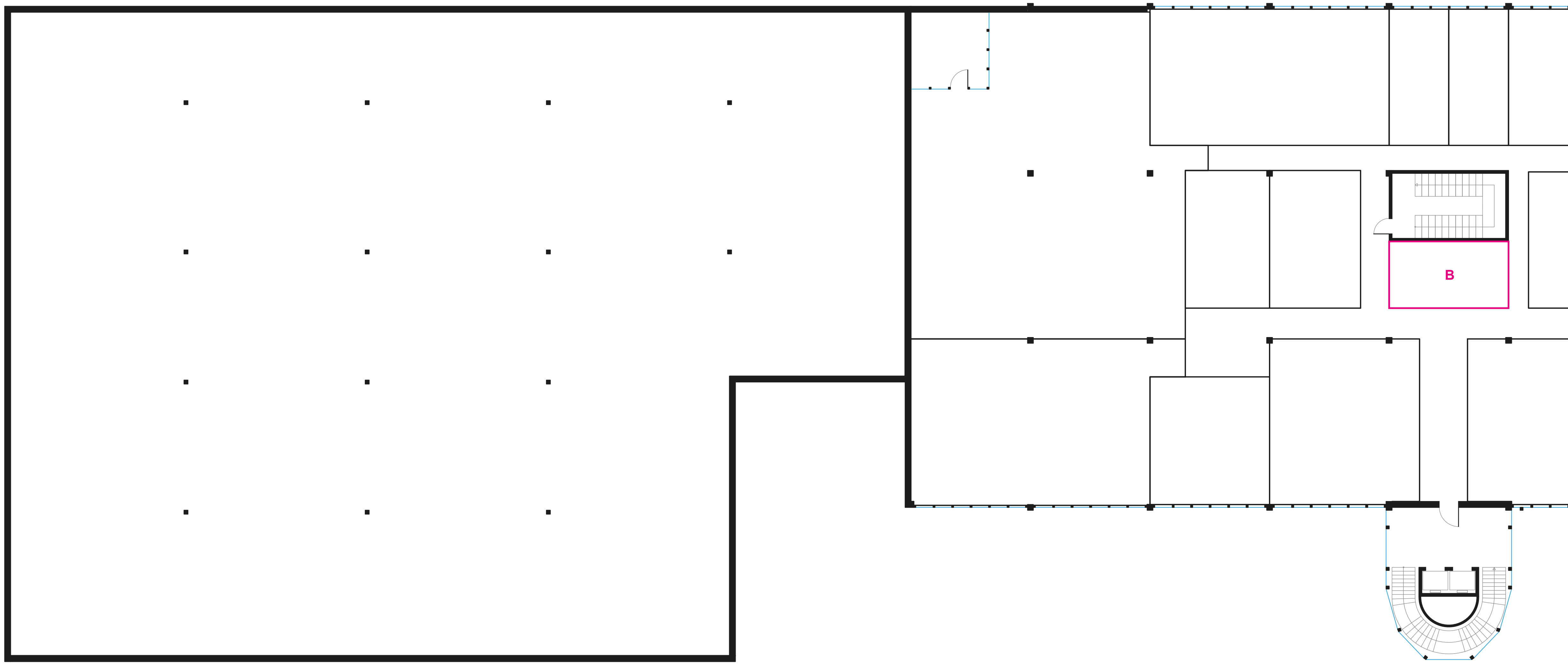


5a

Les Atelier de Renens | **space use** | common areas and services

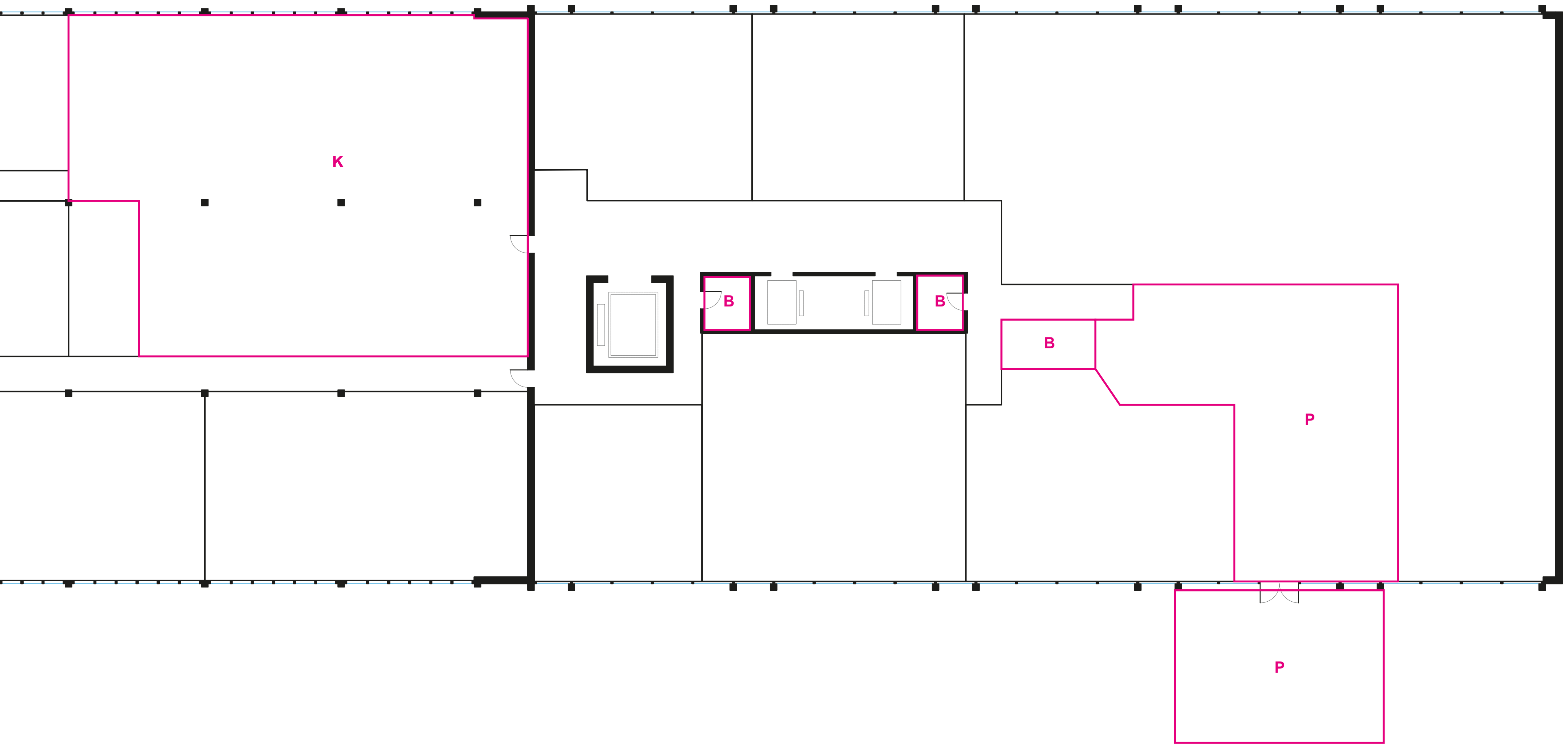


		E	public entrance
		P	bar / relax area
		B	restroom
	closed space	K	shared kitchen
	open space	M	shared machine
	workspace		



