CME – Master Thesis

Maintain a dynamic office real-estate market in the province Noord-Brabant.

The office real-estate market, what are the effects of policies to bring back the equilibrium in the real-estate office market and vanish structural vacancy?

's Hertogenbosch case study

Date: March 5, 2013
Final presentation March 12, 2013

Author

G.L.J.J. Lamers (Geert)
Student number: 0751115
E-mail school: g.l.j.j.lamers@student.tue.nl
Telephone number: +31 6 11 340 430

Evaluator/ supervisors

Eindhoven University of Technology

Prof. dr. ir. W.F. Schaefer (Wim)
E-mail: w.f.schaefer@tue.nl
Ir. B. van Weenen (Bart)
E-mail: b.v.weenen@tue.nl
Dr. Q. Han (Qi)
E-mail: q.han@tue.nl

Brabantse Ontwikkelings Maatschappij

Ing. A. van der Heijden (Ad)
E-mail: avanderheijden@bom.nl
Drs. Ing. C.M. de Haan (Katja)
E-mail: kdehaan@bom.nl

Content

Part 1 – Problem introduction **2**
1. Introduction **3**
1.1. General introduction 3
1.2. Reading guide 4
2. Research framework **5**
2.1. Problem definition 5
2.2. Research Questions 5
2.3. Research Methods 7
Part 2 – Theoretical framework **12**
3. The financial structure of investment funds **13**
3.1. The present mode of operation within the real-estate industry 13
3.2. The different valuation methods of real-estate (offices) 15
3.3. The use of loans and leverage 17
3.4. Summary 19
3.5. Financial aspects within the real-estate office model 20
4. Investment behavior of office owners **21**
4.1. General behavior of investors 21
4.2. Behavior within the real-estate market 22
4.3. The willingness to invest in real-estate 23
5. The various factors which influence vacancy **27**
5.5. Influence aspects within the real-estate office model 33
5.6. The present state of the art 33
6. The life cycle of real-estate, the ageing part **35**
6.1. Technical ageing, the technical life cycle of real-estate 35
6.2. Economical ageing 36
6.3. Economical and technical depreciation translated to the office model 37
7. Governmental policies **39**
7.1. Various instruments of control, by the government, passive or active 39
7.2. WRO, spatial planning act 40
7.3. Expropriation, and pre emption right 41
7.4. GREX, (land development act), BIZ, Business investment zones 43
7.5. The present state of the art in the office market, awakening to adaption 44
Part 3 – Modeling process **46**
8. GIS – modeling **47**
9. System Dynamics Modeling **51**
10. Game Theory analysis **65**
10.1. Different Game Theory scenarios for simulating the System Dynamics model 66
Part 4 – Outcome **74**
11. The real-estate office model results **75**
11.1. Geographic information results 75

11.2. System Dynamics results 76
11.1. Game Theory results 81
12. Conclusions 87
12.1. Geographic information systems 87
12.2. System Dynamics conclusion 87
12.3. Game Theory Conclusion 89
12.4. Conclusion out of interviews 90
12.5. Overall conclusion 91
13. Discussions 95
14. Recommendations 97
Reference list 100
Appendix 103

Preface

In this document I present my graduation thesis for the completion of the master Construction Management and Urban Development at the Eindhoven University of Technology (TU/e). This study is one of the forerunners of a possible 'vacancy' research programme. Which helps to recognize the problem, tries to predict the future, and figures out possible solutions.

First of all, research is not just collecting data and making wise conclusions, it is more. A good researcher should also be a good project manager. The main pillars are: time management (get the right data at the right time), and decision making. During the production of this research both were extreme important. I started the data collection early with a wide approach. In the beginning I thought I could model the whole province of Noord-Brabant within 3 weeks, these wide naïve approach helped me by collecting too much information (the whole Brabant Stad), luckily different experts strictly advised to have a focus one location, by the use of one, maybe two research methods. Which all the expert meetings were helpful, but they all had a different focus, hence a different direction which they advised, for this the decision making was important to construct a good construction boundary.

Second, I would like to thank the Brabantse Ontwikkelings Maatschappij (BOM), Especially Ad van der Heijden by giving me the opportunity by facilitating this research, despite of the small difference between this research subject (offices) and their core business (industrial areas), my colleagues by their substantive and social chats, and last but not least, the constructive criticism of internal supervisor Katja de Haan, Katja you helped the research towards a higher level. Furthermore I would like to thank my supervisors Bart van Weenen and Qi Han from the TU/e, Bart for his practical approach and support, Qi for the scientific approach and quick chats by just walking to her offices.

At the end I want to thank my parents, by their support, they gave me the opportunity to study. Beside this I want to thank my friends, for the chats which have nothing to deal with doing research.

By the completion of my master and providing this research I hope I constructed a road map which helps the province of Noord-Brabant to manage the real-estate office market. Especially by giving insight in the different influential aspects by the use of System Dynamics.

Enjoy reading,
Geert Lamers
Tilburg, march 2013

Management Summary

The past decades the real-estate office market in the Netherlands has produced a lot of newly built offices. This because of the economical growth and the development eagerness of both municipality and project developers. This lead to too much office stock, which there is possible a wrong distribution of the present stock.
Which there is no need for extra scientific research to demonstrate the structural vacancy in the office real-estate market in the Netherlands. But to indicate how big this problem is, some facts and figures: The office stock in the Netherlands consists of 41 million m2 in use and 7,6 million m^2 in offer, this means a vacancy rate of +/- 15,6%. This overall rate could be divided in cyclical vacancy approximately 5% (the dynamics of the market) and structural vacancy (over stock, mismatch between demand and supply).
Normally the government could leave the problem by the office owners. By this scenario there occur two major problems. On the first hand the supply of new office which they mostly provide land (these give the government financial benefit). Beside this it is a social problem, this because lots of pension funds have invested in office real-estate, a freefall could be a financial catastrophe for lots of (future) retired people.

A first step in this research has been a literature study, this to determine the state of the art. Major items are: the financial structure of investment funds, investment behavior, vacancy influence factors, the life cycle of real-estate, and governmental policies.
To get grip on the office vacancy first the market is mapped. For this a GIS-analysis is done which 's Hertogenbosch is used as case study. The vacancy influence factors: 'geographic location' and 'quality' are represented in the GIS-model.
Second the factors out of the literature study are used to construct a System Dynamics model which simulate the office real-estate market.
The first 3 scenario simulations are representing the present situation. They predict the effect of economical growth and shrinkage, with the most probable decisions.
The last 3 scenarios simulations predict the market behavior by the use of different measures which could bring back the equilibrium in the real-estate office market. In general these scenarios simulate the use of:

1) Hierarchal governmental office withdrawal (demolishing or transformation);
2) Vacancy Tax (a collective tax to create an office fund);
3) Development credits.

At the end of the research the preference of different policy makers out of the B5 region is measured by the use of Game Theory.
Finally, it is possible to adjust the real-estate office market. It only has huge implications. For this the government as well as the office owners should do concessions, and have more a focus on quality improvement by (re)development. Instead of new developments.

