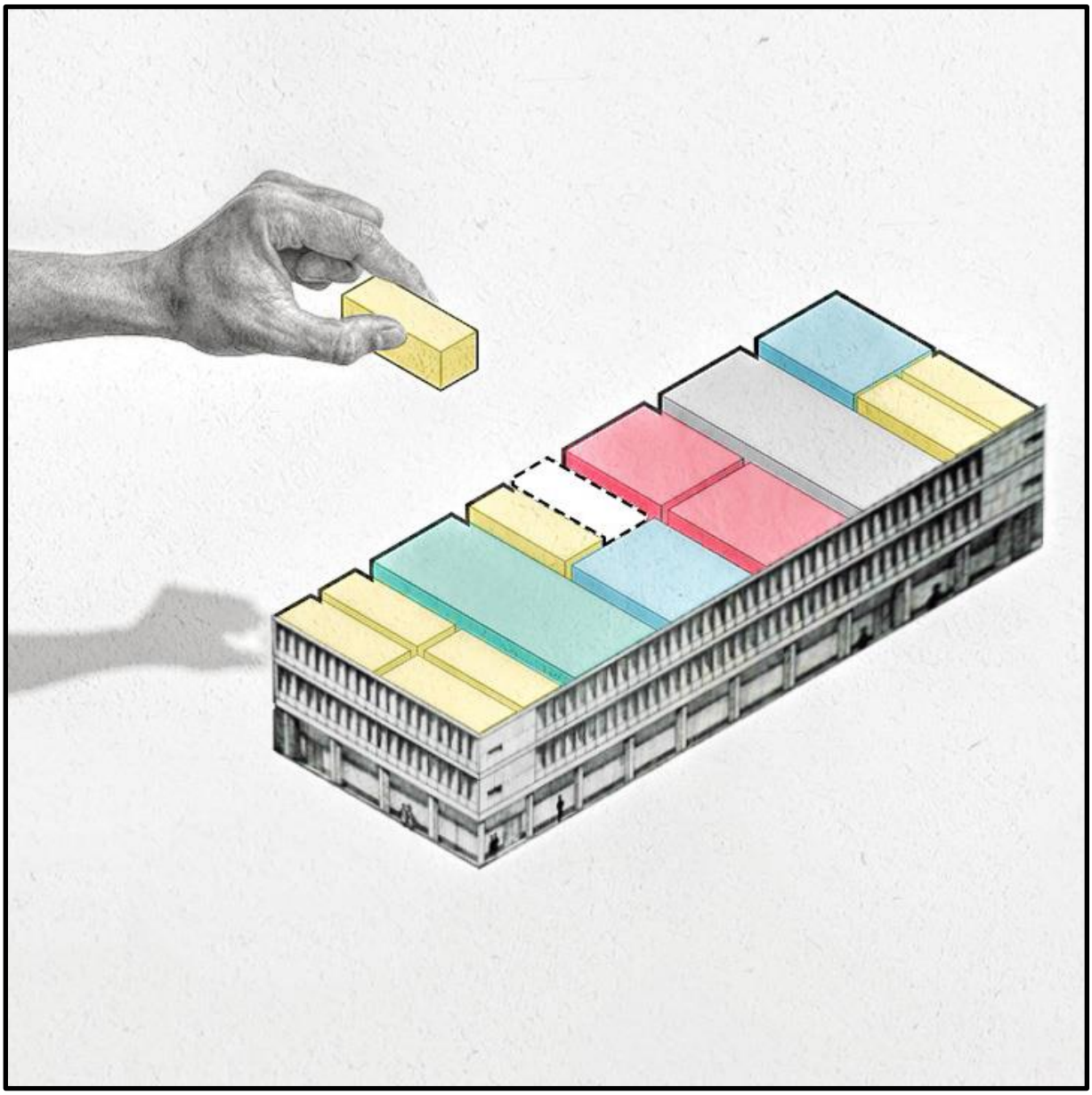
Confronting Vacancy with Flexibility

Establishing adaptability for users within existing boundaries

Jordy Wagemaker, 24 January 2022 - Research plan



Research Plan for aE Studio Students

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Title

Confronting Vacancy with Flexibility

Graduation Project

Keywords

Adaptability, flexibility, Open building, , reusability, user participation

Definitions

Adaptable: capable or willing to change in order to suit different conditions. (Cambridge Dictionary, n.d.)
Circular economy: an economic system of closed loops in which raw materials, components and products lose their value as little as possible, renewable energy sources are used and systems thinking is at the core. (Ellen MacArthur Foundation, 2011)
Infill: stands for shaping one's own living environment; it recognizes the human potential to create his or her own world. (Werf, 1993)
Open Building: an approach to the design of buildings that takes account of the possible need to change or adapt the building during its lifetime, in line with social or technological change. Open building design seeks to co-ordinate inputs from different professions, users of the building, and other interests associated with the locality. (openbuilding.co, n.d.)
Open Systems: defines the ambition to use compounds, systems, materials and researches the way they are produced, detailed, and mounted. Not only are Open Systems a good strategy to define closed life cycles of materials. It also offers changes for new technologies and supports the implementation and use of renewable materials such as timber and bamboo. (openbuilding.co, n.d.)
Support: a repeated common structural pattern with endless infill possibilities. (N.J. Habraken, 1961)
Temporary building: a building that lasts for only a limited period of time, max. 15 years (Bouwbesluit, n.d.)

Problem Statement

According to the current state of affairs at Statistics, (CBS, 2020) there is currently a rising housing shortage, which currenlty stands at 315,00 houses, Figure 1. This is expected to continue to grow in the coming years. Since the Second World War, different organisations such as government, building contractors and architects have been searching for a solution, which resulted for this shortage in mass-produced standardized housing (Bosma, Hoogstraten, & Vos, 