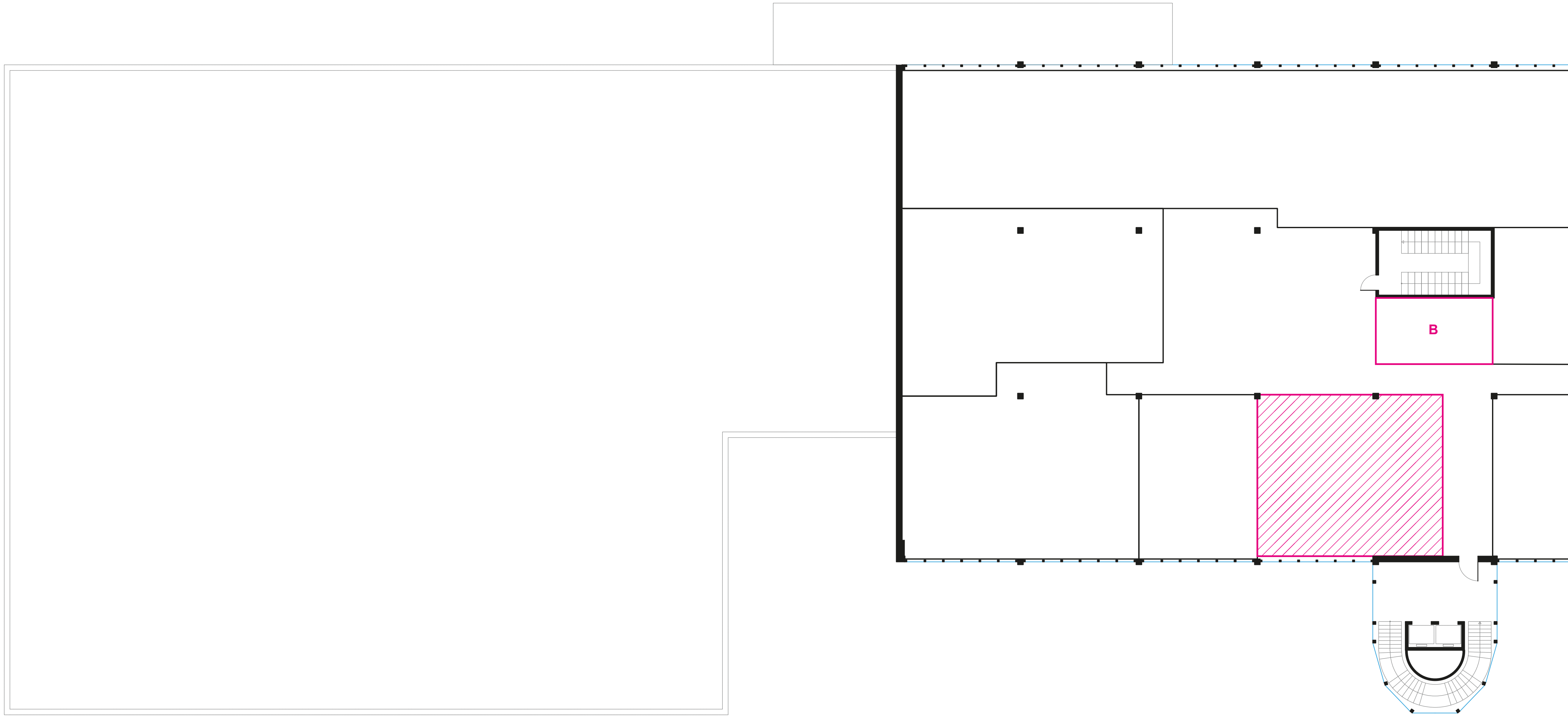
5b

Les Atelier de Renens | **space use** | common areas and services



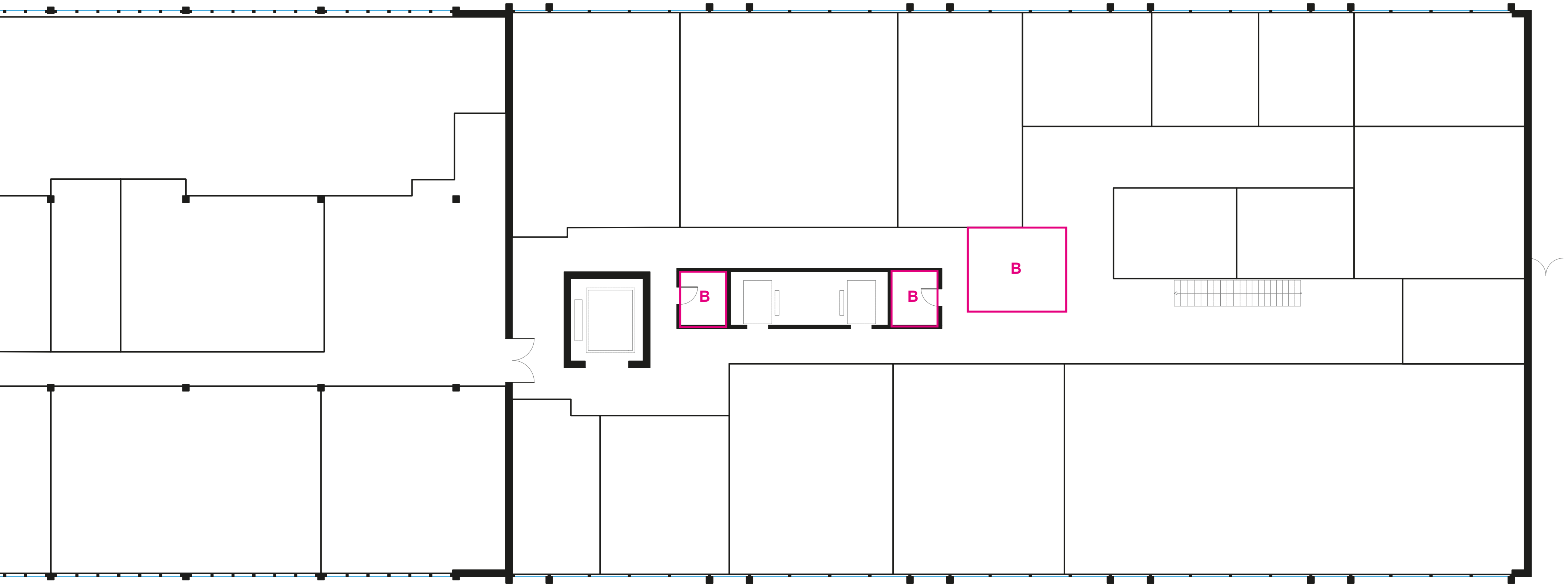
closed space
open space
workspace

E public entrance
P bar / relax area
B restroom
K shared kitchen
M shared machine