Glossary

Within this paragraph the most important definitions within the office real-estate industry will be defined. This to create a clear view about which we talk by which definitions.

The definition of vacancy: In almost all the research offices with a bigger amount then 500m^2 are/will be taken along. By the survey to monitor the statistics only the rentable area will be measured (Dutch: v.v.o./ verhuurbaar vloer oppervlak).
The next definitions are common used:

- *DTZ, 2011:* 'Offered office space in realized buildings during the moment of inventory are not been used'
- *van der Voordt, 2007:* 'Not rented offices (or parts of them) in general'
- *Bak, 2011:* An office is a building bigger then 500m^2, which they are mostly offices activities will be provide. The registration of vacant offices is also limited to municipalities with at least 10.000 m2 office space. The national database of BAK covers at least 90% (within the stated definition).
- NVM, 2011: An office could be nominated as structural vacant as the building in three consecutive years constantly offer the same amount of square meters.

Institutional/ public investors: Financial institutions which because of their function the position have to invest cash for a long period. Institutions which invest in real-estate are: pension funds, insurance companies, and investment companies.
Professional/ private investors: This group exists out of the institutional investor and the listed real-estate funds.
Normative aging: If an office not meet the actual quality standards of users, this could have a relation with technical aging, but also with the change demand of users.
Economical ageing: If the exploitation of an office is no longer profitable.
The supply side: The supply is the total office supply including the vacant offices. For the definition of a vacant office there are used several different definitions, the next are set by leading researchers.
Hard plan capacity: Available land (greenfield or brownfield) with already a zoning plan which there could be developed new real-estate.
Soft plan capacity: Available land (mostly greenfield) with no zoning plan which there could be developed new real-estate.
BrabantStad (B5): A cooperation between the 5 biggest municipalities in the province of Noord-Brabant. (Eindhoven, 's Hertogenbosch, Tilburg, Breda, and Helmond). In these municipalities are the most offices of the province located.

Part 1 – Problem introduction

1. Introduction

1.1. General introduction

'The dynamics of the office market'. The previous sentence could be a description of the whole real-estate office market, the previous sentence is comprehensive but finally means nothing. It only indicates the complexity of the market. To create a complete picture this part of the research will introduce the boundaries of the problem consideration and it will state the major notions.

In general the office property market is clearly characterized by a succession of cycles, with expansionary and recessionary stages emerging as direct response to monetary and fiscal policies, to economical parameters, and trends in the use of offices.
The game between demand and supply of offices is interactive with always a form of tension, which it makes it interesting. To give the market 'space' (literally and figuratively) there need to be a small oversupply (if not the market is locked). A healthy vacancy rate should be 5% till 7% of the stock. There occurs an equilibrium when the ratio between the supplied square meters and the demand of square meters is 1,5 more supply than demand (Besselaar, 2011).

There is no need for extra scientific research to demonstrate the structural vacancy in the Office real-estate market in the Netherlands. But to indicate how big this problem is, some facts and figures: (Contenders in the market, DTZ Zadelhoff 2012).
The office stock in the Netherlands consists of 41 million m^2 in use and 7,6 million m^2 in offer, this means a vacancy rate of +/- 15,6%. This overall vacancy rate could be divided in cyclical vacancy (the dynamics of the market) and structural vacancy (over stock, mismatch between demand and supply).

This research has got a focus on the supply and demand of offices, especially on the quantitative and qualitative supply and demand. Most of the considerations are economical driven. The next statements are important starting points:

- *Office vacancy:* An office is a building bigger then 500m^2, which they're mostly offices activities will be provide. The registration of vacant offices is also limited to municipalities with at least 10.000 m2 office space (Bak. R.L., 2011);
- *The use of space:* Space is scarce in Holland, so the efficient use of space is an important parameter. Beside the quantitative use of space (amount of used land) is the qualitative use of space important, e.g. vacancy at the top locations;
- *Vacancy:* A consequence of vacancy is the not used space, while the building use the land. Beside this vacancy has got a negative influence on the environment and life cycle of surrounding buildings (Anink, 2010).

In this report the present situation of the real-estate market in 's Hertogenbosch will be reviewed. First the present state of the art of the city will be determined on a static way (GIS-analysis) and dynamically (System Dynamics analysis). At the end of the research possible

governmental solutions which could bring back the equilibrium in the market will be tested in the future, the effect as well as the preference. This preference determines the willingness to intervene by the government (different policy makers). On the next page the reading guide visualize the structure of this report.

1.2. Reading guide

Part 1 Problem Introduction	Part 2 State of the art (model input)	Part 3 Modeling process (data collection)	Part 4 Outcome
- Problem definition - Research framework - Research Questions - Research methods	- Financial structure investment funds - Investment behavior - Vacancy influence factors - Life cycle of real-estate - Governmental policies	- Modeling - GIS-analysis - System Dynamics - Game Theory	- Results - Conclusion - Discussion

2. Research framework

2.1. Problem definition

In the past decades lots of new offices are built at mostly formal locations. Because of the race for the most attractive office, the available capital, the eagerness to do land development by the municipalities and the drive for developments of offices was high. Finally possible future developments of the economy are not taken into account. This has led to too much office stock, where there is a possible skewed distribution of office quality.

2.2. Research Questions

As mentioned in the previous introduction there is an unbalance in the present office stock, in short there is too much structural vacant stock in comparison with the decreasing demand. For this specific problem there is done several research to determine this vacancy, and to a lesser extent what would be done with this stock. In general there are two solutions which are the most frequently mentioned. (Akkoord over sloop lege kantoren (Volkskrant), Convenant aanpak leegstand kantoren (ministerie I&M)).
Solution 1: 'The transition of the 'deprived' offices to other functions like: leisure and living';
Solution 2: 'Take some of the 'No chance' offices out of the stock by demolishing them to reconstruct the equilibrium of supply and demand'.

- Partial solution 2a: 'Make the demolishing financial feasible by a (vacancy) tax';
- Partial solution 2b: 'Make the demolishing financial feasible by 'the exchange of demolished or transformed stock with claims for new developments''.

For the problem within the office market there could be drawn several other measurements. Because the above standing measures are the most purposed by the government at the moment, these will be reviewed in this research.
The tension of this research will be around solution 2. This will be done by the next research question:
Main question: 'What are the effects of policies to bring back the equilibrium in the real-estate office market and vanish the structural vacancy?'

Sub question one: 'How big is the structural vacancy in the province Noord-Brabant (especially 's Hertogenbosch), is this an equilibrium or unbalance?'
Sub question Two: 'How will react the office real-estate market on the 'vacancy tax' and 'development credits/ construction claim'? Are there other suggestion by the market?'
Sub question three: 'Which governmental policies are the most beneficial to take offices out of the market or improve it sustainable?'
Sub question five: 'Which governmental policies are the most preferred?'
Sub question four: 'How could the proposed policies legally be carried out?'