2000). This is a quick, easy, and cheap building process, offering accommodation to a large number of people. Nevertheless, according to architect N.J. Habraken, this solution is only successful if the residents are excluded from the construction process, since the individual lifestyle of the residents does not have to be taken into account (Habraken, 1961). By designing for anonymous users, the investors, building contractors, and architects decide how the people should live. When combining this with maximizing financial gain and mass production, copy-and-paste architecture will arise, such as the famous post-war row houses that can be found throughout the entire Netherlands. These copy-and-paste architectural buildings were built with no further consideration in future adjustability, therefore resulting in a lack of flexibility and future adaptability in the future.

To re-establish the residents' influence within the building process, Habraken started an experimental foundation called the Stichting Architecten Research, SAR. The main goal was to investigate new possibilities within a standardized building process using the advantages of mass housing building techniques without excluding the influence of the resident to alter the plans, thereby making flexibility a core issue (Bosma, Hoogstraten & Vos, 2000). A continuation of their ideology is found within the Concept of Open Building, where the distinction between support and infill described by Habraken in combination with the layers of Stewart Brand form the core principles. Hereby the architect is the master of the support, where the resident is the creator of his own infill. This innovative design method generates a diverse set of challenges, especially on the technical level of installation distribution. The pipe shafts either penetrate the support or they limit the freedom of the infill in space. This raises the question of how installations can be flexible without interrupting both the support and the infill.

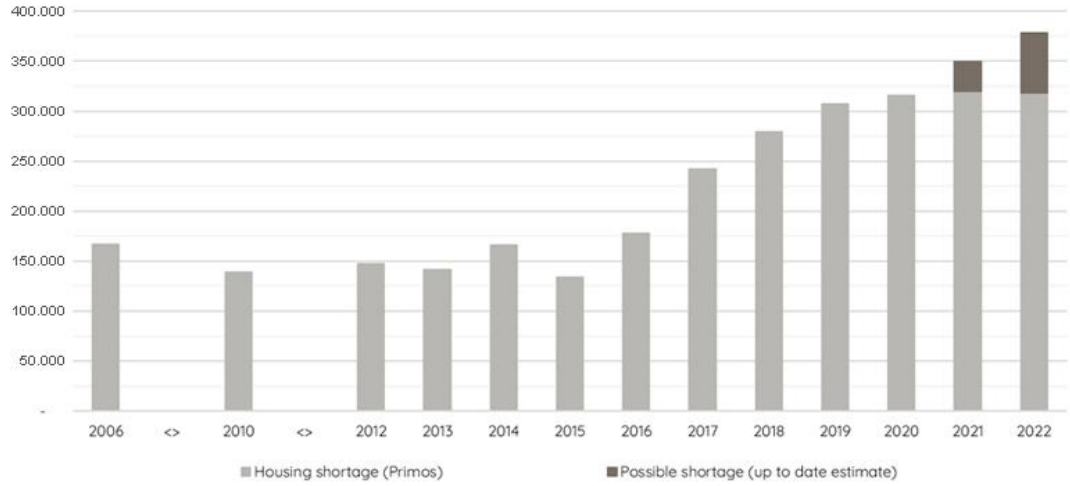


Figure 1. Housing shortage in the Netherlands (CBS, 2020)

The lack of flexibility in the present building stock is further fuelled by the current linear economy. Demolition of a building is seen as a sensible solution when the demand within society changes. In addition to neglecting raw materials, this results in embodied