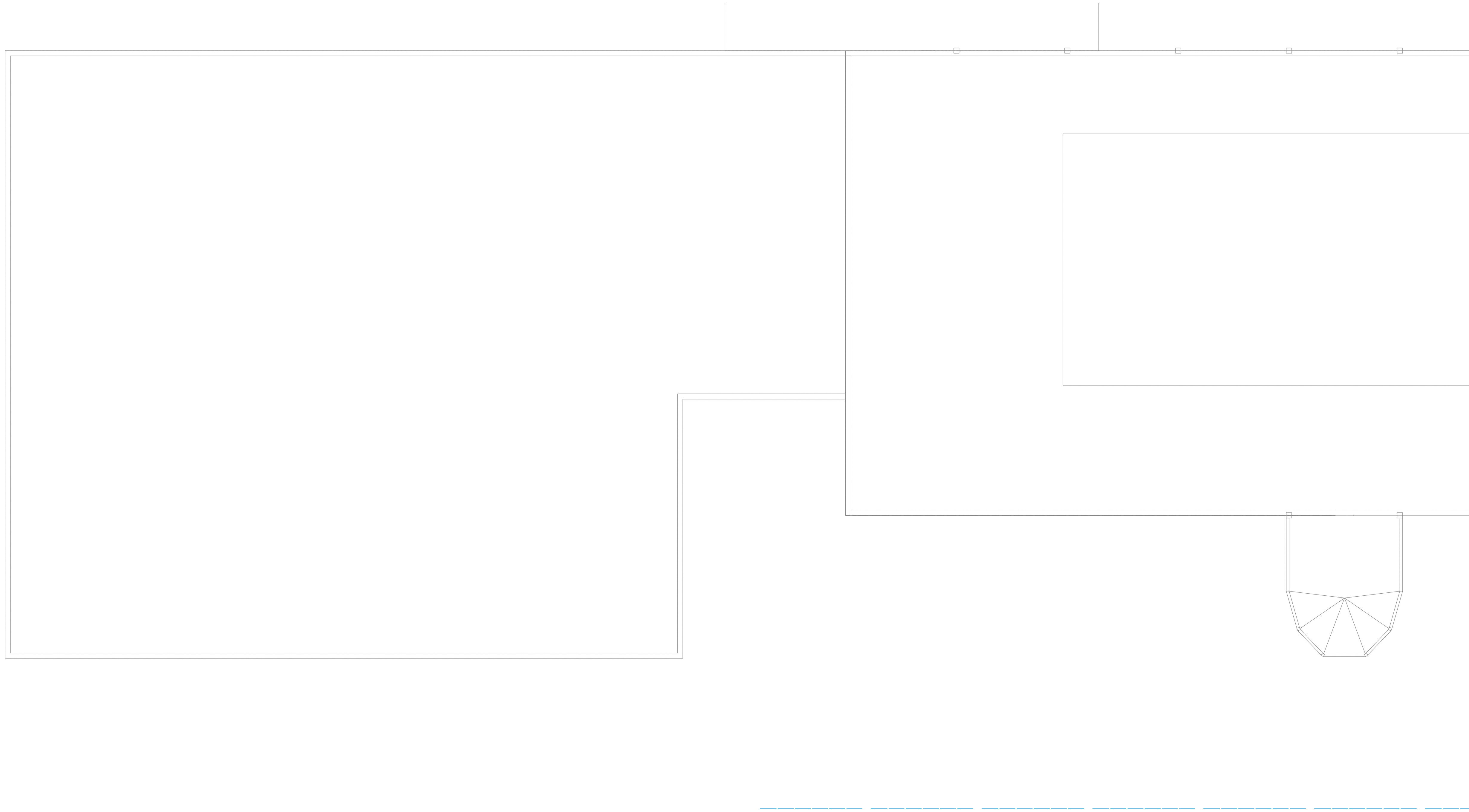


5c

Les Atelier de Renens | **space use** | common areas and services

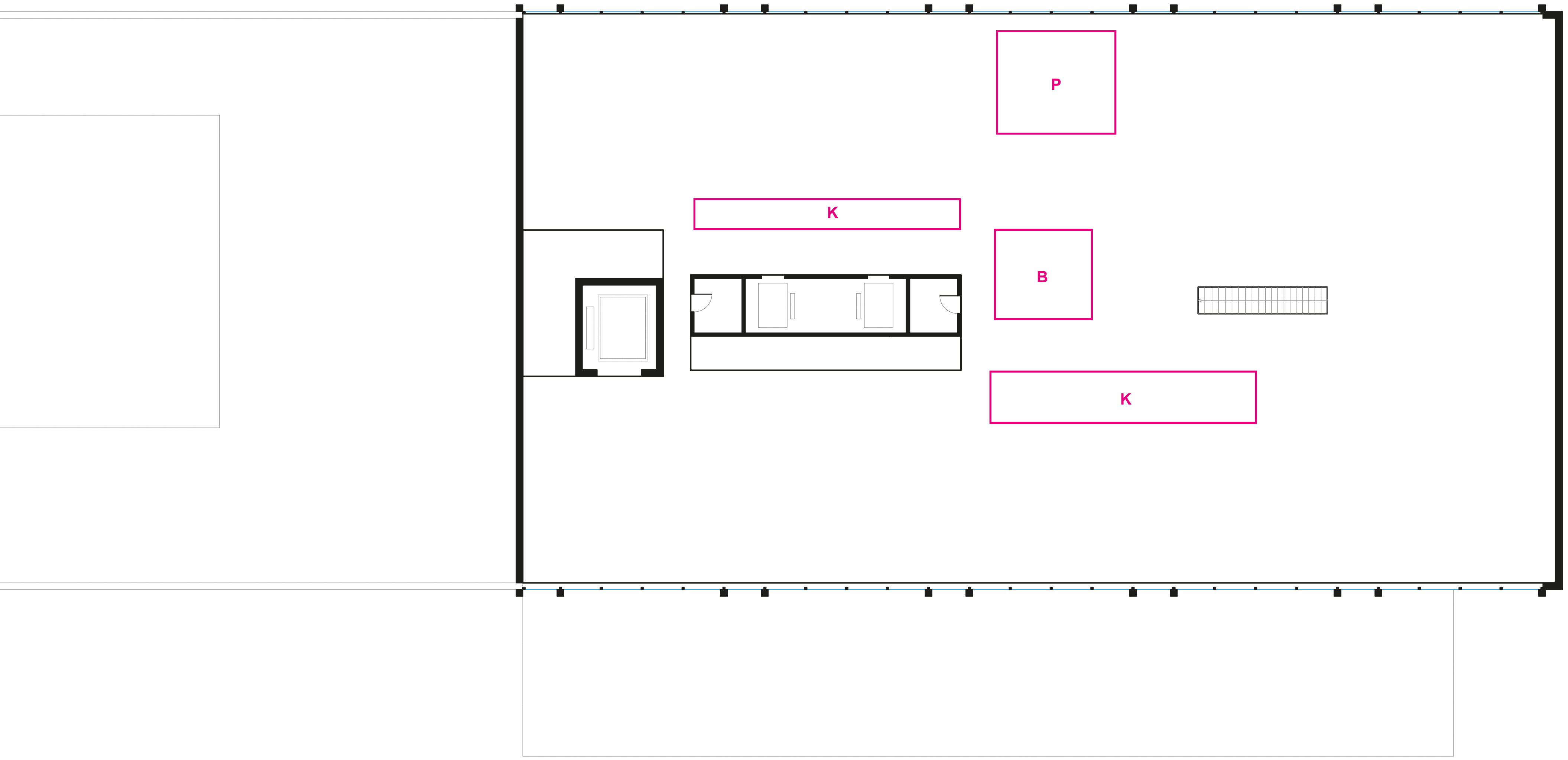


		E	public entrance
		P	bar / relax area
		B	restroom
	closed space	K	shared kitchen
	open space	M	shared machine
	workspace		