Out of the previous questions the complexity and the present problem of the real-estate office market turned out. The government already made a starting point by the reorganization of the problem, for this they already set up the 'Agreement vacant office approach' (appendix B). Out of the first literature and field research the un transparency of the financial construction of

office funds has emerged. This discovering not actual means an exclusion of financial factors, but more a focus on the other aspects of urban development (*land development, plan capacity, legal issues, geographic locations, quality, and life cycle*).

2.2.1. Research limitations

As earlier mentioned the office real-estate market is huge and complex, to make the research feasible in time it will be limited to the next boundaries:

- The province of Noord-Brabant, primary the behavior in the big 5 cities (B5): Breda, Eindhoven, 's Hertogenbosch, Tilburg, and Helmond. Which 's Hertogenbosch will be the city to do a case study to determine the present problems;
- The focus of this research is on the 'No chance offices'/ 'deprived offices';
- The willingness to cooperate by a collective solution will be reviewed, mostly measured by the responsible municipalities (B5);
- The focus of the measurements is at the 'collective tax', 'development credits', and a 'governmental payment ' (hierarchical approach by the government);
- The willingness to take an office out of the market will be measured, if it will be transformed to another function of use or demolished will be not taken along;
- The problems within the market will be stated on 6 position postcode level, the solutions will be modeled on area level;
- The change in land position which could arise after the demolishing of offices will be disregarded.

2.2.2. Research model

During the process of the research several phases/ processes need to be accomplished to acquire a scientific result. Figure 1 determines the different phases. To get a smooth process and a result within the limited amount of time the different phases of the research need to be tightly scheduled. This means the preparation work need to be done properly (part 1 and 2). After these phase the real scientific modeling need to be done which should result in scientifically substantiated conclusions.

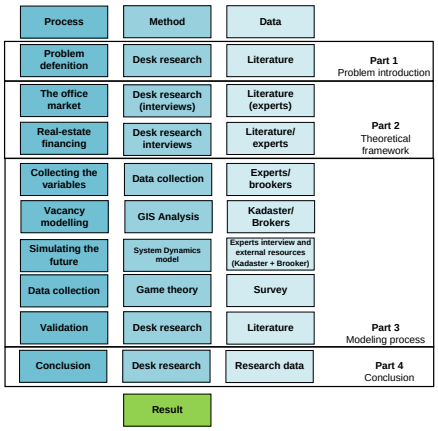


Figure 1: Research model

2.2.3. Relevance

TU/e, This research is relevant for the faculty Architectural building and planning as well as the master construction management and engineering. This because the topic is very hot at the moment in governmental, financial, organizational and technical way. Almost all the aspects which are important in the field of CME will be elaborated.

Dutch business, As mentioned in the introduction a lot of investments funds are stuck in the present office market, this because of the economical crisis, credit crisis, graying and new forms

of working. This research could give a better insight in how to solve the problems to create a healthier market which will help investors (healthy portfolios) and the government (better rents give better tax income).

2.2.4. Hypothesis (before starting the research)

During the start of the research there could only set up a hypothesis by the use of expectations of experts and the use of present published research. For this there is a main focus on the determination of the present vacancy rate and possible solutions, but there is less published about the functioning of the market in the future. For this I set up a twofold hypothesis, first if there is also a problem with a structural amount of vacancy in the province of Noord-Brabant and second what the effect could be of governmental policies.
First I think there will also occur vacancy in the province of Noord-Brabant, this because Brabant is represent by different top sectors within the Dutch economy (High Tech/ Eindhoven, Agro-food /'s Hertogenbosch and North-East Brabant, Pharmacy/ Oss, Automotive/ Helmond). As a result of the crisis the investments by the different top sectors will he shrunk, which influence the total economy of Brabant, this result in less employment, a side effect is less demand for offices.
Second the governmental policies could help to accumulate financial resources which should be used to push the office market in the right direction. The income out of taxes could be used as demolishing fund to take some offices out of stock.
Beside the 'scientific' result there could be discovered possible solutions or measures which are advice by the different experts I will survey/ interview. This will possible taken along in the research as recommendations.

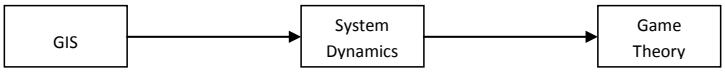
2.3. Research Methods

To give a consistent answer to the research question and to test the hypothesis one or more different research methods will be used within this research. Just picking one method is not right. First the proposed outcome need to be taken along, after this the type of data need to be determined and the last step is to determine the right research methods. The previous steps are determined in Table 1.

Determination of research method		
Proposed outcome	*Type of data*	*Research method*
Vacancy determination	Quantitative	Geographic information system (GIS)
System of supply and demand	Quantitative	System Dynamics
Willingness to take measures	Qualitative	Game Theory

Table 1: Research methods

Just the proposed outcome is not enough to determine why the different methods will be used in succession. All the methods are giving input to the subsequent method, this input cannot be obtained by the each one of all the three methods. The omission of one of the methods will shrink down the detailing of this research. Practically the next relationships are there between the research methods in this research.



GIS: GIS determines the quality distribution at a specific location (different stocks) also the previous supply of offices.

System Dynamics: System Dynamics will give insight in the effect of different new policies or policies adjustments.
The next paragraphs will give a brief introduction of the research methods, this to get acquired with the methods before they will be applied in the research. And why the specific research methods are used in this research.

2.3.1. Geographic Information Systems

GIS allows to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts[1].
The above standing quantity of a GIS-model directly define why it is involved in this research. It helps to give easily insight in the data do determine office vacancy.

2.3.2. System Dynamics

Why the use of System Dynamics

System Dynamics is a research method which is useful to simulate different scenarios in complex systems, it is the simplification of a complex world (Sterman, J.D., 2000).

General explanation of the use of the method

Causal loop diagram:
Before constructing a real System Dynamics model all the different influential variables will be set apart in the stock and flow diagram with their relation to other variables and vice versa. Within the diagram each relation will be visualized by an arrow, these arrow also indicates or the variable has got a positive (+/B) or negative (-/B) influence on the other variable (Figure 2). This not means a negative value, but a inverse influence.

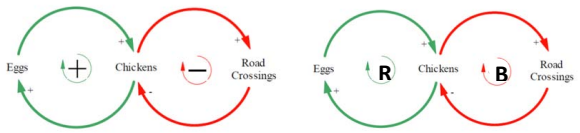


Figure 3: Example of a causal loop diagram

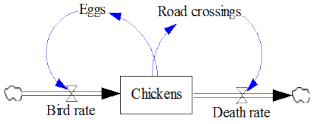


Figure 2: Example of a stock and flow diagram

[1] Source: http://www.esri.com/what-is-gis/overview

Stock and flow diagram:

The previous produced causal loop diagram need to be transformed in a real working stock and flow diagram. The way of thinking and the flow of the model will approximately be maintained. It will possible change because of the limitations of the mathematical layer which will be add behind the stock and flow model. Last but not least one(or more) of the variables of the stock and flow model need to be modeled to a stock with an inflow and outflow (other variables). For this there need to be taken along the next remark: the stock is cumulative in positive or negative way, so it is difficult to model this as a constant factor or ratio. The example of Figure 2 could be transformed in the stock and flow model represented in Figure 3.

