Managing the student housing supply in Delft

Resit P2-report Master thesis

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Content

Preface

I would like to start this thesis with a quote mentioned by the Ministry of the Interior and Kingdom Relations, which describes the starting point for this research: 'Zoals het hoger onderwijs de motor van de kenniseconomie is, is goede studentenhuisvesting de accu van die motor.' (2011, pp. 2) This quote implies that student housing is needed to run higher education, which in turn is needed to run the knowledge economy.

The first part of this quote is consistent with previous research conducted by den Heijer and de Vries (2006) and Florida (1999; 2006). In general, the authors explain that higher education is the engine for a knowledge-based economy and that it is being used for knowledge development. The second part of the quote I find to be more interesting as it mentions that the battery for this engine is student housing.

According to Pieter Guldemond (Delft's city councilor for student housing), '...the Delft knowledge economy can only grow if there is enough housing for Dutch and international students.' (TU Delta .36 2011, pp. 36) Research conducted by DUWO (2010, pp. 24-25) mentions something similar, as it states that the first priority for a successful knowledge economy is a high quality of teachers and good study conditions, including living space. This implies that the accommodation of students is considered as an important subject for the development of a knowledge-based economy.

Based on several posts during the past few months[1], I can say that I agree with the conclusions being presented here as all of these posts mention the urgent need for additional student housing in the Netherlands. Delft is also included with an estimated deficit of 3,600 units by 2015 (VSSD 2011), which is expanding to 5,000 units in 2023 (RIGO 2011 in ARCADIS 2011). Even though the deficit of student housing varies from city to city, the urgency for additional student housing remains equally.

This research will focus on the current accommodation problems for student housing in the city of Delft. Because Delft University of Technology (hereafter TU Delft) is expecting a vacancy of 44,000 sq m (TU Delft 2010) and no actual plans have been made so far, I am interested in the options it can offer for the development of student housing. For this research I will therefore use TU Delft as the main case, which will be described in more detail later in this report.

I hope that this research can be used as a background for finding solutions for the accommodation problem for student housing in the Netherlands and across borders. Hopefully other cities and universities that have similar problems can and will use this thesis to help them develop other options.

Daniel Bosnjak BSc.
February 2nd 2012

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[1] The complete list of resources has been included in the literature

Problem analysis

During the past few years the amount of students that attended higher education has risen significantly. Research of VSNU (based on statistical data from CBS) shows that between 1998 and 2010, the amount of student numbers amongst universities has risen from approx. 140,000 to 210,000 (increase of 50%). The development of student numbers can be seen in figure 1.
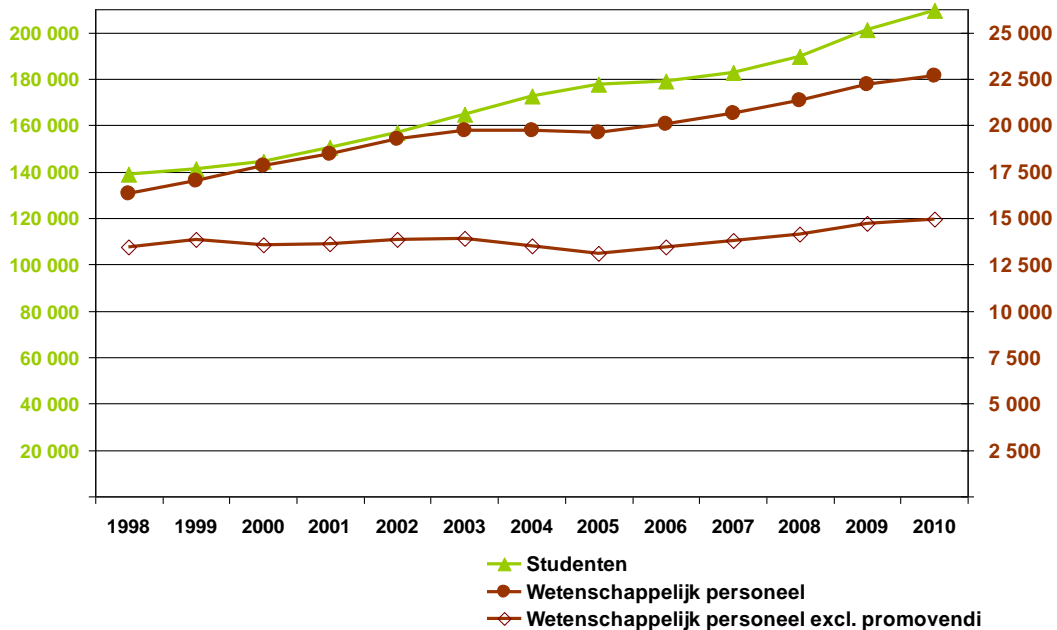

Figure 1: Amount of students in the Netherlands from 1998 – 2010 (Source: VSNU/CBS, 1cHO2010 in VSNU 2011)

In 2011, the Ministry of Education, Culture and Science made an estimation of the growth in student numbers. The amount of student numbers is expected to grow even further by the year 2025, based on recent trends and developments. As compared to 2011, the amount of students in the higher professional education ('HBO' in Dutch) will grow with approx. 22% while the academic higher education ('WO' in Dutch) will grow with approx. 36%. Figure 2 shows the current estimations for the growth of student numbers for both 'HBO' and 'WO'.

The effect for higher education will be an increased demand for educational space. Basically it means that higher education institutions should develop additional space in order to accommodate the growth in student numbers. Additional classrooms, study areas and student housing are some examples. Given the expected growth in student numbers within a relatively short period, these developments should take place fairly quickly. The question is whether and where there is room for it.
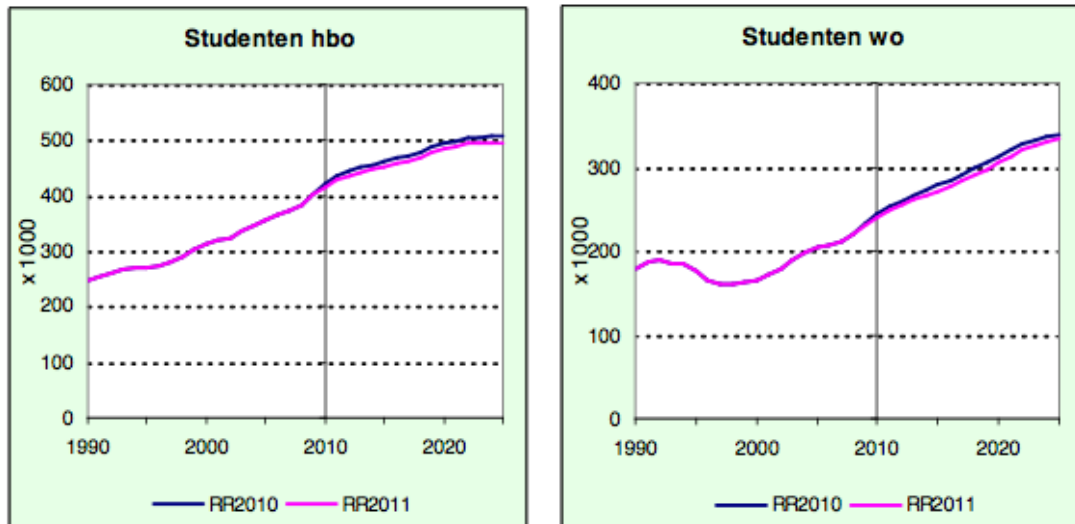
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Figure 2: Growth in student numbers in the Netherlands from 1998 – 2025 (Source: 'Referentieraming 2011' Ministerie OCW 2011, pp. 38-39)

Initially, the growth in student numbers should not be a major problem for the Netherlands. As research shows, a growth in student numbers could lead to an increase in knowledge development and thus a growth of the knowledge economy (den Heijer and de Vries 2006). The problem however lies within the accommodation of these students.