CO2 emissions. Which contraposes the objectives agreed stated on the Paris Agreement of 2015, in which the aim is for nations to be CO2 neutral before 2050 to minimize humanity's influence on the climate. The Dutch government has taken initial steps by requiting the current new buildings comply with the Nearly Zero Energy Building, NZEB, regulations. Although this advances CO2 emission reductions in the building construction industry which is responsible for 10% of the total emissions and buildings 28% of the total emissions, it does affect the reason to build flexibly (figure 2). The NZEB regulations focus on the moment of completion, whereby function, square meters of usable area, square meters of facade area including facade openings, and square meters of roof area are also important for a successful calculation. However, from a flexibility point of view, this is hard to determine because at the time of completion it is unknown what will take place behind the facade, much less what will take place behind it in the future. This raises the question of whether flexible buildings could possibly be energy neutral according to today's regulations.

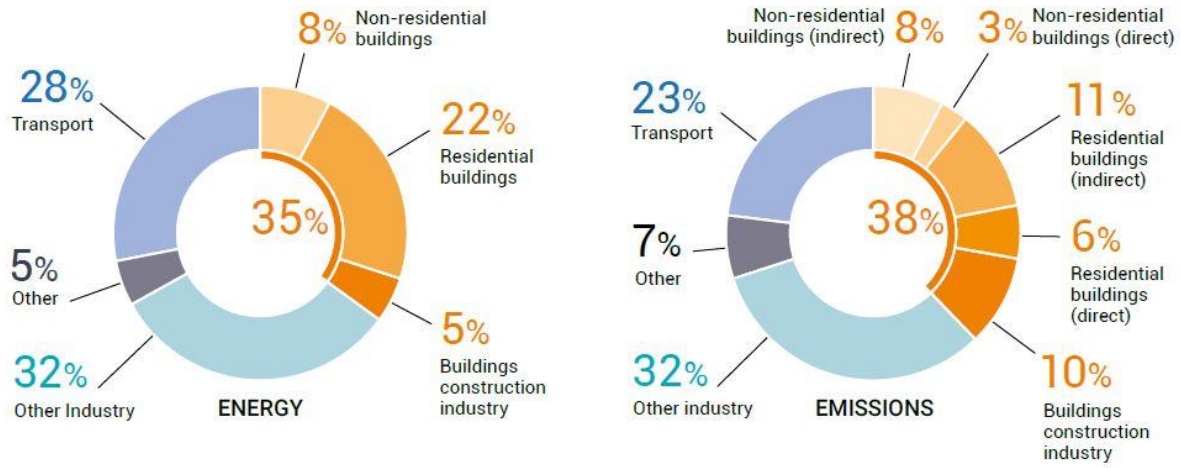


Figure 2. Percentages of CO2 emissions per sector (UNEP, 2019)

Another regulation that the government is introducing in the near future to reduce CO2 emissions is that from 2023 all office buildings must meet a minimum energy label C. Research by the Economic Institute of Construction, EIB, from 2021 shows that 37% of existing square meters of office space will not meet this new requirement and therefore these buildings may no longer be used for office function if no transformation takes place, figures 4 and 5. This will only increase the 3.3 million square meters of vacant offices in the Netherlands (CBS,2019). This raises the question of what to do with these buildings. According to a 2020 study by Real Estate Advisor Colliers, the demand for square meters of office space is decreasing due to the influence of the Covid-19 pandemic (Financieel Dagblad, 2020). Several companies will go bankrupt if the government support stops and the trend of working from home continues. It is still unclear exactly how much influence this will have, because companies are tied to long-term contracts, creating hidden vacancy. These vacant office buildings built before 2000 can be seen either as a problem or as an opportunity for a transformation into energy neutral flexible dwellings. To initiate maximum flexibility for the user in their floorplans, the installations and shafts should be placed outside of the floorplan, and interfere with the existing structure as least as possible. A new skin, that is needed to upgrade the energy performance of the existing building, could therefore be a possible outcome to accommodate these installations.