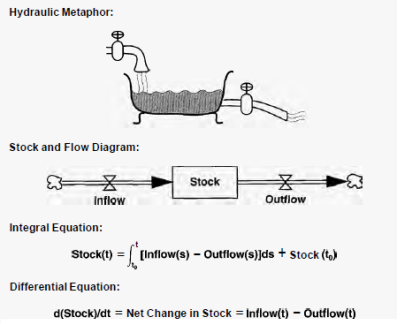


Figure 4: Hydraulic Metaphor (Sterman, J.D., 2000)

Beside the step of constructing the stock, flow and variables the mathematic equations behind each stock, flow and variable need to be construct. Which the hydraulic metaphor of the filled bath tub the best represent this (Sterman, J.D., 2000) (Figure 4).

The liquid in the bath tub will be gathered cumulative (stock) depended of the position of the incoming valve (inflow) and out coming valve (outflow). Which the valves are influenced by different variables.

How to use System Dynamics in the context of this research

The aim of the construction of the System Dynamics model is to reconstruct the present and future situation of the real-estate office market as best as possible. For this there is data needed to build a good 'foundation'. In part 2 (the state of the art) the most important influence factors will be reviewed. Each different influence factor will first set out in an influence flow chart, before these will be used in part 3 (the modeling process).

2.3.3. Game Theory

Why the use of Game Theory

Game Theory is a widely used research method which the aim of the method is to find the best solutions of all parties involved. This can only be achieved by an interactive analysis between two or more parties. Because of this Game Theory is mostly called interactive decision making. In this chapter the basic terms of Gamy theory and why it will be used in this research will be shortly explained.

Game Theory is a way to analyze interaction among a group or rational agents who behave strategically. Game Theory games mostly be played in a normal (simple) form or an extensive form.

Normal (simple) form[2]:
A normal form represents a game (mostly) in a matrix form (2x2, 2x3, 4x4, etc.). This approach could be useful to find a Nash equilibrium or different strategies. To figure out the best solution concept, the game need to be played with perfect information (all players has got the same information available).
Within the normal simple form the zero sum game is frequently used. If we add up the wins and losses in a game, treating losses as negatives, and we find that sum is zero for each set of strategies chosen, then the game is a 'zero-sum-game'.

Extensive form[3]:
The extensive form of Game Theory gives the players more information about the possible steps which could be made. This is mostly represented by a game three, which the moves of each player are visualized.
First each node (decision intersection) has got a chance the player will chose for the first, second, third, etc. option, (Figure 5). The information of the set of all these nodes which the player will encounter is called the information set. Within this game players could have perfect information (all players has got the same information available) or imperfect information (different players has got different information available).

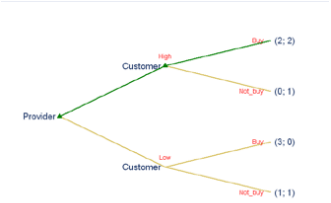


Figure 5: Example Game tree

The different players which participate in a game could each take in another position, specifically a different strategy, depending on the strategy there will be played a specific kind of game, the most common are Non-cooperative games, and cooperative games, in this research only non-cooperative games will be played.

Non-cooperative game:
In 'Non-cooperative Game Theory' individuals are normally assumed to maximize their own utility without caring about the effects of their choices on other persons in the game. The outcomes of the game, however, are usually jointly determined by the strategies chosen by all the players in the game.
Consequently, each person's welfare depends, in part, on the decisions of other individuals 'in the game'. To get the most beneficial result, the players could each use another kind of strategy, namely:

- *Dominant strategy*, Within a non-cooperative game a strategy of a player is constant if he always will get the best payoff. Regardless the move of another player. Shortly, a strategy that outperforms all other choices no matter what opposing players do.

[2] Source: http://en.wikipedia.org/wiki/Normal-form_game
[3] Source: http://en.wikipedia.org/wiki/Extensive-form_game

- *Weakly dominant strategy*, Within a non-cooperative game a strategy is constant if he get a payoff at least as high as any other strategy. A strategy is weakly dominant if it is always at least as good as any other strategy. Shortly, circumstancing where a strategy is 'not worse' instead of 'always better' makes a strategy weakly dominant.

Depended on the preference of each player they will play a certain kind of game. A frequent used one is a mixed strategy, for this there are three reasons to play a mixed strategy:

1) A pure strategy that is not dominated by other pure strategies may be dominated by a mixed strategy.
2) Playing a mixed strategy can keep your opponent off balance. The worst case payoff of a mixed strategy may be better than the worst case payoff of a pure strategy.
3) In a game without a pure strategy Nash equilibrium, but in which a mixed strategy provides a useful approach.

Solution concepts:

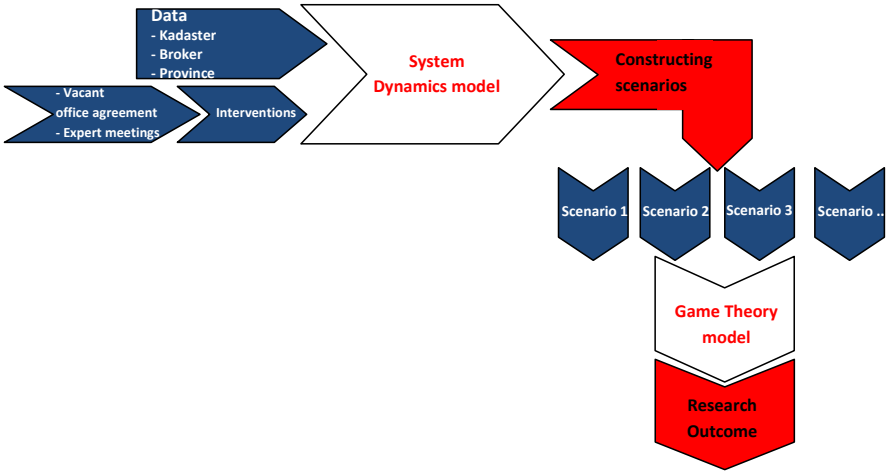
As mentioned in the previous paragraphs, dependent on the type of game, the players, the information, the payoff etc. each players uses another strategy to play his game. To calculate the 'best' solution there are constructed different solution concepts, for simple or extensive form of games or both. The most known are (different explanations are easy to find on the internet):

- *Neumann and Morgenstern;*
- *John Nash;*
- *Reinhard Selten;*
- *Harsanyi.*

How to use Game Theory in the context of this research

Within this research a non cooperative simple game will be played in a 2x2 matrix, by the zero-sum principle, with a mix strategy. Hereby the outcome of the field research (questionnaires) will be reviewed by the Nash Equilibrium concept.