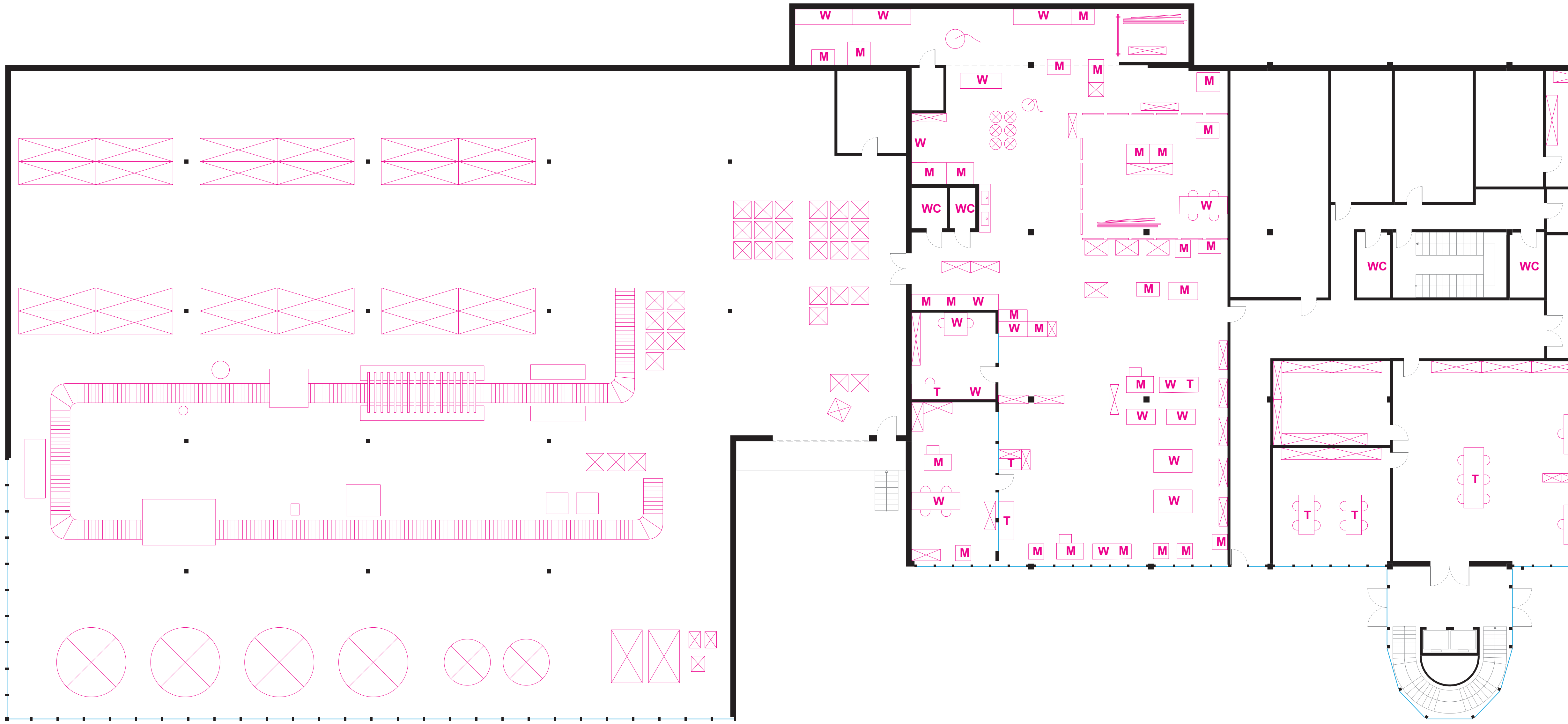
<u>5c</u>

Les Atelier de Renens | **space use** | common areas and services



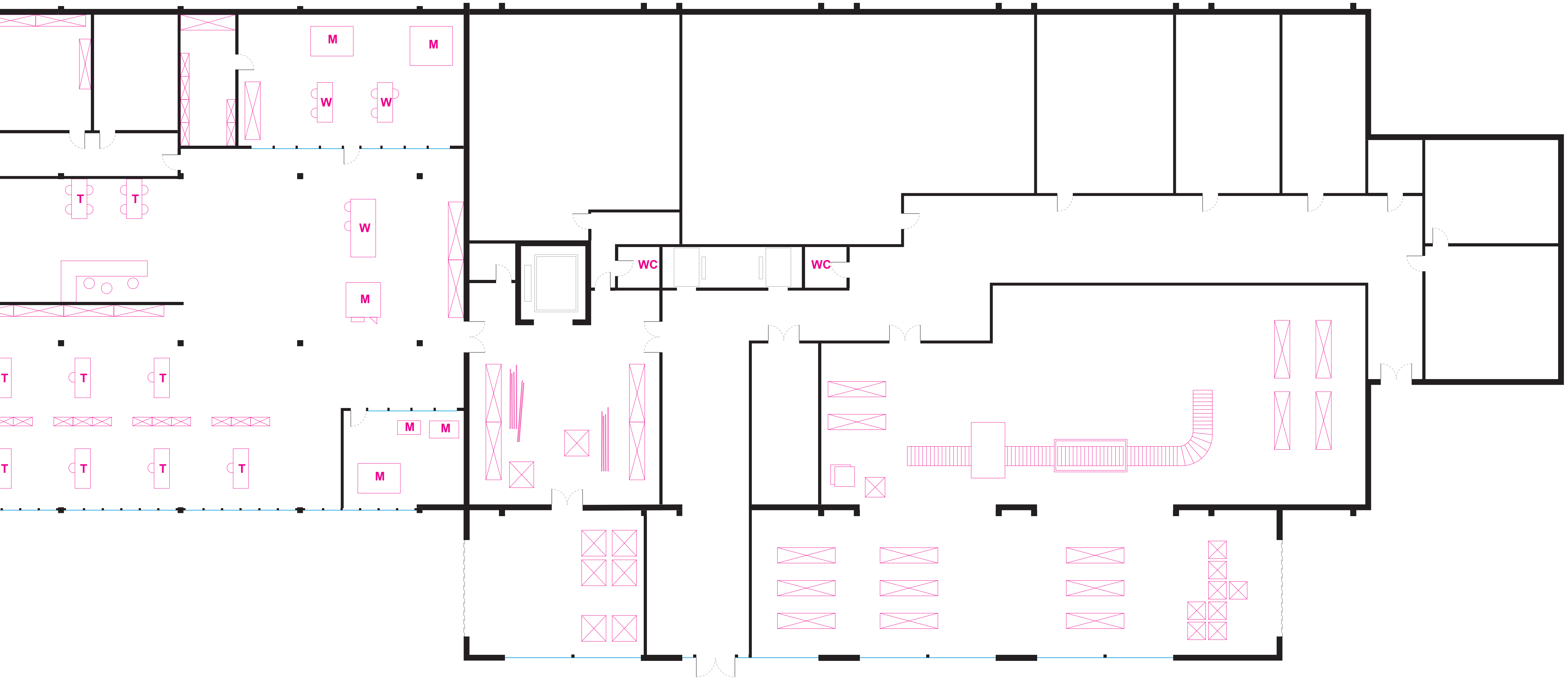
closed space
open space
workspace

E public entrance
P bar / relax area
B restroom