Given several reports of the past year, with regard to student housing, it becomes clear that currently there is a shortage of student housing in the Netherlands.[2] The shortage of rooms varies by city. In 2011, the National Student Union (LSVb) made an inventory of the shortage of student housing per city. The results are shown in figure 3. In the case of Delft, there is currently a shortage of 3,600 student units by 2015.

The value and importance of real estate for companies and higher education has already been mentioned in previous research (de Vries 2007, pp. 79-80; den Heijer 2005; 2006; 2011, pp. 91-103; de Jonge et al 2009; de Graaf 2005). Combining these results with research conducted by den Heijer and de Vries (2006) it cannot be excluded that the shortage of student housing will have an effect on educational institutions, and thus on the knowledge economy (TU Delta .36 2011, pp. 36; DUWO 2010, pp. 25-25).

Further research of Marlet (2009) explains: cities that tend to have a relatively large amount of highly educated, creative people also tend to have a larger human capital as compared to other cities. In turn, these people are willing to spend more money on the local economy, which affects both the livability and the innovation climate of that city.

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[2] The complete list of resources has been included in the literature

Cities with a relatively large contribution to the knowledge economy should provide sufficient student housing in order to meet the current demand and to stimulate the growth of the economy. Delft, amongst others, tends to be one these cities where the knowledge sector covers a relatively large part of the urban economy (TNO 2009).

Factsheet Kamernoodinventarisatie 2011 - Landelijke Studenten Vakbond (LSVb)

Gemeente	Kamer Tekort (tot 2015)	Gemiddelde wachttijd in maanden voor een onzelfstandige woning	Gemiddelde wachttijd in maanden voor een zelfstandige woning	Gemiddelde huurprijs onzelfstandige kamer corporaties (inclusief)	Gemiddelde huurprijs zelfstandige kamer corporaties (inclusief)	Totaal toekomstplannen /projecten/te realiseren eenheden
Amsterdam	9000	Ca. 18 (De Key)	n.b.	276 (DUWO) 370 (De Key)	402 (DUWO) 440 (De Key)	9000
Breda	1000	4	25	330	450	n.b.
Delft	3600	n.b.	n.b.	321	416	2200 - 5000
Den Haag	3000	n.b.	n.b.	324	395	2000 - 3000
Eindhoven	0*	22	26	275	375 (ex. Gwe)	500 +
Enschede	0*	n.b.	10	263 (Acasa) 248 (SJHT)	396 (Acasa) 227 (ex. Gwe)	400
Groningen	0*	6	24	275	350	4500
's-Hertogenbosch	0*	10	n.b.	256	n.b.	n.b.
Leiden	4150	n.b.	n.b.	246 (DUWO) 270 (SLS)	515 (SLS)	4000
Maastricht	300	6-18	12-24	350	440	500 +
Nijmegen	166	8	30-60	240	390	1000-1250
Rotterdam	0*	8	24	360	500	n.b.
Tilburg	0*	11	18	330	450	1000
Utrecht	6700	21	60	270	404	864 +
Wageningen	600	8-14	13-20	293	382	1000
Zwolle	440	8	19	288	389 (ex. Gwe, servickosten)	475

Figure 3: Shortage of student housing per municipality in the Netherlands (Source: 'Factsheet Kamernoodinventarisatie 2011' Landelijke Studenten Vakbond (LSVb) 2011)

Currently, the city of Delft has a total of 8,242 student rooms of which 1,212 are located on the campus of TU Delft (DUWO 2011; FMVG 2011). To counteract this shortage, a nationwide plan ('Landelijk Actieplan Studentenhuisvesting 2011-2016') has been developed. Different actors (e.g. municipality, educational institutions, and student housing authorities) are willing to cooperate in order to develop additional student housing (Ministerie BZK 2011). As this research will be using TU Delft as the main case, the current supply of student housing on the campus is presented in figure 4 and table 1.
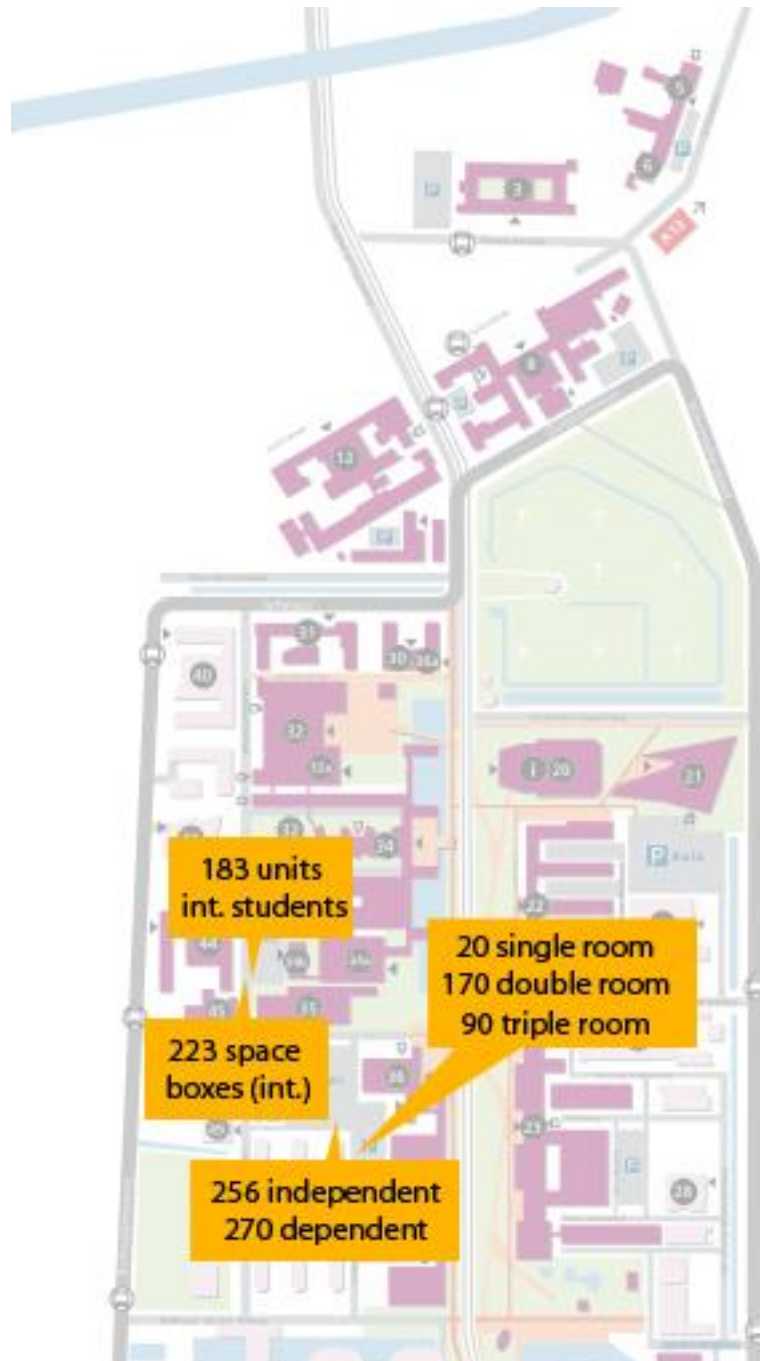
Figure 4: Student housing supply on TU Delft campus (Data: FMVG 2011)