2.3.4. Flowchart of both methods



Part 2 – Theoretical framework

3. The financial structure of investment funds

Just buying some real-estate is not the present time, especially not with the (during) real-estate crisis. For this almost every investor should need to borrow money, the different investment vehicles which been used to borrow money are important for the structure of a portfolio of investments in offices. Despite of a good constructed portfolio the financial structure could limit the investor to handle in different market situations.
In this chapter the financial basis of real-estate investments will be reviewed. This because (office) real-estate is used to safeguard assets (secure money) and gain profit. Which the financial issues has got direct and indirect links to the office real-estate crisis, some facts are possible suitable for the real-estate office model.
First the present mode of operation within the office real-estate industry will be briefly reviewed, after this the different valuation methods, and the leverage effect will be reviewed.

3.1. The present mode of operation within the real-estate industry

The real-estate market is dynamic with different kind of players, each with another role, also another role in the origin of the present structural vacancy, which they all have got benefit out of an equilibrium in the real-estate office market. Figure 6 indicates the different kind of players, their mode of operation and impact on the real-estate crises are briefly stated bellow.

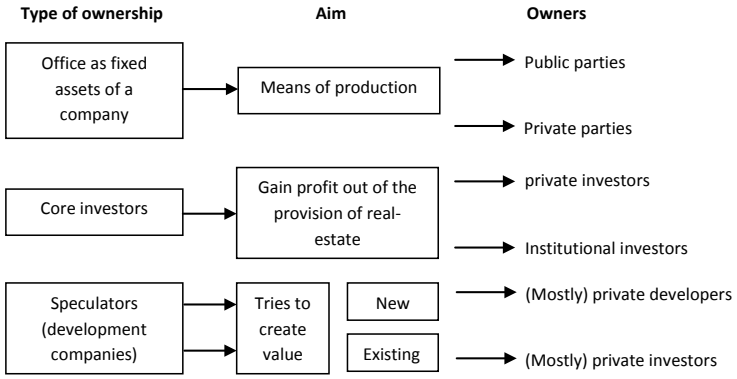


Figure 6: The different players in the real-estate market

Office as fixed assets of a company:
An office as fixed asset occurs often by a one-man-business as a part of their dwelling, beside this some companies has strategically chosen to own their office, or possess these out of past generations (mostly public parties). The benefit of offices owned by the users is the full influence on the building, which the disadvantage is the difficulty to move fast towards another office.
Most of the parties which has an office as mean of production are playing a passive role on the office real-estate market. Beside this the value of the office will be more expressed in production benefits instead of rent incomes.

Core investors:
The last decades offices are used to secure money and gain profit, these core investors calculate the value of the property mostly by the Net present value method (NPV/DCF) which in short term means the estimated cost minus the estimate income capitalized in time. The rent contract for 5 or 10 years is a enough to determine the 'Book value'. The mean of operation of the core investor is or should be shift in the future, this because the over stock in vacancy, this shift will be short explained.

The means of operation in the past (providers market)
Because of the stress in the market, less demand than supply, the rental prices were higher and contracts were more reliable (late nineties). Because of this the present value of offices was based on a long period (approximately 20 years), on a higher rent and with a higher residual value. This results in a high net present value/ book value. When there always stays a providers market (scarcity) the value of the office will be stable or increase or increase, if not the value will drop down.

The means of operation in the future (renters market)
Because of the oversupply in the market, more supply than demand, the rental prices will drop and contracts will be shorter, more movements of tenants to a higher quality building or a better location will go on. This result in a lower net present value, because this short term contracts the building need to be earlier depreciated, beside this the rent is droped down, which means less income in a shorter period.

So in the upcoming periods developers and investors should change their perception of financial calculations within the office real-estate industry.

Speculators (development companies):
The speculators (development companies) mostly do not earn money by a stable cash inflow, but by creating value. Which the development companies has developed lots of new office space in the past by doing greenfield development in collaboration with the government. There key to success is/was to develop an office and sell it with a long term rent contract to an investor (core investor).
The speculators (real-estate dealers) are trying to buy cheap offices (out of bankrupt office portfolios) and add value (by renovation or transformation) before they will sell it to an investor with a rent contract.

In the past the developers are one of the origins of the problem by developing too much stock, which in the present they still try to do, but the present (capital) market has set up a natural brake, and the government should set up a legal boundary in the future.
The speculators could also have a positive role in the future by restructuring depreciated offices and transforming deprived offices towards another function.
Out of these paragraph there can be filtered out the importance of the valuation method, the most used methods are elaborated in paragraph 3.2. Beside this there could be an extra risk if a

big amount of the portfolio is financed by debts. This side effect of financial leverage will be explained in paragraph 3.3.

3.2. The different valuation methods of real-estate (offices)

Why buildings need to be valued?

Property in itself has no inherent value, rather is it the use to which property can be put which gives it its value. An office-block or a factory have no value unless there are people who wish to use them, and the same applies to any property. Indeed, if there are no would-be users a piece of property can have a 'negative value' as expenditure will be incurred on such things as unavoidable rates and taxes, basic and essential maintenance, and essential management tasks, while with no users no income will be produced to encounter those outgoings (Millington, 1994). The above standing statement indicates a possible reason for valuation before an object can be appraised, the next reasons are common used:

- A valuation for sale;
- A valuation for purchase;
- For rental purposes;
- Balance sheet purposes (property may requiring valuing as an asset);
- For insurance demands;
- Redevelopment purposes;
- Compulsory purposes (bankruptcy);

Although it is apparent there may be a whole range of different values in any one property at any one time, depending upon the reason of valuation, it should be remembered that there will be only one market price. This makes it very difficult to evaluate a property for other purposes than a sale, if the valuation is too high the owner could encounter problems by a future sell, is it too low there is 'wasted' capital which could be put in by other investments.

Another important future of real-estate is that, relatively speaking it is durable. Many goods wear out and deteriorate rapidly, but real-estate normally lasts for many years with a very slow rate of deterioration. It is very durable over time and generally affords very good security for money over a long period.

In comparison with other goods a large amount of capital is usually required to purchase real-estate. Even the meanest interest will usually require a considerable amount of money for its purchase, and allied to this is the fact that real-estate is often in units which cannot easily be divided into smaller units. The result is that the minimum sum required for real-estate purchase is usually quite substantial, and it is necessary for a potential investor in land and buildings to be able to raise such a sum before he can in fact realize his ambitions. The above standing quantities of real-estate investments makes lots of investors eager to invest in real-estate. For this the investor need to take a long the next factors which cause changes in the value of real-estate and variations in value between different properties (Millington, 1994).

- Any increases or decreases in population;
- Changes in the age distribution of the population;
- Changes in technology;
- Any change in the proportion of married people single people;
- Change in building costs;
- Money supply;
- Cost of finance;

How buildings could be valued?