K shared kitchen
M shared machine

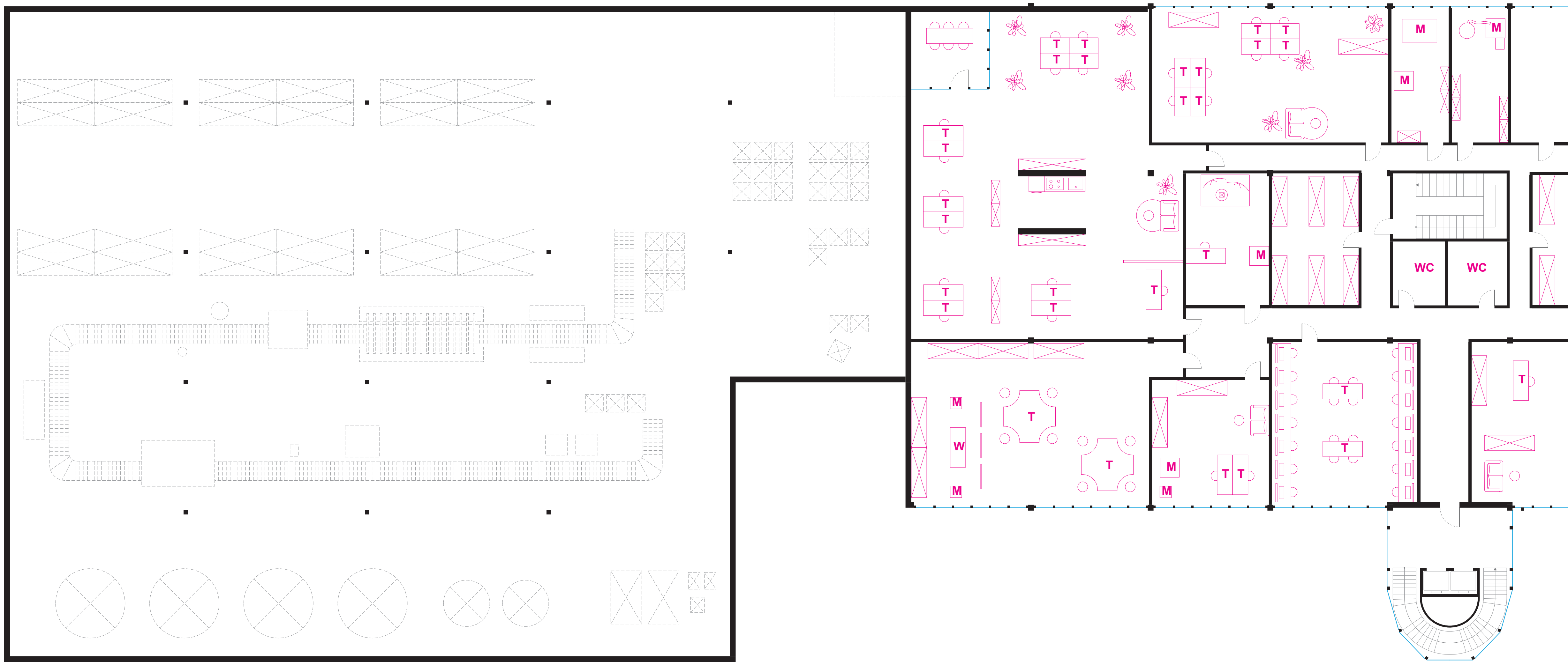


6a

Les Atelier de Renens| **space use** | Ground floor



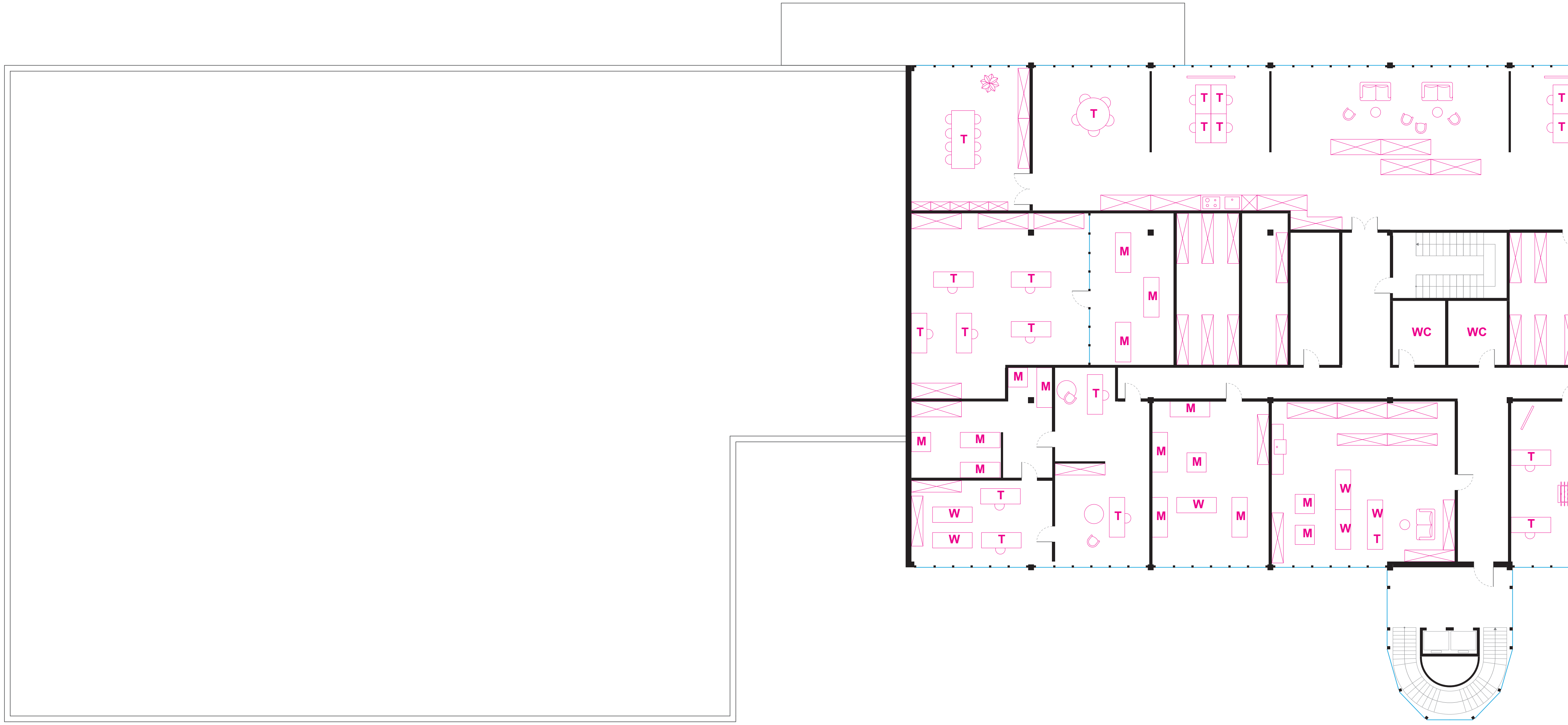
T office desk
S storage
K kitchen
M machine
W work table