Bouwjaar (en verwacht label)	%
<1974 (G)	35
1974-1981 (F)	8
1982-1992 (E)	14
1993-1999 (D)	13
2000-2003 (C)	12
2004-2005 (B)	4
>2006 (A of beter)	15
Totaal	100

Figure 3. Unlabelled office stock (in terms of numbers) by year of construction and expected label, percentages (EIB, 2021)

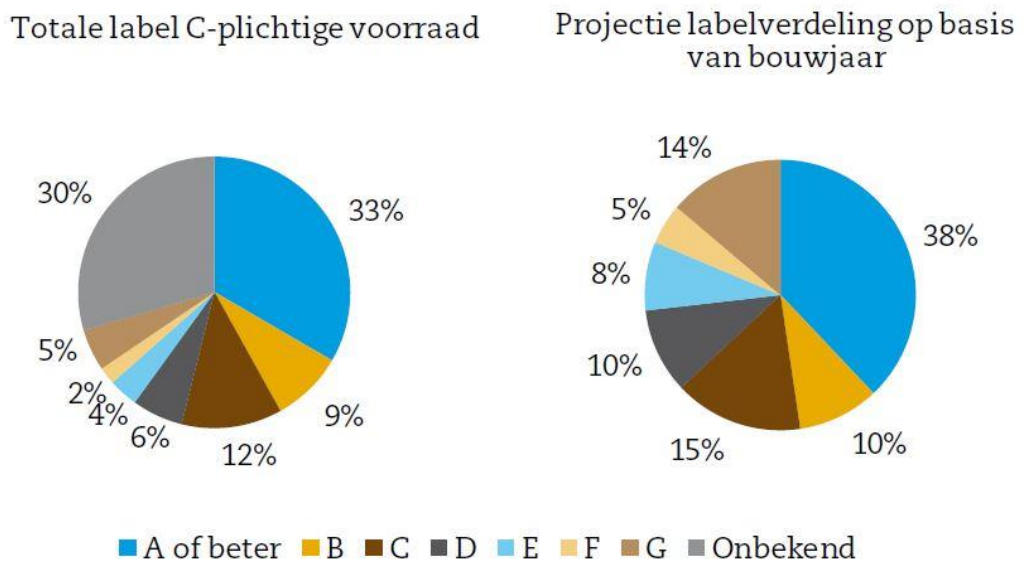


Figure 4. Label distribution total label C-compulsory stock in square meters, unestimated (left) and projected based on year of manufacture (right), percentages (EIB, 2021)

Objective

As the economy transition from linear to circular maximizing flexibility and adaptability of the existing building stock is arguably the biggest challenge, yet it would also have the largest impact in reducing CO2 emissions. A study by Brockman and Naganuma (2021) indicates that reusing a building avoids 50-75% of the embodied carbon emissions that an identical new building would generate. Therefore, focusing upon transforming upcoming Dutch post-war vacant office buildings would not only reduce the CO2 emissions in the construction process, but by introducing flexibility and adaptability within the building process the demands of the current market can be answered, in this case housing in the Netherlands, without producing new CO2 emissions. The addition of flexible and adaptable building stock will also establish a place within the building process for user participation. By using the layers described by Stewart brand (Figure 5) and disconnecting the stuff and space plan from the services, structure, and skin the new users can design and build within their domain. When focusing on dwellings, residents can build their own unique designs with the use of standardized elements instead of standardized houses with repetition in every layer, as often is created by buildings contractors, investors, and housing corporations. To arrange an empty canvas for residents, the architect should upgrade the outdated skin and services to today's

standards without interfering with the domain of the individual, figure 6, since services take away the freedom of the user when designing their own house according to the regulations and limitations.

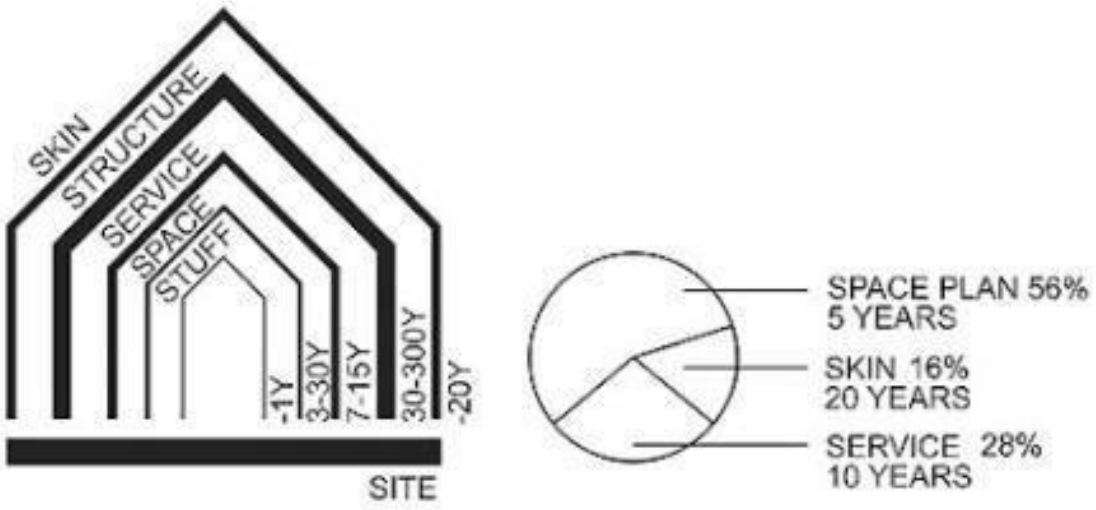


Figure 5. How buildings learn (Stewart Brand, 1994)