The importance and the reason of valuation is already indicated, only within the real-estate industry there are several valuation methods, the use of them depends on the accuracy and aim of the valuation, according to Millington (1994) the most used are: *the comparative method , the contractors method, the residual method, the profits method, the investment method, The full rental approach (Dutch: BAR + NAR, the mortgage/ equity method approach, the present value method, and the internal rate of return*. In the next paragraphs the most common in the Netherlands are shortly explained.

Static valuing

The residual method (Hypothetical development method): This is used when a property has development or redevelopment potential. It is needed when there is an element of latent value which can be released by the expenditure of money on a property.

The basic valuation approach is: (value of the completed development-Total expenditure on improvements or developments(including developers profit)) = Value of site or property in its present condition (residual value).

The method is often criticized as being clumsy and containing too many variables, but there is little doubt that it is the only real method of valuation applicable when there is latent value in a property.

The profits method (Accounts method, Treasury method): This method is based on the assumptions that the value of some properties will be related to the profits which can be made from their use. It is a fact that the vast majority of properties will have no value unless they can be put to beneficial use, but not all properties will be used in a way which generates a calculable profit in money terms.

The basic equation on which the profits method is based is as follows:

(Gross earnings-Purchases)-(Gross profit-Working expenses (except rent))=Net profit

The investment method (Capitalization): This method is based on the principle that annual values and capital values are related to each other and that, given the income a property produces, or its annual value, the capital value can be found. The method is widely used by appraisers when properties which produce an income-flow are sold to purchases who are buying for investment purpose.

In addition to these conventional methods, valuations can be made using discounted cash flow techniques. These are to all intents and purposes extensions of the investment method, and entail estimating all future items of income which an investment will produce, and converting these future sums into present day equivalents in money terms.

The full rental approach (Dutch: BAR + NAR): The full rental value of a property is the maximum rent for which it could be let in the open market on a given set of letting terms. The concept envisages that it is possible to let the property on that rent, and it follows that if the full rental value is known a valuer can use it in his valuation, confident in the knowledge that it would be paid by at least one potential tenant.

Dynamic valuing:
The need for complex valuations also arise from background factors which were perhaps not so important in past years. In the past it was often possible to borrow large sums of money for long periods at fixed rates of interest. Nowadays, it is likely that the cost of borrowing will be related to other variable factors, such as the base lending rates of banks, and there may therefore a need to build into a valuation calculation variations to allow for anticipated changes in the cost of finance.
There are several kinds of discounted cash flow appraisal but consideration will be restricted to the two most commonly used, the net present value method and the internal rate of return method.

The present value method: The NPV method is just like the investment method of valuation in that all future items are discounted to a net present value by using compound interest calculations. However, whereas in an investment valuation it is conventional only to consider the net income of each year, the use of a tubular format for the net present value method facilitates the inclusion as separate items in the appraisal of all items of income and expenditure for each year. The valuer can decide whether he will then in fact simply discount the net income or the net deficit for each year to the present, or whether, if there is sound reason for doing, he will discount items of income and expenditure separately using different rates of interest for the purpose as appropriate. Not only can different rates of interest be utilized but calculations can be made for individual items at more precise dates rather than at the end of each year, which the conventional investment valuation purposes.

The internal rate of return: The only indication the net present value method gave of the rate at which money was earned was to show whether the rate of earning was below or above the rate chosen for the calculations (that is the target rate). To know the size of a profit (or loss) may be helpful, but if the highest return also requires the highest capital outlay the information may be of limited use. An investors real wish will be to know the rate at which capital will earn money. The internal Rate of Return therefore seeks to find the precise rate at which the capital invested will earn money thus enabling a more precise comparison to be made between competing investment opportunities. The internal rate of return can be found by trial and error, or by the use of a programmed financial calculator or a suitable computer programme.

3.3. The use of loans and leverage

The average people will borrow a substantial part money to buy something which they (primary) need, e.g. a house, car, medical healthcare, etc.. An investors has got other aims to borrow money, his aim is to earn more money with the combination of equity and debts instead of only equity. This investors 'behavior' can be the best nominated as gearing.

3.3.1. Finance and gearing (the leverage effect)

Because of the need of large sums of money to invest in real-estate, the majority of purchasers cannot provide all the necessary money from their own funds, and they have to borrow money to obtain a sufficient amount to proceed with a purchase.

If an investor is able to borrow a substantial sum of money at a relatively low rate of interest and is able to ensure that money will be available for a long period, the overall security of an investment is likely to be considerably stronger than if funds were only available at high interest rates for a short time. The terms on which an investor can borrow will depend not only on the type of investment, but also upon the general state of the economy (local, national, international), at the time of loan. If overall interest rates are high then the cost of borrowing is likely to be high, whereas during times of low interest rates, there will naturally be a greater chance of borrowing money on attractive terms.

Sadly, many people learnt the hard way that the purchase of a property does not guarantee a capital gain and that if general economic circumstances are unfavorable property prices can and do fall. Too many people had, it is suggested, bought properties on the basis of capital gains they hoped to make. Rather than for the benefit of the value-in-use they expected to get big profits out of the bought properties. Which for the vast majority of property purchasers this was the major reason for purchase.
In many cases a purchaser of commercial investment property will borrow money from a finance house, or a body such as one of the large insurance companies. Insurance companies do lend for such propose, although in these days the majority of them probably prefer to invest in directly property.

Where the equity is a small proportion of the total capital involved, and the greater part is money which has been borrowed, the project is referred to as being highly-geared, and where the converse is the case the project will be said to enjoy a low gearing. The degree of gearing has been an important factor in property investment since the second world war, and the rate of interest charged on borrowed money is also been important.
If the cost of borrowing is below the overall yield on the total capital invested, investors can increase the yield on their equity by increasing their gearing. The higher the gearing, the greater will be the yield on equity. Whatever the gearing, as long as the cost of borrowing money remains below the overall yield on the property, the project will remain financially sound.

Within the next example (Appendix A)the financial gearing will be explained on a practical way by an example of different scenarios, also referred as the leverage effect.

Out of the example in the appendix can be concluded that assets which forming the portfolio are related to one another, as well as the direction of this relation: this can be assessed by measuring the correlation between the rates of return on assets. Three situations can occur which are briefly summarized:

1. If the portfolio under consideration includes enough securities whose returns are perfectly negatively correlated, diversification can virtually suppress portfolio non-systematic risk;
2. If enough assets show uncorrelated returns, then diversification will reduce risk significantly, the diversification effect increasing with the number of assets included in the portfolio;

3. But if all investments returns are perfectly positively correlated, then diversification will not result in any risk reduction, but merely in risk averaging. While 'perfectly negative correlated' assets can almost never be found in the real world.

3.3.2. The miss perception of 'Book value'

The problem stated in the research framework about the present high book value is true, but it is not the question if portfolio directors are willing to let drop down the book value, but more how and when. If this will be done in once probably lots of companies/ portfolios go bankruptcy. For this phenomenon some portfolios director tries to disguise the unrealistic value by high rents. Eventually this is an in transparent valuation method, by a NPV-valuation method, means no income, no value. By the accountant audit (valuation for balance sheet purposes) this unrealistic value should be discovered. For this the real-estate market is passing in transparent.