Location	Amount of units
Leeghwaterstraat	183 permanent units for int. students
Leeghwaterstraat	223 space boxes for int. students
Korvezeestraat	256 indep. And 270 dep. student units
Balthasar van der Polweg	20 single, 170 double and 90 triple room units

Table 1: Locations of student housing supply on TU Delft campus (Data: FMVG 2011)

1. Research definition

Based on the information required from the problem analysis, this chapter will start with defining the problem statement.

1.1 Problem Statement
A constant growth in student numbers since 1998 has resulted in an increasing demand of student housing in the Netherlands. Both major cities as well as smaller cities like Delft have been affected. As of today, the shortage of student housing in Delft is approx. 3,600 units by 2015. Despite efforts of reducing this shortage, the amount of units is expected to grow to 5,000 by the year 2020.

1.2 Hypothesis
The results from the problem analysis and the above-mentioned problem statement are combined in the following hypothesis for this research:

A total amount of 2,500* student units can be developed within the 44,000 sq m vacant real estate of the TU Delft Campus.

Two assumptions have been made here:
- *2,500 student units can fit into 44,000 sq m;*
- *44,000 sq m can be used for the development of student housing.*

*The amount of 2,500 units is based on the average surface area of one unit:
1. SUM[3]: avg. unit is 17.5 sq m (national avg. based on 12 cities)
2. LSVb[4]: avg. unit is 17.43 sq m (national avg. based on 23 cities)
3. Bouwbesluit 2012[5]: min. 18 sq m / unit

Total average: 17.5 + 17.43 + 18 = 17.64 sq m / unit (not actual room!)
Total amount sq m: 44,000 / 17.64 = 2,494 units (approx. 2,500)

1.3 Research questions
In order to answer the main research question this research has been divided into five parts:

> Part I: 'Background and research definition'
> Part II: 'Theoretical research'
> Part III: 'Practical research'
> Part IV: 'Data analysis and reflection'
> Part V: 'Conclusions and recommendations'

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[3] 'Gemiddelde kamerprijs per studentenstad' SUM (2011)

[4] 'Check je kamer – Resultaten 2009-2010' LSVb (2010) pp. 14

[5] 'Studentenkamers van 18m2 in het Bouwbesluit 2012?' Omgeving in de praktijk (2011)

Part I: 'Background and research definition'
The first part of this research is based on giving background information about the main problem of this research, the problem statement, the hypothesis that has to be tested and the main research questions that are going to be used to validate this hypothesis.

The main research question for this research is as follows:
Is there a demand for developing student housing on the TU Delft campus? Can this demand be accommodated in the vacant real estate of TU Delft and to what extent?

As a way of describing the research background more clearly, this thesis will elaborate on one specific case, which is the TU Delft campus. This part will give a short introduction about the location, target group, actors, development plans and ways of measuring the performance of these developments. As mentioned, this case will be used as the basis for this research.

Part II: 'Theoretical research'
The second part of this research will elaborate on three main subjects: 'real estate management', 'accommodation strategies' and 'assessment methods'. The first chapter on 'real estate management' will mainly focus on the management of universities and campuses. The differences of managing universities as compared to other corporations and ways of approaching the management of universities will be discussed. Chapter two 'Accommodation strategies' will mainly elaborate on different ways of developing real estate strategies. This will be compared to the accommodation strategy that TU Delft is using now. The last chapter about 'assessment methods' will focus on universities as well. Universities most likely have different main goals as compared to corporations, thus different ways of assessing the real estate. The way in which universities could be assessed will be explained in more detail as well as the main assessment criteria.

The information required for this chapter will mainly be based on extensive literature review on the three subjects mentioned. To define more specific assessment criteria, chapter three of this research will use interviews to determine specific actors' needs. Part II of this research should end with the following products:

- A scheme that shows the main criteria when managing university real estate;
- A scheme that shows the main differences between accommodation strategies found and the strategy of TU Delft;
- A basic assessment model, which could be used to assess university's real estate.

Part III: 'Practical research'
The third part of this research will focus on answering the first four sub-questions:

- What is the current real estate supply of student housing in Delft? And what is the current assessment value/condition of the real estate in question?

- How does the development of the TU Delft area look like from the perspective of the actors involved? Which actors are involved? And are there possibilities to develop student housing?

- Which areas on the TU Delft campus are eligible to be developed as student housing, given the fact that 44,000 sq m is expected to be vacant?

- How is the environment changing the future demand for educational functions, for each actor involved?

Part III will first start with defining the exact boundaries for this research by defining areas that are related to the research area in question and by defining which actors are involved. Each actor will be asked to give his/her future perspective on the development of the TU Delft area. Based on these results it should be clear whether the development of educational functions (e.g. student housing) has been taken into account.
The second chapter from Part III will elaborate on the changing demand for educational functions. Again, the actors in question will be asked to what effect the changing environment has on their future demand, as development of the TU Delft area concerns.
The possibilities of developing student housing on the TU Delft campus is the last step. The areas that cover the 44,000 sq m of vacancy will first be assessed to determine whether they're suitable to be developed as student housing. Which areas will be used cannot be determined at this point, as additional information is needed, which will be discussed in part IV.

Information required for this part of the research will partially derive from available documents, as these already contain some of the data needed. However, the need for actor specific data plays a bigger role in this part. The only way of getting this information is through interviews with the actors in question. The conclusions of Part III should be included in the following end products:

- A scheme that shows quantitative and qualitative data of the current student housing supply;
- A scheme that contains the development demands of each actor in question and how this demand is changing;
- A list that contains areas that are eligible for student housing;

Part IV: 'Data analysis and reflection'
In general, this part will analyze, compare and process the data acquired in the previous chapters. The first chapter of this part will focus on exploring other

possibilities, university related functions, of developing the vacant areas in question (results taken from Part III).