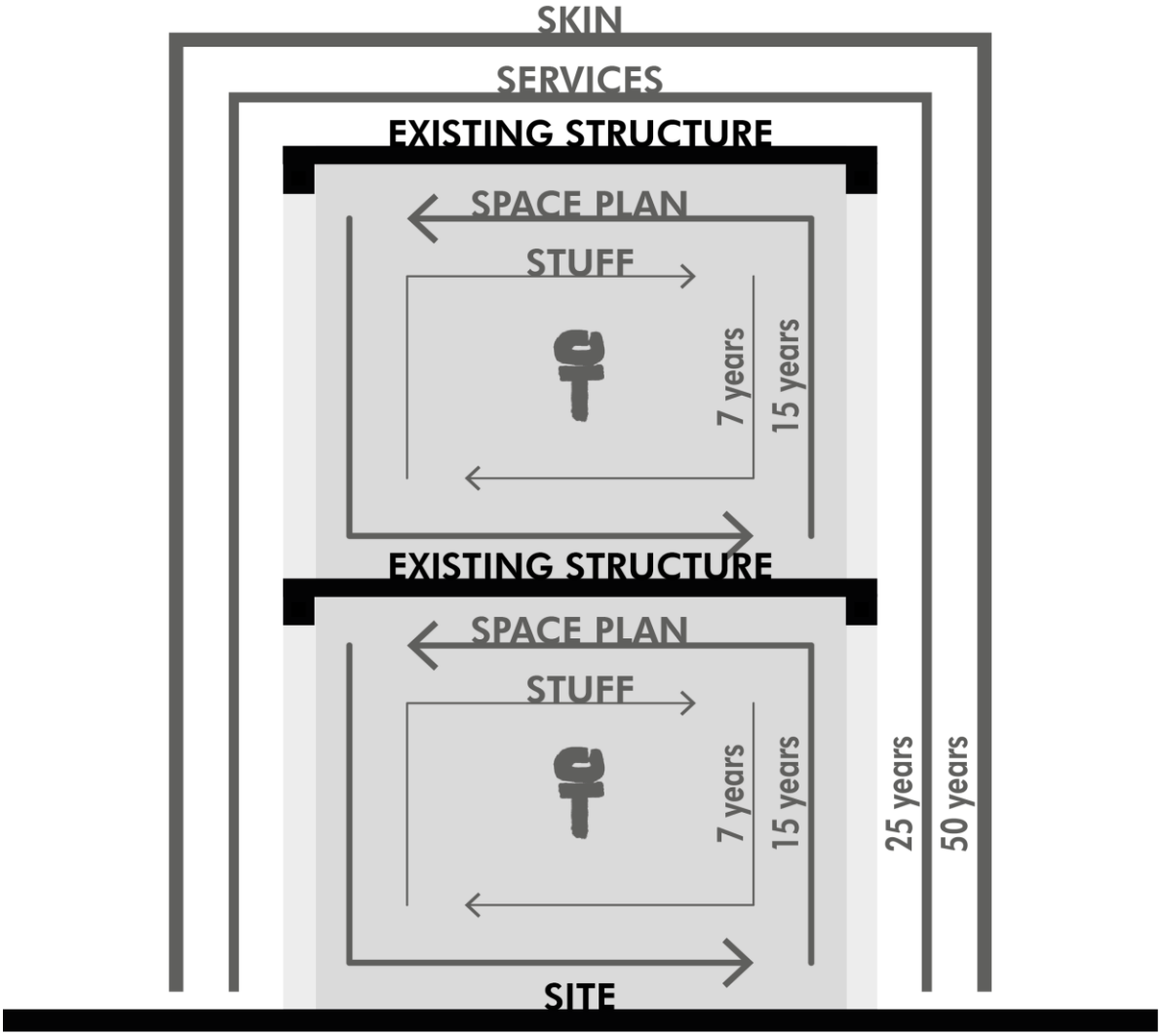


Figure 6. My intentions (Own ill, 2021)