3.4. Summary – Which of the financial aspects has got a direct influence on the real-estate office market?

3.4.1. Influence flow-chart

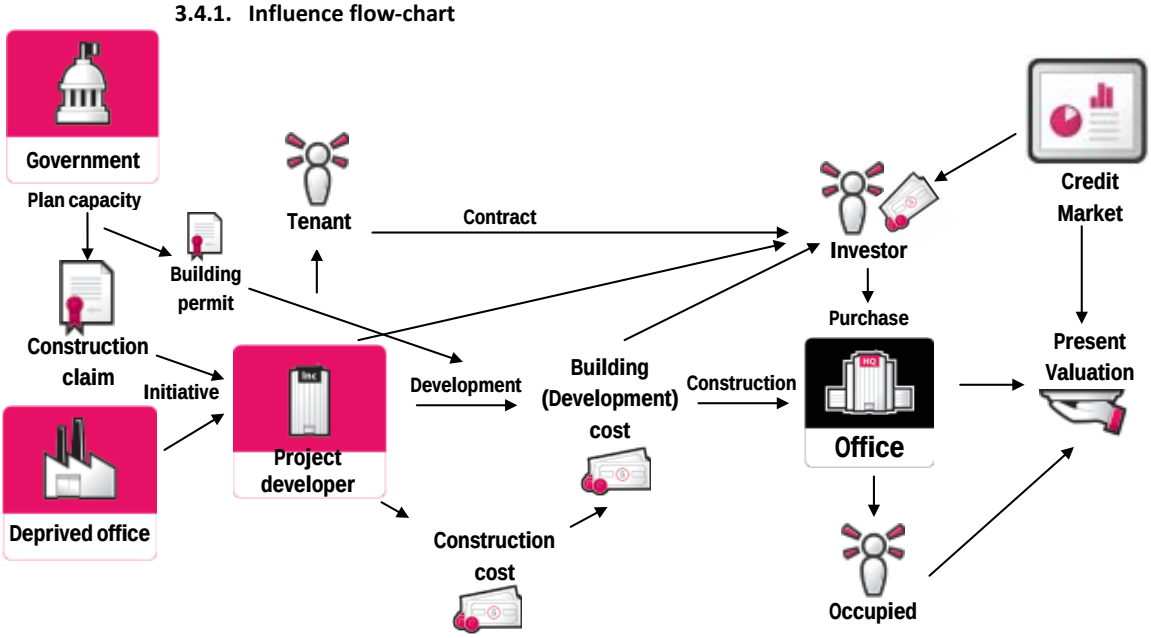


Figure 7: (financial) Stakeholders in the office real-estate market

3.5. Financial aspects within the real-estate office model

The above standing relations between the different stakeholders in the real-estate office market are important to consider, some of them are interesting to model in the purposed office real-estate model, namely: Plan capacity (construction claims), the (re)development rate, and if an office is occupied or not, these factors come back to be addressed in Part 4 of the research, the modeling process.
The method of the free market system is financially driven. By modeling the real-estate market there are some issues which make them not scientifically consistent too take along with. The next consideration off the different influential aspects is made:

*Book value, t*he book value of offices within the different real-estate portfolios cannot be taken along. This because several reasons. First it is not a case if investors are willing to let drop down the book value but when and how they will do it. Beside this the book value is extremely difficult to determine because of the different valuation method and confidentially of it.
Rental prices, The rental price is easily to extract out of the market and easily available. But it need to give a interesting for the real-estate model. By the construction of the model it can give input for the demand of offices, low price will result in a high demand and the other way around. Beside this it could give interesting input if there will taken different kinds of tax along to bring the market back in an equilibrium.

4. Investment behavior of office owners

Investment decisions are mostly based on the past, for this there could be mad a static or dynamic decisions. The static decisions are made on short term facts (the last decades) and the dynamic decisions are made on long term facts, with respect to the different cycles in the real-estate market. First the general behavior of investors will be reviewed including the reason to made an investment decision. After this the investment behavior specific on the real-estate market will be reviewed.

4.1. General behavior of investors

In deciding what yield is acceptable out of an investment investors will work on the basic principle that the greater the overall risk the higher will be the yield required. Conversely, as risks decrease he or she will be happy with lower yields, although it should never be forgotten that investors will always hope to obtain in the highest yield possible from any investment. Which the yield or profit is one of the first aspects of assessment for a future investment.

Static decision making:

Beside the possible profit which an investor could gain there are other aspects which make investors eager to buy an office. By a wrong fine-tuning of investments this eagerness could result in oversupply, Kummerow (1999) filtered out the most important reasons:

- Greed or fee-drive deals: Every expense item in a project budget is a profit centre for somebody. E.g. land assembly profits, construction profits, staff bonuses, consultancy fees, etc..
- Flood of capital seeking investment opportunities and financial deregulation: The office supply market is capital market driven. Lenders need time after a bust to repair their balance sheets. This lag delays new projects, drivers rents higher and sets the stage of a new cycle.
- Strategic behavior (prisoners dilemma): If everyone should develop and build new offices, market rents will fall and we will all loss money.
- Land use regulatory process delays and other government policies: Faulty data and poor forecast of supply, demand, rents and values: Conventional value methods using naïve trend extrapolation misprice investment property. This mispricing exacerbates the tendency to start too many projects during a burst.
- System Dynamics: Markets often respond to current prices, forgetting about lags and cycles. This ensure a backlog due to supply lags (Varkencycles).

Out of the eagerness to buy and develop an office there occurs imbalance in supply and demand this imbalance introduce production inefficiencies. Too little supply constrains economic growth by imposing high costs on tenants and making it more difficult to add office workers. Too much new supply leads to land and construction cost inflation, followed by excess vacancy, price collapses and negative net present values. Nonperforming properties contribute to financial intermediary liquidity and balance sheet crises, market wide price drops and recessions.

Dynamic decision making:
As mentioned dynamic decision making is based on analysis out of different real-estate cycles. For this the research of Kummerow (1999) stated the next real-estate cycle description. Real-estate cycles are longer because of the reduced mobility in the years ahead. Because of this real-estate returns are generally more stable (non-negative) in the years between the booms and busts. Thus, asset allocation models based upon the boom/bust period will have to be adjusted to the calmer conditions in the more disciplined market environment in the immediate future, in order to make a more accurate allocation decision.

Because of the different approach of different types of investors, stated in: chapter 3, paragraph 3.1, Figure 6: The different players in the real-estate market there could be observed a skewed distribution between the different types of investors. Institutional investors (risk averse) has got less vacancy in their investment portfolio instead of indirect investment funds and speculators (opportunistic). Beside this there is a high vacancy rate by portfolios of investors out foreign countries instead of Dutch investors (mostly German investors).