The second chapter will explore the changing demand of developing student housing based on actor scenarios. To give an indication of what the future might look like, the actors will be asked to give their view on which scenario is most likely to happen.

The last chapter of Part IV will focus on the added value of student housing for the actors involved. As the main goals of each actor vary, so does the added value of developing student housing. Actor interviews will be used again to determine the main conditions of developing student housing. This information will be used as weighs and alternatives and will in particular be useful when developing recommendations. In this way you can take into account every actor's needs.

Based on the results, sub-questions five through seven will be answered:

- What are other possibilities of the real estate areas in question? Which functions of TU Delft can be accommodated in which areas?

- What are the most important criteria for developing student housing for each stakeholder involved?

- How are different actor scenarios affecting future development plans for student housing? Which scenario will most likely take place according to each stakeholder?

The end products of Part IV should consist of:

- A scheme that shows the development possibilities of each area that is eligible to be developed as student housing (addition to the scheme in Part III);
- A scheme that shows different stakeholder scenarios and their effect on the development of student housing;
- A list of weighs and alternatives which should be used to determine recommendations in part V;

Part V: 'Conclusions and recommendations'
The last part of this research consists of a short summary of the main conclusions found throughout this research. The main focus will however be to give an answer to the main research question and to develop recommendations for the development of student housing within the TU Delft campus. As mentioned, for this particular case the assessment criteria of each stakeholder should be taken into consideration carefully before establishing the final recommendations. Prior to developing recommendation, the last sub-question has to be answered:

- At what point should TU Delft consider investing in (or making its real estate suitable for) student housing?

To do so, calculations should be made based on three types of development: renovation, transformation or demolition and construction. This will give an overview of the building costs based on the type of work that has to be done.

1.4 Research structure

Figure 5 shows the research structure designed for this thesis. As mentioned, the research questions will all be answered within their respective part:

- Question one will be answered in chapter 1 of Part III.
- Questions two and four will be answered in chapter 2 of Part III.
- Question three will be answered in chapter 3 of Part III.
- Question five will be answered in chapter 1 of Part IV.
- Question six will be answered in chapter 3 op Part IV.
- Question seven will be answered in chapter 2 of Part IV.
- Question eight and the main research question will be answered in chapter 2 and 3 of part V.
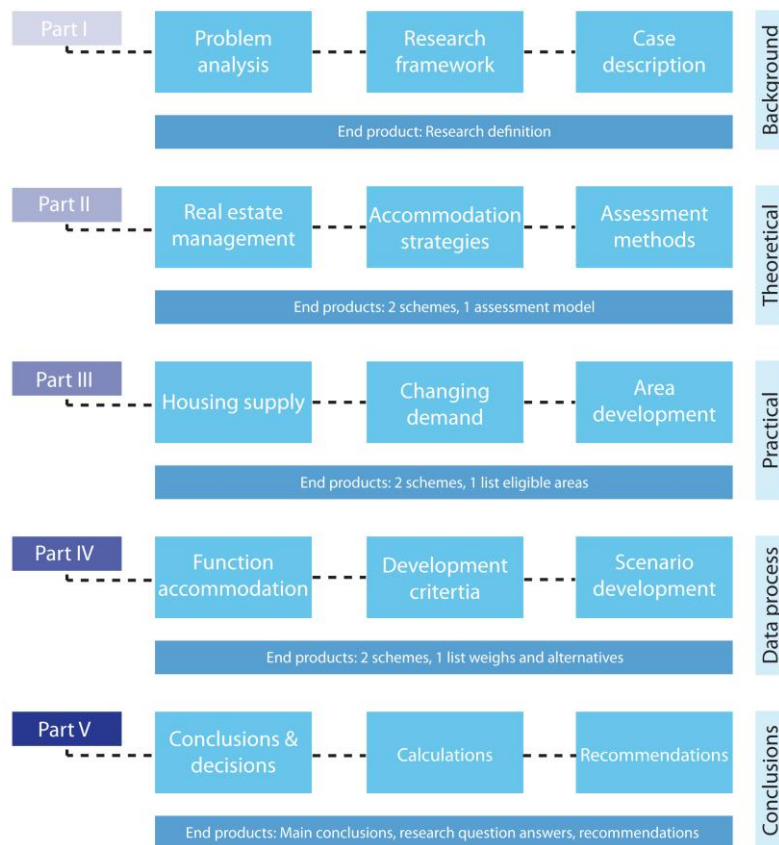

Figure 5: Research structure

1.5 Academic relevance

The main theme and subject of this research is closely related to the PhD research 'Managing the university campus', which was published recently by Alexandra den Heijer MSc PhD (2011). Her PhD research is focused on gaining more information on campus management and developing tools that can support the tasks of campus managers (den Heijer 2011, pp. xi). Stakeholder analysis, performance criteria and function accommodation are some of the topics that are being mentioned as well.

This research continues with the subject on function accommodation and focuses on one function in particular that has been mentioned by den Heijer (2011, pp. 184, 228), which is student housing. The importance for a university of developing student housing has already been mentioned (den Heijer and de Vries 2006; Marlet 2009; DUWO 2010, pp. 25; TU Delta .36 2011, pp. 36). Therefore, this research focuses on contributing towards the research on the accommodation and development of student housing.

The intended end product of this research will consist of a list of recommendations developed in particular for the university of Delft (TU Delft), which should assist decision makers by giving valuable information on which decisions satisfy the needs of the actors involved. In order to do so, research on accommodation strategies and 'Designing an Accommodation Strategy (DAS Frame)' (de Jonge *et al.* 2009) has been implemented as well. Topics that are being mentioned in the 'DAS Frame' will be implemented on the case of TU Delft, which is being used as a starting point for this research.

1.6 Social relevance

From a social perspective, this research stimulates four themes, which are important for both a knowledge city like Delft and TU Delft: knowledge creation, economic growth, attractiveness of the place/city and user satisfaction. The results from a international symposium of 'Enhancing City Attractiveness for the Future' (OECD 2005) explains that one of the elements that enhances the city's attractiveness is the availability and quality of the housing stock.

Marlet (2009) and van den Berg and Russo (2004) explain that attractive cities are cities that contain residential attractions, nature and work or study close to home. According to Marlet, people tend to search first for a place to live and then for a place to work or study. Thus, providing sufficient and quality student housing in close range to the university should make Delft more attractive as a place to live and study. Having an increase in student numbers attending a study at TU Delft should result in an increase in knowledge development as mentioned by den Heijer and de Vries (2006).

Furthermore, this research is also contribution towards the 'Landelijk Actieplan Studentenhuisvesting 2011-2016' (Ministerie BZK 2011), by helping solve the nationwide shortage of student housing. At first, this research is an effort to decrease the shortage in the city Delft, but it is also an effort of creating an example for other cities and universities.

1.7 Research timetable

The way, in which the planning has been made for the remaining weeks, is presented in figure 6. Due to a resit, the time available should be used more efficiently and more data should be processed within a shorter time period.