Relevance

One of the biggest challenges for the current Dutch cabinet and other countries who signed the 2015 Paris agreement is to be CO2 neutral before 2050 by upgrading the existing rigid buildings to future-proof flexible and adoptive supports. Vacancy, demolition, and the use of outdated existing buildings all contribute to today's CO2 emissions. On the basis of flexibility and adaptation, upgrading will be simplified and demolition will be prevented, while users can also be involved in the construction process and continue to realize their wishes over the years. This can prevent long-term vacancy in the future and will contribute towards solving the current housing shortage in the Netherlands. These ideas can be linked to the idea of open building and the emerging circular economy. Through research and design, these ideas will be supplemented with new information and to try to determine whether the existing building of today can be the support of an open building of tomorrow. It will thus set an example for municipalities and investors who are confronted with the same problems.

Context

To find a suitable context, an existing vacant Dutch office building is needed. It is important that the typology of this office building is common within the current vacancy, so that this research forms a basis for numerous other possible transformations in the Dutch building industry. A study by DTZ (2010) has shown that office buildings between the construction years 1980 – 2000 account for a large part (52 %) of the vacancy, figure 7. Combining this with the upcoming vacant office buildings that will not meet the new regulations of energy label C in 2023, a focus upon a post-war building typology that is built typically is essential. In addition to the building itself, location is also important. The transformation of a vacant office building could only be successful in a neighbourhood with a high demand for a certain needed function, in this case housing, and municipalities that benefit from this are shown in Figure 8. Finally, the desired types of houses are important, as according to research done by ABF in 2021, 28.000 affordable (< €310,000.00), 15.000 mid-market (€310,000.00 – €480,000.00) and 9.000 high-end owner-occupied houses (> €480,000.00) are needed on a yearly basis. These numbers could help as a benchmark to design a diverse community within the transformation to flexible dwellings.

The existing building Bruggebouw Oost at Juliana van Stolberglaan in The Hague meets these criteria. This building is built in 1999 by Zwarts & Jansma and is currently vacant. The current plans are to renovate the building for the upcoming 6 years and then demolish it to fit the new urban plan of the Grotuisplaats, which is currently being redesigned by MVRDV.

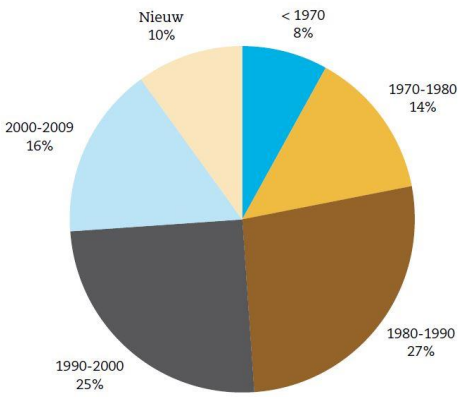


Figure 7. vacancy office building by year of construction (DTZ, Dynamis, 2010)

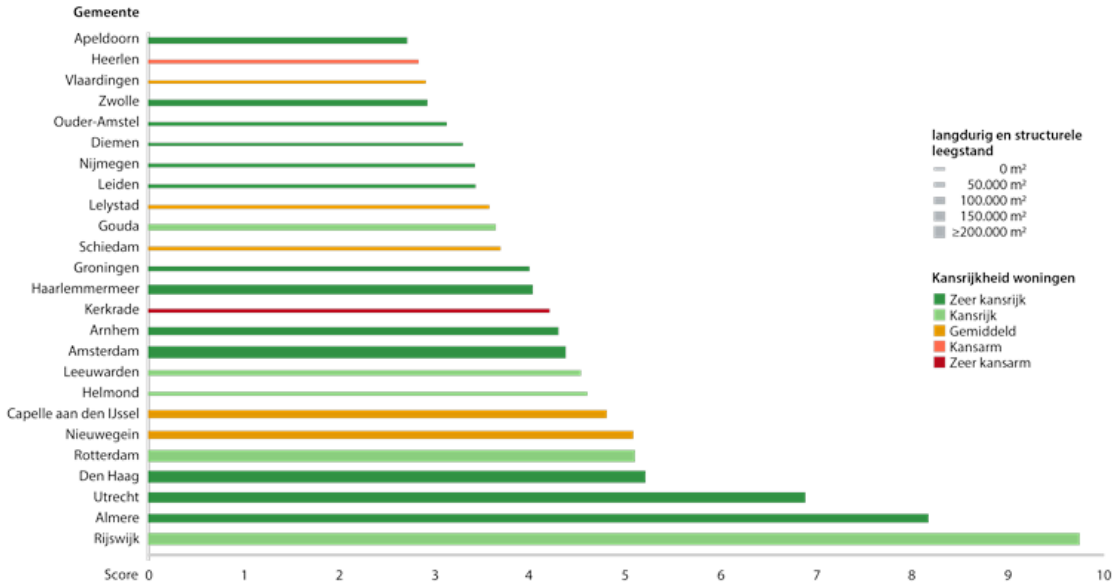


Figure 8. Promising municipalities for transformation (Rabobank, 2017)

Overall Design Question

How to implement demountable open systems when transforming an existing vacant Dutch post-war office building to user-specific adaptable dwellings?