6b

Les Atelier de Renens| **space use** | First floor

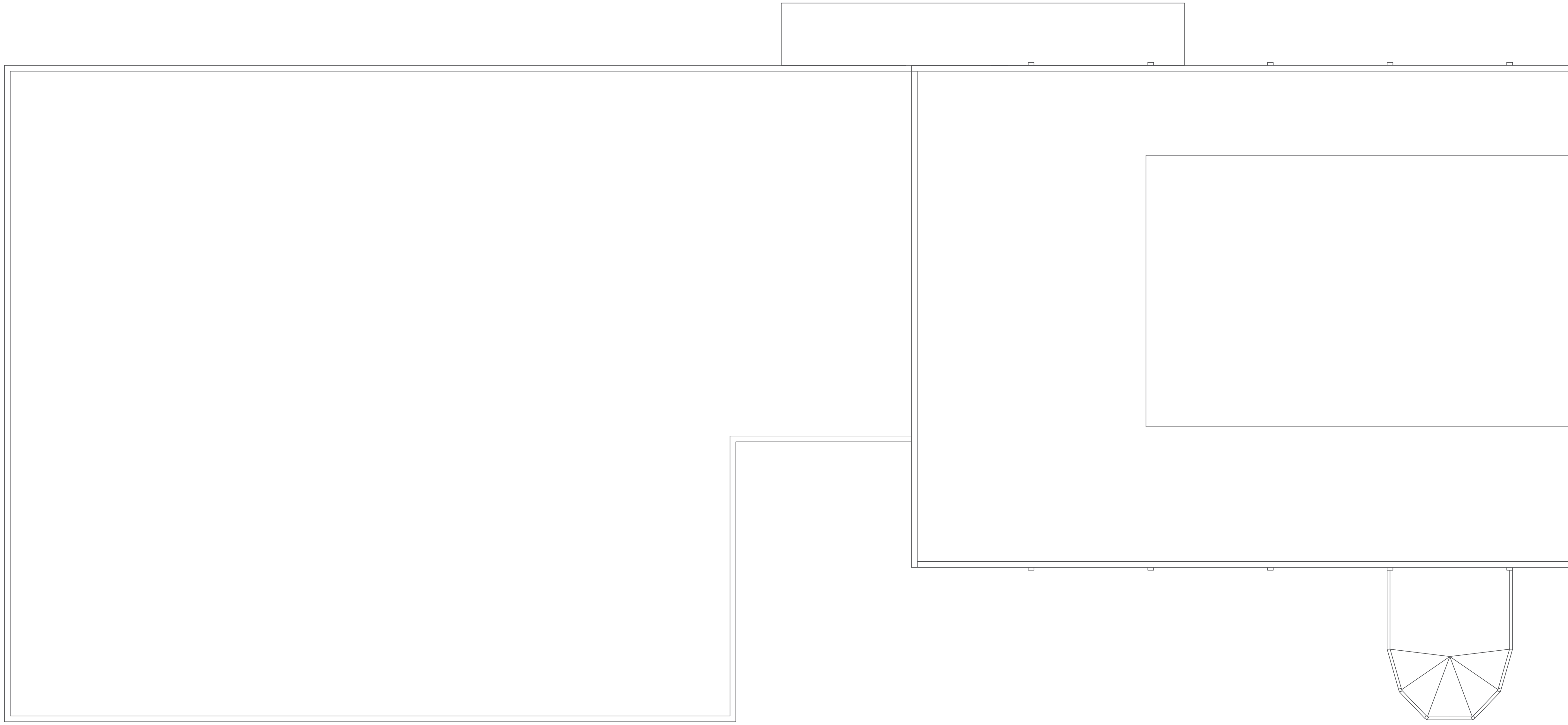
	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table



6c

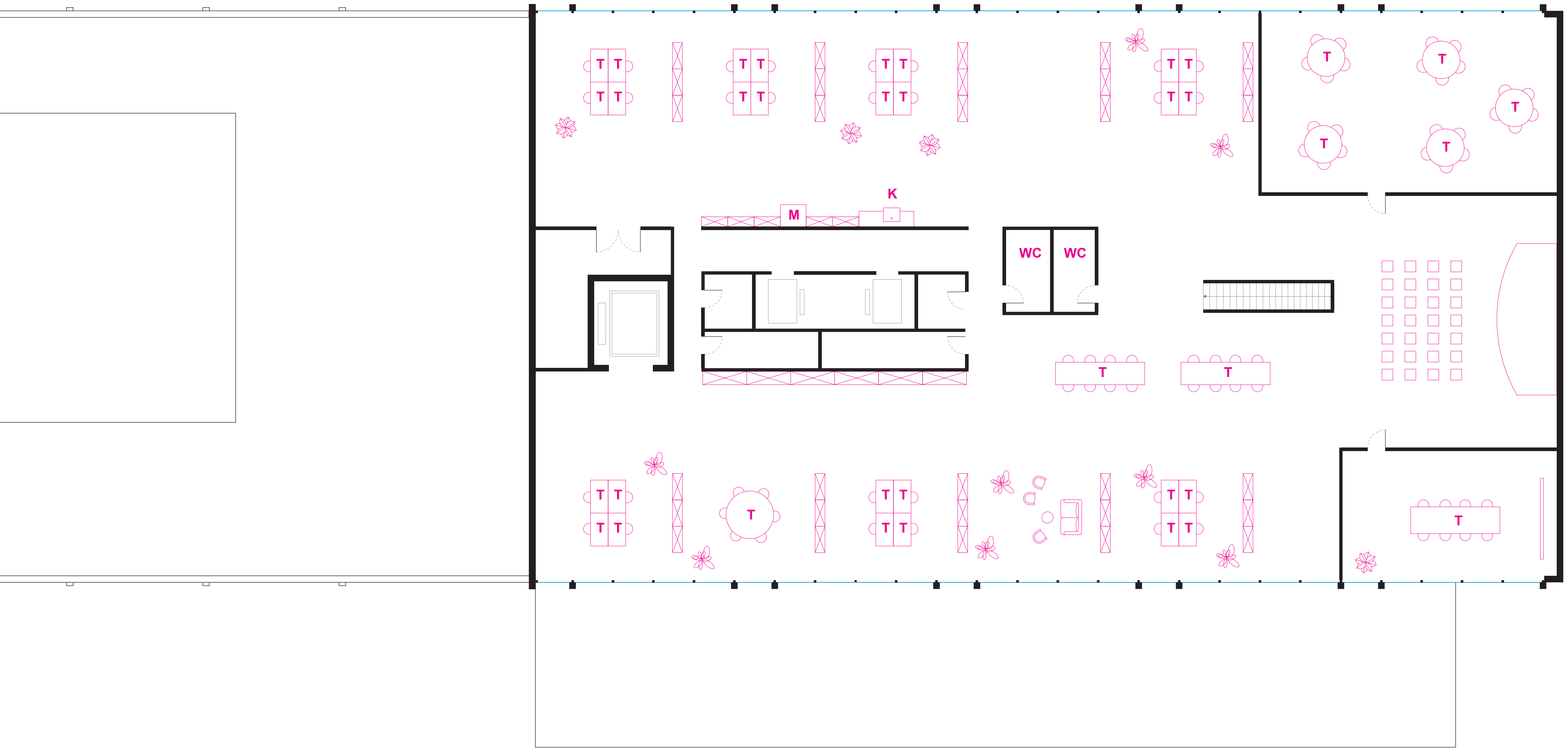
Les Atelier de Renens| **space use** | Second floor