Month '12	Week	Primary task	Secondary task
January	Week 3 Week 4	**P2 Presentation** Resit: processing reflection given at P2 presentation	Take notes of reflection given Rewriting P2-report
February	Week 1 Week 2 Week 3 Week 4	Finishing P2-report for resit **Resit: P2 Presentation** Quick pace: literature review on selected topics	Hand-in P2 report and start working on P2-presentation Take notes of reflection given, quick start with literature review Developing interviews and arranging appointments
March	Week 1 Week 2 Week 3 Week 4	Finishing last parts of literature review Start working on Part III **P3 Presentation**	Start finishing Part II of the report Process data gained by interviews, and determine what is missing Preparations for P3 presentation, new appointments for interviews
April	Week 1 Week 2 Week 3 Week 4	**P3 Presentation** Correct P3-report where needed and finish part III Continue with part IV	Reflect on comments given during P3 presentation, start finishing Part III Process data gained by new interviews, start with part IV Data analysis and processing
May	Week 1 Week 2 Week 3 Week 4	Finish part IV and make main conclusions from all chapters Start developing real estate recommendations Continue with real estate recommendations Finish part V, Preparations for P4 presentation	Start with part V Answering question 8 and main question Preparations for P4 presentation
June	Week 1 Week 2 + 3 Week 4	**P4 Presentation** Correct remaining parts of P4-report and start with refining report and conclusions **P5 Presentation**	Reflect on comments given during P4 presentation

Figure 6: Research timetable

2. Case description

As mentioned earlier, the focus of this report will be on the city of Delft with the TU Delft campus in particular. This chapter will describe the case in more detail, starting with the location. Zooming in one step further will show the exact areas that are expected to become vacant. Because this case also affects the city of Delft, there should not be only one actor and only one target group. The main target group and actors, with their background and main goals, will be explained. Based on the National Plan ('Landelijk Actieplan Studentenhuisvesting 2011-2016') a closer look will be taken at the current plans made for future developments. The real estate in question concerns TU Delft's real estate; therefore future developments should be of adding value to the university. The way in which this should be measured and assessed will be explained at the end of this chapter.

2.1 Location

The city of Delft is located in the province of 'Zuid-Holland' between two big cities, Rotterdam and The Hague (figure 7). Delft is a knowledge city that is more than 750 years old and that has been a wealthy merchant town during the Golden Age with famous scientists and painters.

In 1842 the Royal Academy of Civil Engineers was developed, which from 1986 is known as Delft University of Technology (TU Delft). Today, TU Delft is known to be the biggest employer in the city of Delft (Gemeente Delft 2012). The university is collaborating with other education and research institutions in order to develop a high standard of research and education.

Figure 7: Location of Delft within the Netherlands (Source: Google Maps 2012)

TU Delft puts a focus on taking a clear position in an environment, which is becoming more competitive for men and where the role of money is increasing (TU Delft 2012). To achieve its focus and to support its vision, TU Delft is interacting with internal and external stakeholders. This should contribute towards the development of TU Delft, but also towards the development of Delft as a knowledge city.
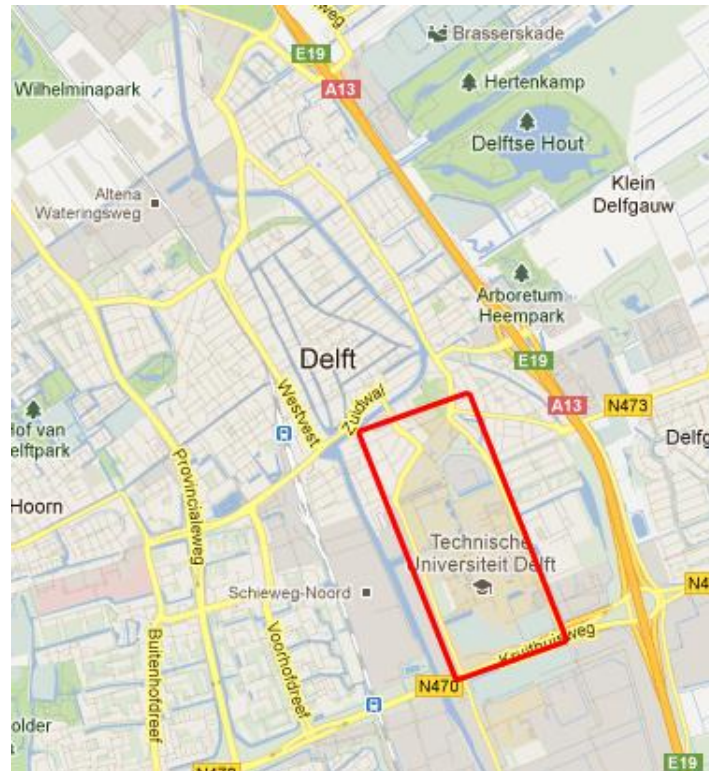

Figure 8: Location of TU Delft within the city of Delft (Source: Google Maps 2012)

As can be seen in figure 8, the TU Delft campus is located in the southern part of Delft. Three major roads enclose the area: the N470, which is located at the southern edge of the campus, and the A13 and E19, which are located east of the campus. In addition to these major roads various bus lines and two train stations are located relatively close to the campus, which give the campus several access options.

This is also the area where the vacant real estate in question is located, which is presented in figure 9. Given the information from the annual report of 2010, it is clear that the 44,000 sq m in question is not located within one building. As a matter of fact, the 44,000 sq m is divided amongst eleven buildings. The sizes of these areas vary from 324 – 6,529 sq m, as well as the type of area. Table 2 shows the areas in question, the amount of sq m per area and the respective type per area.

Labels on map:

Kramerslab
3.382 sq m

PMB
1.292 sq m

Building part 5B
1.567 sq m

MSP
Office/Hall
2.585 sq m

P&E
Lab + Hall
4.512 sq m

DCE bdp. 8b
410 sq m

Stevin II
6.529 sq m

Stevin III
716 sq m

EWI Veemhal
1.293 sq m

L&R - 3,4,10
Office
1.545 sq m

TUDL area
Fellowship
324 sq m

Figure 9: Prognosis vacancy University of Delft (Source: TU Delft 2010, pp. 66)

Building	Surface (sq m)	Area type
Kramerslab	3,382	Laboratory
PMB	1,292	Machine area
Building part 5B	1,567	n/a
MSP	2,585	Office/Hall
P&E	4,512	Laboratory + Hall
L&R – 3,4,10	1,545	Office
TUDL area	324	Education
DCE bdp. 8b	410	Office
Stevin II	6,529	Laboratory
Stevin III	716	Laboratory
EWI Veemhal	1,293	Hall

Table 2: Expected vacancy and area type per building (Data: TU Delft 2010, pp. 66)

2.2 Target group

Based on the background of this research, this thesis will focus on the following three target groups:

- Cities and universities who seek ways of coping with student housing problems;
- 'FMVG' who is required to design accommodation strategies for TU Delft;
- Academics who seek interest in the development and management of university campuses.