Thematic Research Question

How can a generic façade module with integrated installation distribution elevate the design of flexible floorplans, when transforming an existing Dutch post-war vacant office building to energy neutral dwellings?

- Sub question 1: *How are installations distributed in renovated buildings that have been transformed to open buildings?*
- Sub question 2: *Which space temperature regulation, ventilation, water heating and, energy generation systems are available in the current market, that are reusable, adaptable and, efficient?*
- Sub-question 3: *What are the restraints of three different existing Dutch post-war slab office typologies with frame structures?*
- Sub-question 4: *How can flexible and adaptable open buildings be energy neutral according to the NZEB calculation tool?*
- Sub question 5: *What are the minimum and maximum possible infill solutions within the boundaries of existing Dutch post-war offices?*

Hypothesis

A new generic reusable facade module with integrated installation distribution will upgrade post-war vacant office buildings to NZEB certified energy neutral, circular and adaptable dwellings to establish flexible infill possibilities for the upcoming users.

Methodologies

The various methods and techniques of research required for answering the thematic research sub-questions are:

Sub question 1: The analysis of four open-building projects should inspire installation distribution solutions. The projects should have the following criteria: different architects, built with the use of the existing, built in the Netherlands and dwelling or mix function. This gives the following list:

Number	Project	Architect	Year	Adress	Function
1.	Top up	Tom Frantzen	2019	Buiksloterham Amsterdam	Dwelling
2.	Park hoog Oostduin	CEPEZED	2016	Oostduinlaan Den Haag	Dwelling
3.	Fenix 1	Mei Architecten	2019	Veerlaan Rijhaven Rotterdam	Mixed-use
4.	JFK Smartlofts	Space and Matter	2016	President Kennedyplantsoen Amsterdam	Dwelling

Sub-question 2: Market analysis of products for the installation distribution and overall installation concept such as heating water / heating space, ventilation, cooling, generating electricity should narrow down the possible solutions. These installations should meet the following criteria: reusable, adaptable, efficient, and upgradeable to fit the idea of flexibility.

Sub-question 3: Analysing three Dutch post-war offices built before 2000 and in need of transformation should form a list with criteria that can form a generic base to design for. Besides being vacant and built before 2000 these project should have the following criteria: a non-loadbearing façade, consisting of a column structure, maximum floor depth from the façade of 8 meter (max. daylight 7 m + internal passageway 1m) and space surrounding the façade to be able to extend. This gives the following list:

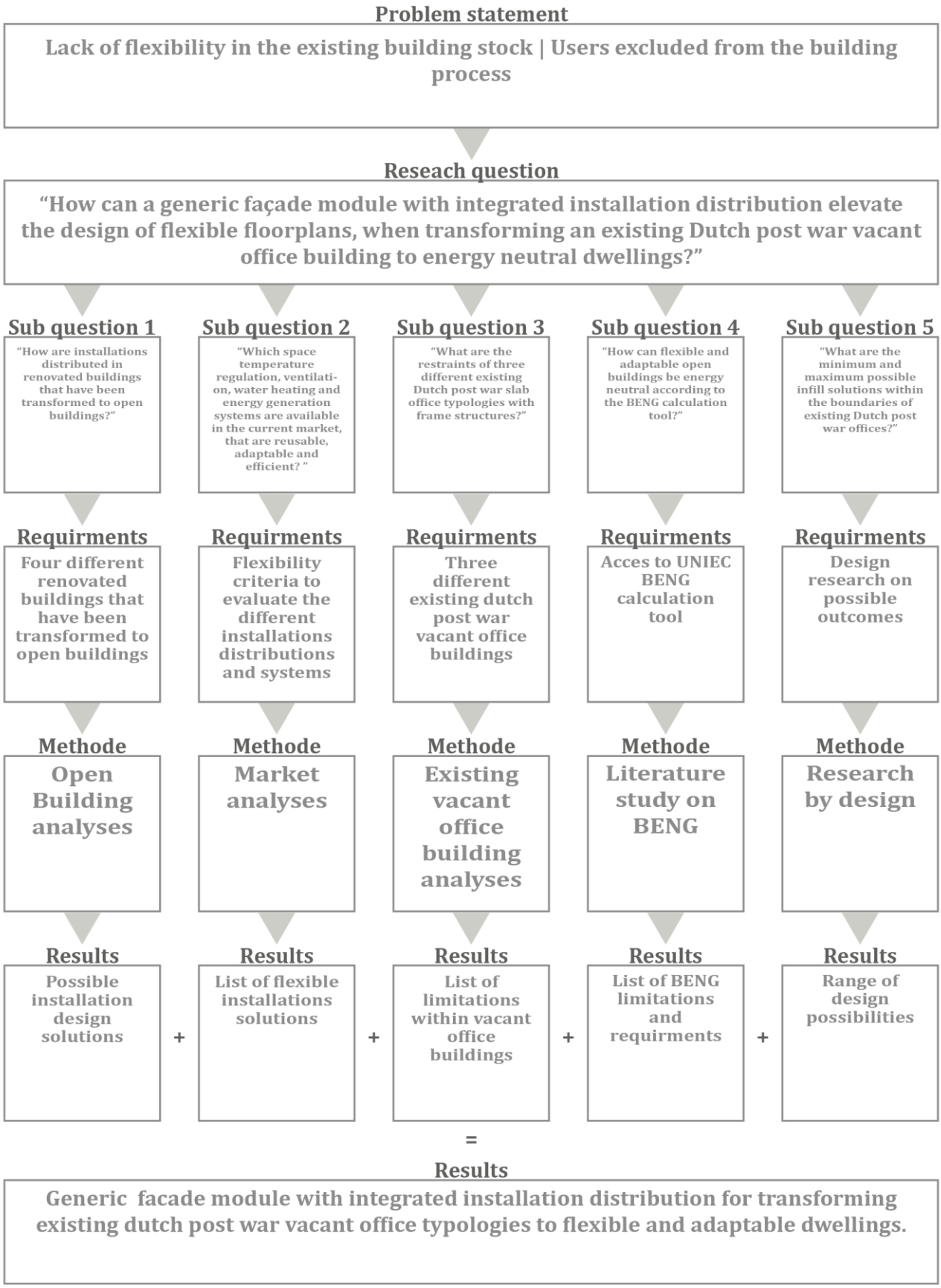
Number	Project	Architect	Year	Adress
1.	Bruggebouw Oost	Zwarts & Jansma	1999	Juliana van Stolberglaan, Den Haag
2.	De Knip	Abe Bonnema	1994	Kingsfordweg 1, Amsterdam
3.	Tax office	Piet Zandstra, de Clerq Zubli & partners	1970	Tesselschadestraat 4, Leeuwarden

Sub-question 4: A literature study on the NZEB regulation with the use of the UNIEC tool should show how to achieve energy neutral buildings with flexible floorplans that could change function overtime.

Sub question 5: Design research to define the range of design possibilities (min-max) that open buildings could have now and in the future. This automatically defines boundaries for minimum-max openness of facade, minimum-max amount of dwellings per floor / per building, minimum-max rooms per appartement, and possible functions.

Finally to answer the main thematic research question mock-ups are made of a façade module and an experiment is held where people get to design their own floorplan layouts.

Appendix: Summary of research structure



Appendix: Planning

	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10
Design	Introduction + First ideas			Searching for site location		Visit site location		Start initial ideas		**P1 presentation definitive Research plan**
Research				List of casestudies, set up meetings, relevance and objective		Research and Design question, Strengthening problem statement		Preparing presentation		
Products	Pavilion pitch	Pitch Poster	Draft research plan		Writing final		**Hand in Research plan**	Making presenation		

	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10
Design	List with limits office typology		Research by design: Creating reusable integrated facade component				Design concept			**P2 presentation definitive Gradution paper**
Research	Analysing: office typology limits, Open Building techniques, current installation techniques				Literature study: BENG			Preparing presentation		
Products	Writing draft version				Writing final		**Hand in Gradution paper**	Making presentation		

	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Design	Reflection	Sketching: models, drawings		Designing						**P3 presentation**
Research		Model existing building Revit and site + analyses		Experiment: let people draw their own floorplans within the limits		Circulair materials and connections				
Products		Final design Concept		Site, sections, floorplans and 3D renders						

	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10
Design	Reflection	Designing				Final Physical model		Report		**P4 presentation**
Research		Mockup reusable integrated facade component				Final Mockup		Preparing presenation		
Products		Updated: Site, sections, floorplans and 3D renders Extra: Details				Final products		Making presenation		

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