	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table

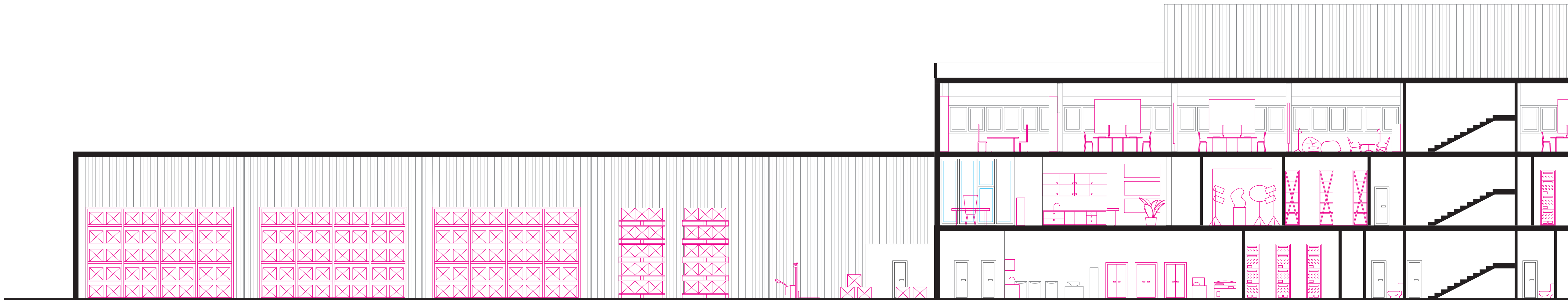


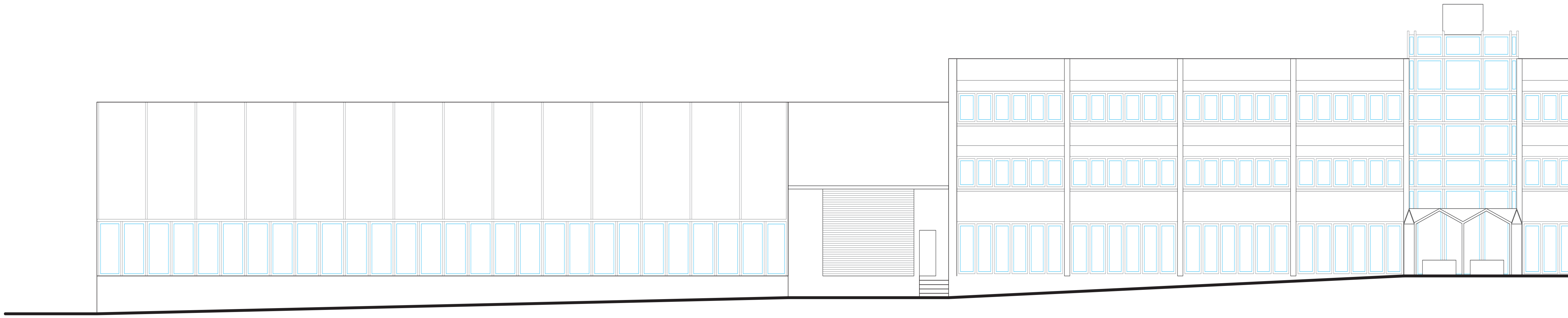
6c

Les Atelier de Renens| **space use** | Second floor



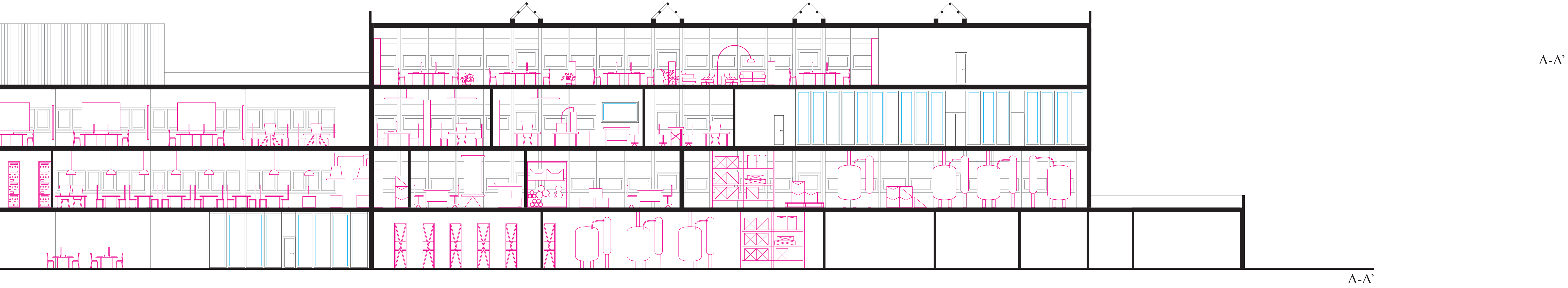
	T	office desk
	S	storage
	K	kitchen
	M	machine
	W	work table