2.3 Actors

Initiations for coping with the student-housing problem have already started, as a national plan has been made with a variety of actors. Because the target areas are dispersed across the TU Delft campus, the campus is being considered as the main target area. However, areas located right next and in close range to the campus are being considered as areas that should be taken into consideration as well. Therefore, TU Delft is not the only actor that is involved in this area. Given the data in the 'Landelijk Actieplan Studentenhuisvesting 2011-2016' (2011) the following list of actors can be made:

- Municipalities
- Higher education institutions
- Student housing authorities (united in KENCES)
- Private landlords / housing authorities (united in Vastgoed Belang)
- Students (united in LSVb)
- Ministry of the Interior and Kingdom Relations (Ministerie BZK)
- Residents

The above-mentioned list is a general list that account for the Netherlands. However, this research is only focused on the city of Delft, which means that the list has been narrowed to actors that are only applicable for the area in question. The results are shown in table 3. The core actions of the above-mentioned actors can be found in appendix A.

Group of actors	Actors in relation to this research
Municipalities	Municipality of Delft
Higher education institutions	TU Delft, Hogeschool INHOLLAND, Haagse Hogeschool, FMVG[6]
Student housing authorities	DUWO, Vidomes Delft, Vestia Delft, Woonbron Delft, AM Wonen
Private landlords	United in Vastgoed Belang
Students	United in LSVb, VSSD
Ministries	Ministry of the Interior and Kingdom Relations
Residents	All residents within the boundaries of the area in question

Table 3: Actors related to this research (Data: 'Landelijk Actieplan Studentenhuisvesting 2011-2016' 2011, pp. 45; Gemeente Delft 2012) edited

2.4 Development plans

The 'Landelijk Actieplan Studentenhuisvesting 2011-2016' (2011) is one of the documents that show development plans for student housing. Recently, ARCADIS (2011) published a zoning document for the southeastern part of Delft (accepted by the municipality of Delft). This document describes three different alternatives for the development of the southeastern area: 'Alternative spread', 'Alternative around public transport' and 'Alternative Maxi'. All three alternatives incorporate the TU Delft campus. A schematic representation of the three alternatives is shown in figure 10.
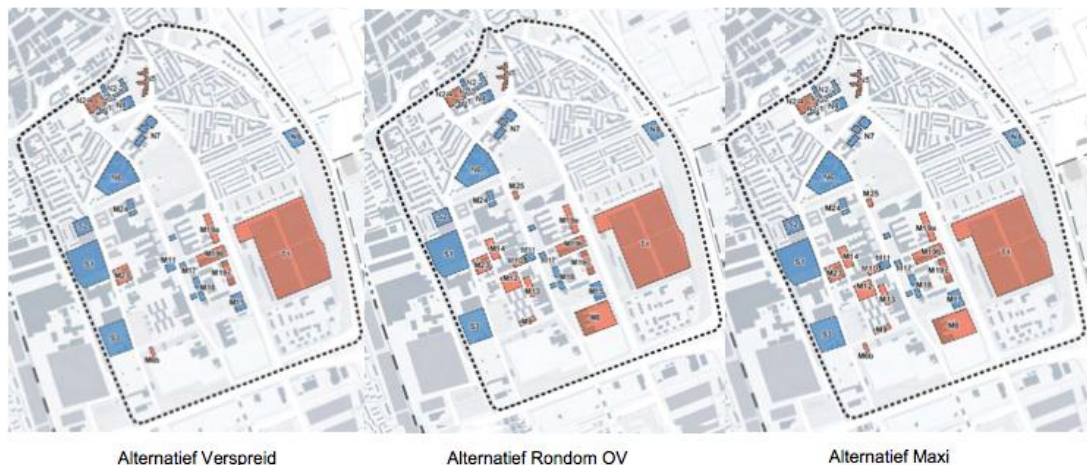

Alternatief Verspreid   Alternatief Rondom OV   Alternatief Maxi

Figure 10: Alternatives for the development of southeastern Delft (Source: 'ProjectMER bestemmingsplannen Delft Zuidoost' ARCADIS 2011, pp. 12)

The key elements of the three alternatives are:

- 'Alternative spread': based on 4,800 housing units, spread throughout the area;
- 'Alternative around public transport': based on 4,800 housing units, located around public transport stops;
- 'Alternative Maxi': based on maximum utilization of space, combining the developments of the previous two alternatives.

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[6] FMVG is being a part of Delft University of Technology and is therefore included in group 'Higher education institutions' (FMVG 2011)

In addition, the presented alternatives are based on four types of development (ARCADIS 2011):

- Development in housing (e.g. apartments, student housing, regular houses), tourism and business;
- Development of the water structure;
- Principles and developments of the ecological structure;
- Principles energy and sustainable development.

Given the fact that this research puts a focus on student housing, makes the first development type the most important one. However, the development plans have to be approved by the municipality on several aspects, which means that the other three development types have to be taken into consideration as well.

Data in the zoning document shows that all three alternatives have several developments in common. Focusing on the development of student housing gives the results as presented in table 4. It can be concluded that each alternative has a fixed amount of student units, which in this case is 695 units, distributed amongst five areas. As table 4 shows, these are all new developments. The locations of the areas in question are presented in figure 11.

Area nr.	Location	Developments
N2-1	Mijnbouwhof	75 st. units (new)
N2-2	Kanaalhof	200 st. units (new)
N2-3	Prof. Schermerhornstraat	200 st. units (new)
N8	Pauwmolen	150 st. units (new)
S1	'Nieuwe Haven'	70 st. units (new)

Table 4: Development of student housing in all three alternatives (Data: 'ProjectMER bestemmingsplannen Delft Zuidoost' ARCADIS 2011, pp. 13)

Two of the intended areas are located at the edges of the TU Delft campus, while the third area (N8) is located approx. 800 m east of the campus.