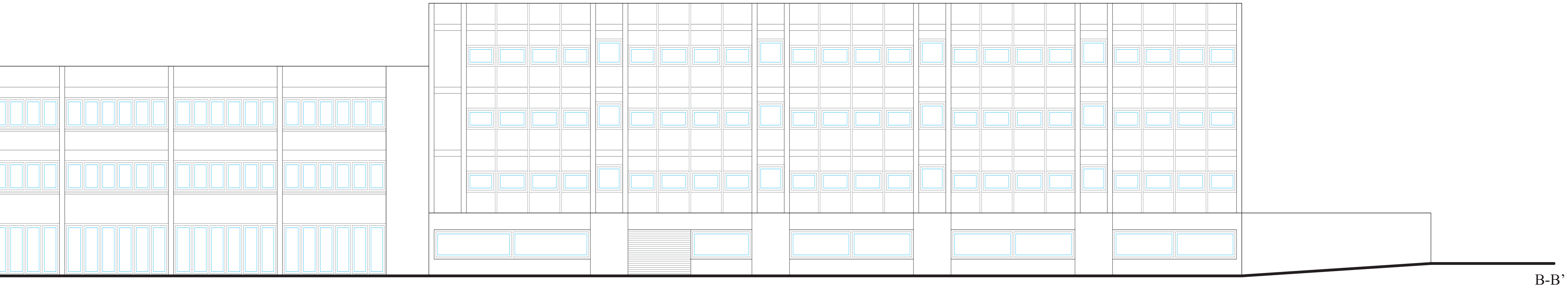


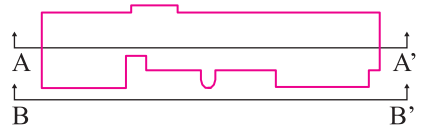


7a

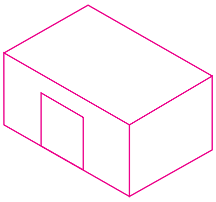
Portland Works| **material characters** |Structural section | Re-use strategy | Elevation


A-A'
A-A'


B-B'


A
A'
B
B'

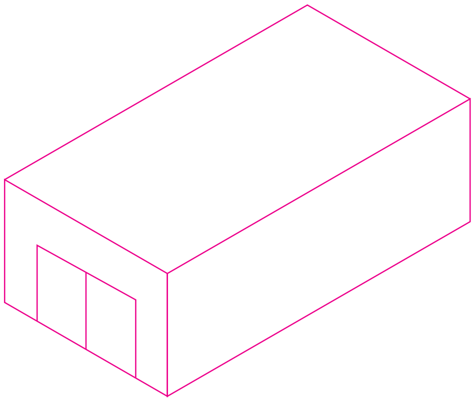
1



SHARED WORKSHOP

The high cost and large size of industrial machinery are often prohibitive for the single tenant. This condition has led to the creation of a common area where carpenters can use machinery for specific processes.

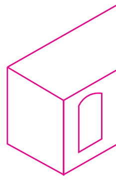
2



BIG WORKSHOP

Big workshops derive from the growth of the companies that expand taking up more space, or they are companies that come from outside. Large companies often collaborate with smaller ones, building an internal working ecosystem.

3

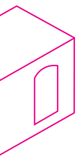


ATE

This type of s
characterized
floor area wit
ceiling heigh
and 4 m. The
space that co
ler and lighte
than the work
is indicated a
artistic categ
aned light ma
process.

8a

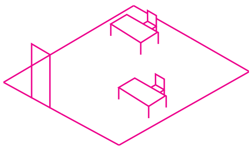
3



LIER

space is
. by a single
th a floor
t between 3
atelier is a
ntains smal-
r machines
kshop and
bove all for
pries or cle-
anufacturing

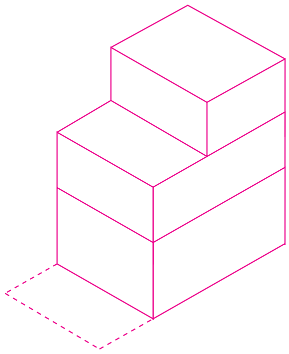
4



OFFICE

These spaces are orga-
nized according to the
main rules for the orga-
nization of office spaces;
they mainly contain clean
work areas and simple
furnishings. They are
often placed alongside
production areas separa-
ted by an opaque or tran-
sparent wall. Sometimes
the two space are locali-
zed in different areas of
the building.

5



VERTICAL FACTORY

Some productions en-
larging occupy different
spaces of the building by
forming a vertical pro-
duction chain, with the
office spaces on the upper
floors and the industrial
areas on the lower levels.
These productions coe-
xist with other activities
linked to the production
chain or independent
realities.

External view of the building of Les Atelier de Renens. Source: photo of the author, 2018

external view of the building of Les Atelier de Renens and the loading / unloading area. Source: photo of the author, 2018

Internal view of the workshop of a cuckoo clocks produces. Source: photo of the author, 2018

View of the main staircase block of the building. The vertical structural elements were made using old matrices to print newspapers. The memory of the place and the original production is clearly visible to the visitor. Source: photo of the author, 2018

Internal view of the shared makerspace. Source: photo of the author, 2018

Interior view of the workshop of a micro and nanotechnologies company in the are of marking. Source: photo of the author, 2018

Inside a watchmaking workshop. Source: photo of the author, 2018

Inside the workshop of a graphic and printing company. Source: photo of the author, 2018

Interior view of the workshop of a electrochemical surface treatments company. Source: photo of the author, 2018

Inside a ceramic workshop. Source: photo of the author, 2018

The restaurant area, meeting point of the internal community. Source: photo of the author, 2018

Shared makerspace work area. Source: photo of the author, 2018

Ringraziamenti

La tesi qui presentata è solo il risultato concreto di un più complesso e ampio percorso che è l'essenza di una ricerca. Un percorso difficile quanto stimolante, costituito da persone, luoghi, esperienze, oggetti, emozioni. Un bagaglio immateriale che è unico quanto personale.
Un bagaglio prezioso.

Per questo motivo voglio ringraziare tutte le persone che ne hanno fatto parte, che hanno valorizzato la mia ricerca, contribuendo con stimoli nuovi, mostrandomi nuovi punti di vista e che mi hanno supportato nei momenti di difficoltà.

La mia famiglia che è stata sempre un punto di riferimento. Marta, per avermi supportato nei momenti più difficili. Ilaria, Andrea e Davide per aver creduto nel percorso che stavo affrontando. Gabriele e Mattia, per gli stimoli, le idee e la positività. Andrea, nel quale ho trovato un prezioso amico. Federica per tutto il bel tempo passato assieme. Sergiu, per essere sempre una certezza. Federica e Mattia per la profonda amicizia che ci lega. Michele e Marco per i continui confronti e stimoli. Denise, Alberto, Paolo, Riccardo, Matteo, Alberto per la spensieratezza e le risate. Monique, Anais e Clèment per la stimolante ricerca e il tempo passato assieme. Alper, Tommaso, Ludovica e Marta per l'ospitalità e i sorrisi che mi hanno riservato durante i miei viaggi.

Tutte le persone che ho incontrato durante la ricerca in Keliewerf, Sectie-C, Les Atelier de Renens e Portland Works per la pazienza, il tempo dedicato e per l'interesse mostrato verso il mio lavoro.