The other, alternative bound developments are presented in table 5. Results show that the difference between 'alternative spread' and 'alternative around public transport' is relatively large. The 'alternative around public transport' is supposed to offer 3,075 student units compared to 1,985 student units in 'alternative spread'. 'Alternative Maxi' plans on developing 4,365 student units. The locations of the areas in question are presented in figure 12.
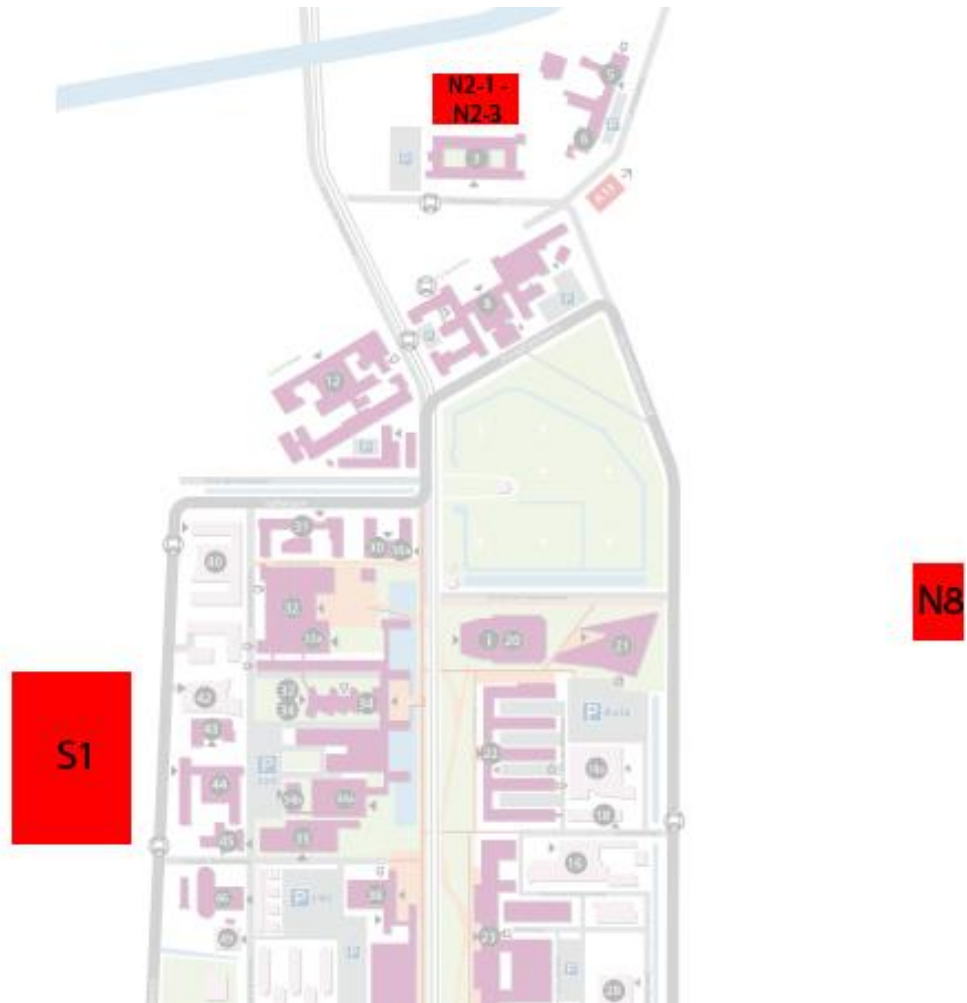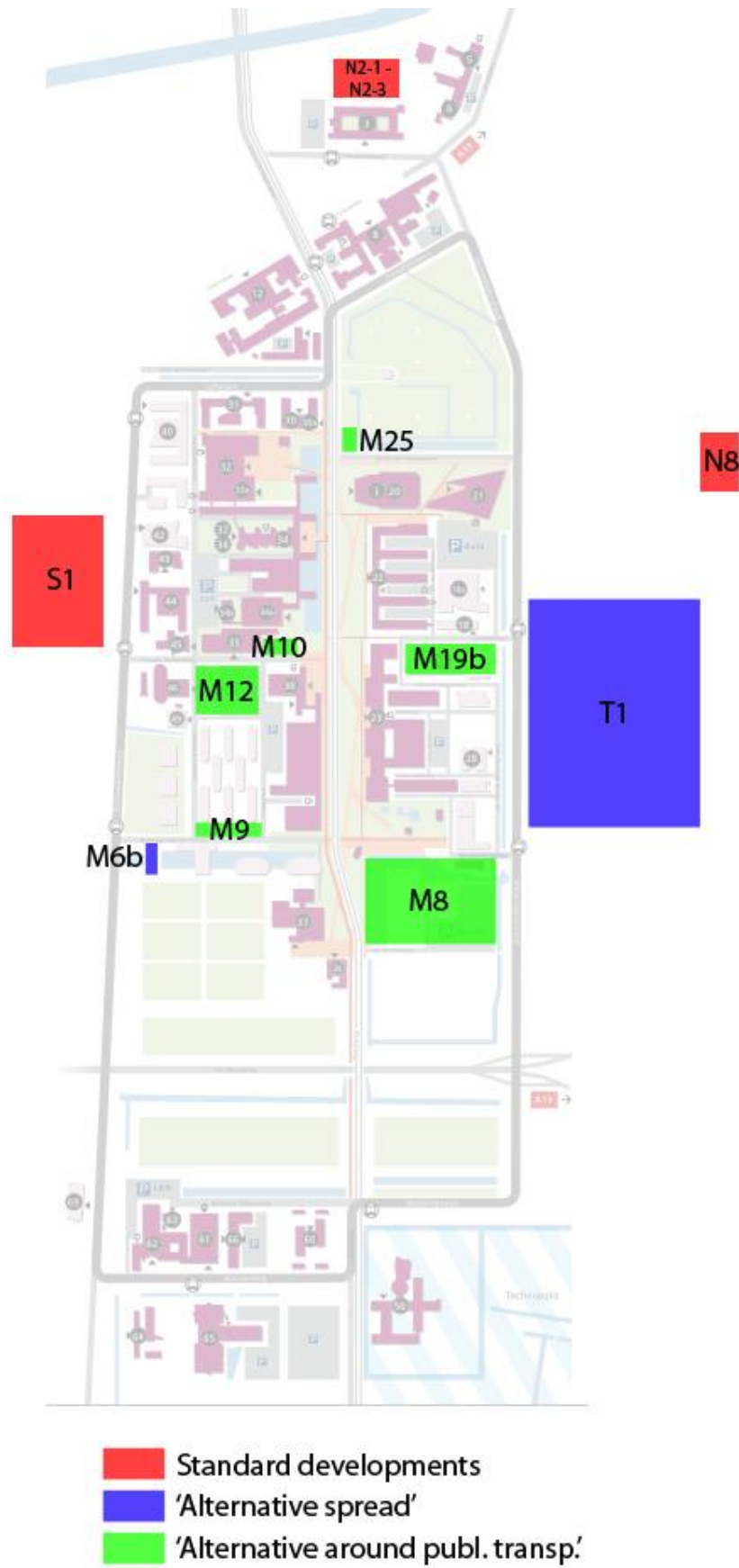
Figure 11: Development areas of student housing (Data: 'ProjectMER bestemmingsplannen Delft Zuidoost' ARCADIS 2011, pp. 12-13)

'Alternative spread' (Area nr.)	Location	Developments
M6b	Balthasar vd Polweg 4	250 st. units
T1	Area between A13, Deltechpark, Schoemakerstraat, Professorenbuurt	1,040 st. units
'Alternative around publ. transport (Area nr.)		
M8	Berlageweg 1	800 st. units
M9	Balthasar vd Polweg Noord	200 st. units
M10	Mekelpark	255 st. units
M12	Cornelis Drebbelweg	680 st. units
M19b	Schoemakerstraat 1	200 st. units
M25	Mekelpark 1	245 st. units
'Alternative Maxi'	**All areas mentioned**	**4,365 st. units**

Table 5: Development of student housing per alternative (Data: 'ProjectMER bestemmingsplannen Delft Zuidoost' ARCADIS 2011, pp. 13)

Figure 12: Development areas of student housing incl. alternatives (Data: 'ProjectMER bestemmingsplannen Delft Zuidoost' ARCADIS 2011, pp. 12-13)

Based on the results, it can be concluded that a relatively large part of the developments should take place on the TU Delft campus. According to the zoning document, the development of approx. 1,300 – 1,450 student units has already been accepted. The estimated number of student housing that is needed in Delft by the year 2023 is expected to be 5,000 (RIGO 2011 in ARCADIS 2011). This means that additional 3,550 – 3,700 units are still needed.

2.5 Performance indicators

Based on the information gained so far, several conclusions about developing student housing have been made (table 5).

Conclusion	Adding value by
There are possibilities of accommodation student housing within the vacant real estate of TU Delft. This could mean that areas, which are in bad technical condition, are being transformed to student housing, which in turn should **increase** the **technical condition**.	**Increasing technical condition of areas**
Knowledge is the engine of a knowledge-based economy, thus knowledge creation leads to **economic growth** (den Heijer and de Vries 2006; Florida 1999; 2006; Marlet 2009)	**Economic growth**
Having a place to live close to a place to study **increases** the **attractiveness of a city** (Marlet 2009; van den Berg and Russo 2004; OECD 2005)	**Attractiveness of a city/place**
Students are in need of additional student housing. Developing additional student housing should cope with the current housing problem. **User satisfaction** should therefore **increase** as the demands have been met (NSE 2011)	**User satisfaction**

Table 5: Added value of student housing development

Developing student housing in the TU Delft area should add value by the elements mentioned in table 5. To make this possible, the developments should be assessed according to stakeholders' individual needs.

Literature review shows several models, which describe the added value of real estate to an organization (De Jonge 1996 in Singer 2008, pp. 5; Lindholm 2008, pp. 26-27). The effect and possible relationships of real estate on higher education institutions have been described by de Vries (2007) for higher professional education and by den Heijer (2011) for universities.

Four perspectives (stakeholders) have been mentioned that should determine the added value of real estate: physical (technical managers), functional (users), financial (controllers), and strategic (policy makers) (De Jonge *et al.* 2009; den Heijer 2011). The list of stakeholders has been supplemented by den Heijer by adding several key performance indicators (KPIs) to measure a university's performance (den Heijer 2011).

The KPIs mentioned by den Heijer have been linked to the results of table 5, which has resulted in a list of performance indicators to be used for this research. As these developments affect both the city and the university, two tables have been made: one represents the university (table 6), the other represents the city (table 7).

Adding value by	What to measure (KPI)	How to measure
Increasing technical condition of areas	• the percentage of the campus in (very) bad technical condition • the percentage of the campus that could easily be sold or disposed	• condition based monitoring • market analysis
Economic growth	• costs/benefits of proposed project in comparison with alternatives	• project database
Attractiveness of a city/place	• quality before and after • user requirements and willingness to pay for quality • references on quality related to costs	• Maslow's pyramid with cumulative user needs, connected to investment levels • project database with references
User satisfaction	• student satisfaction over the years	• post-occupancy evaluations: customer satisfaction

Table 6: University: Assessment methods and tools for the development of student housing (Data: 'Managing the university campus' den Heijer 2011, pp. xxiv, 100, 246, 247)

Adding value by	What to measure (KPI)	How to measure
Increasing technical condition of areas	• vacancy rates • possibilities of transformation	• market analysis • transformation tools (Remøy 2010)
Economic growth	• costs and benefits of foundations of knowledge city • GDP per capita • purchasing power of population	• references of other knowledge cities (Van den Berg *et al.* 2005)
Attractiveness of a city/place	• attractiveness of city, as place to live • attractiveness of city for businesses • diversity in urban population	• Who's your city (Florida 2008) • attractive city index (Marlet 2009)
User satisfaction	• units student housing • quality of (student) housing	• Who's your city (Florida 2008) • attractive city index (Marlet 2009)

Table 7: City: Assessment methods and tools for the development of student housing (Data: 'Managing the university campus' den Heijer 2011, pp. xxiv, 100, 246, 247)

Each KPI mentioned in table 6 should have its own assessment method. The way in which the real estate should be assessed is based on specific stakeholder's needs. Interviews with the stakeholders, which still need to be conducted, should give more information. Therefore, the assessment of real estate developments will not be elaborated at this point.

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Appendix A

Actors in question	Core actions**
Municipalities *(Municipality of Delft)*	- Developing additional student housing (incl. location scan and conversion permit) - Remove obstacles (for the development of student housing) from municipal policy - Land price ➔ social (in case of student housing) - Zoning exemption - Involve all stakeholders and develop performance agreements - Stimulate development of local action teams
Higher education institutions *(TU Delft, Hogeschool INHOLLAND, Haagse Hogeschool, FMVG*)*	- Developing on own land and within own real estate properties (combining education and student housing) - Land price ➔ social (in case of student housing) - Informing housing authorities early - Accommodation of international students important (making appointments with housing authorities) - Avoid overlap of semesters (international students) ➔ avoid overlap housing demand
Student housing authorities *(DUWO, Vidomes Delft, Vestia Delft, Woonbron Delft, AM Wonen)*	- Providing sufficient student housing - Developing 16,000 student units till 2016 - Doubling the investment volume through investments outside own sector - Develop more units ➔ growth in market share ➔ lower rent prices for students - Actively seek for additional finance - Converting regular housing to student housing - Research and developing new tools (e.g. 'Monitor studentenhuisvesting')
Private landlords *(united in Vastgoed Belang)*	- Offer possibilities of being an actor for the development of student housing - Active participation in increasing supply - Offering living space that is not (or not sufficiently) being offered - Finding possible match between office owners and development of student housing - Realization and doubling of investment funds - Stimulation of certifying potential landlords
Students *(united in LSVb, VSSD)*	- Actively in search for housing - Accepting the relatively low chance of receiving a student house on a A-location as a first year student - Helping with building student housing - Participating in district development - The wish for a diverse supply and involvement in local theme groups
Ministries *(Ministry of the Interior and Kingdom Relations)*	- Tax exemption for independent landlords - Supporting research of KENCES and Vastgoed Belang - Identifying problems for shared accommodation - New building code for student housing - Extending temporary waiver of zoning (from 5 to 10 yrs.) - Energy labeling method and property valuation system - Research for additional rent possibilities for two student groups: stay < 2 yrs. Or stay > 2 yrs. - Encourage independent housing options for students (within the housing benefit, without affecting other groups within the housing benefit)

Table 8 : Actors in question and their core actions (Data: 'Landelijk Actieplan Studentenhuisvesting 2011-2016' 2011, pp. 45)

**Note that the mentioned core actions only account for the general list of actors and not for the actors that are specific for this research. A list of core actions for each specific actor in question should be made available later, as this research progresses.