4.2. Behavior within the real-estate market

As in the previous paragraph the behavior focus at general investments, these paragraph zooms specifically in on the motivates to invest in real-estate or not. Which there is a full focus on core investors instead of developers, speculators or combined real-estate users and owners.
First there need to be made a difference in two type of investors, which both could have another approach, because of the origin (and the aim) of the money.

Institutional investors: Are organizations which pool large sums of money and invest those sums in securities, real property and other investment assets. They can also include operating companies which decide to invest their profits to some degree in these types of assets.
Types of typical investors include banks, insurance companies, retirement or pension funds, hedge funds, investment advisors and mutual funds. Their role in the economy is to act as highly specialized investors on behalf of others[4].
Two major macro-economic factors lie at the heart of changing investment behavior of institutional lenders since the earlier seventies.

a) The first one is the massive availability of funds stemming from increased savings channeled into insurance, pension plans and home ownerships as well, which results in institutional investors having to find, and often to create, new investment opportunities.
b) The second one is the endemic inflation that characterizes western economics since the early 1970's, and which leads investors to seek for investment devices that will protect the real value of their assets.

Private placement: (or non-public offering) is a funding round of securities which are sold not through a public offering, but rather through a private offering, mostly to a small number of

[4] Source: http://en.wikipedia.org/wiki/Institutional_investor

chosen investors. "Private placement" usually refers to non-public offering of shares in a public company (since, of course, any offering of shares in a private company is and can only be a private offering)[5].

As stated in the previous paragraph demand and supply are important items by the willingness to invest in real-estate especially the difference between them, In the Dutch office real-estate market Bak (2011), has set up the most complete databse. For this he uses the next market describtion:
The supply exists out of the current stock, the removal because of economic depreciation, the rezoning of offices towards another function, and the newly build stock. Within this research he describes the next behavior within the Dutch office real-estate market:

- The difference between supply and demand will influence the price (in- or decrease). At the present market this is a price decrease.
- The market distinct some autonomous trends, which they mean the economical aging of buildings (depreciation). The modern buildings/ offices of the previous decade will be shift towards lower quality categories.
- The removal of offices out of the 'regular' stock are stimulated by price drops, but economical ageing will be an important factor after the year 2020.
- A decreasing demand because of the less space use per employee. A Reason for this are 'the new type of work'.
- By the restructuring of offices the rigidity/inflexibility of drop down the book value plays an important role, which delays the restructurings process. In this situation the present real-estate value of office need to be used instead of the mostly too high book value.
- If the real value of offices are dropped underneath the 'bottom value' the demand and supply will not change if the office will not be taken out of the market. In accordance with governmental policies there are more interests. E.g. in case of the spatial planning it is desirable to demolish office buildings to change it in public space.
- The development of more or less newly build offices will influence the lagging rent development of existing offices. Just doing greenfield development has led to the result of faster lagging rent development by existing office because of their deteriorating competitiveness. (Korteweg 2002).

Another feature of the property market is that normally it does not consist of one large market, but of a series of smaller markets, each of which is local in nature. Even within local markets the knowledge of property transactions tends to be far from perfect, and purchases and vendors suffer from a shortage of information concerning past transactions.

4.3. The willingness to invest in real-estate

Quite obviously, property has outperformed stocks and bonds in terms of overall returns while proving an excellent hedge against inflation: beside, the risk incurred through property investment, as measured by the standard deviation from the mean return and by the coefficient

[5] Source: http://en.wikipedia.org/wiki/Private_equity

of variation, has been significantly lower than in the case of either stock or bonds. All three indices reflecting equally well diversified portfolios, the reason for such a stability must be found in the fact that economic cycles will rarely cause rent levels or capital values of prime properties to go through deep ups and downs as is the case with other assets. Thus, high vacancy and real interest will keep rents and values relatively constant, but only under particularly unfavorable economic conditions will the overall performance of a high selective property portfolio actually drop.

Only buying some real-estate will not direct gain profit, for this there are underlying factors which the investor use for its choice whether he will invest and in which object he will invest, Millington (1994) figeerd out the underlying factors of the real-estate market, namely:

- The international situation;
- The national situation and finance;
- Government policies;
- The local economy;
- Geographical factors;
- Accessibility.

Specific to the Dutch market Besselaar (2011) has investigated which factors determine the supply of offices, the next one are the most important:

- Production of newly build offices:
  The municipality is an important actor in the process of new office developments. They are mostly playing the game of the prisoners dilemma. In the case of their spatial planning policies. Municipalities are eager to develop land (decentralized) to have the benefit out of the ground fields, the counterpart is the increasing office stock (vacancy).
- Delay reaction on supply and demand;
- Withdrawal of offices out of stock.

4.4. Behavior flow chart

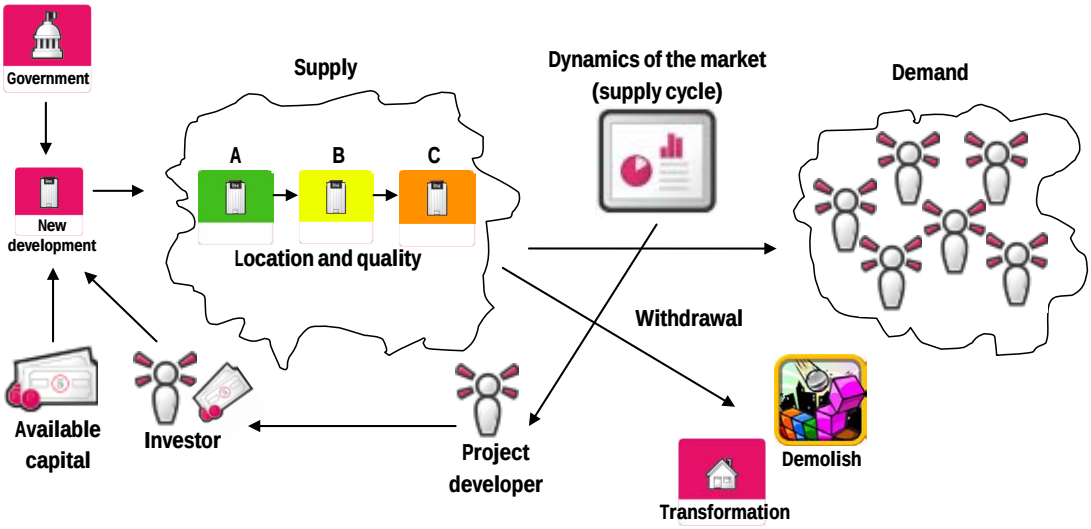


Figure 8: (Behavioral) stakeholders within the office real-estate market

4.5. Behavior aspects within the real-estate office model

Out of the different stakeholders in Figure 8 there could be filtered out important influence factors on the behavior of the key-players within the office real-estate market. These behavior aspects play an important role in the present 'Free-market-system' of office real-estate. There is proposed to take along the next factors within the model.

- Location of an office;
- Quality of an office;
- Office demand;
- Newly developments (plan capacity);
- Office withdrawal (not if it will be transformed or demolished, but if it will be taken out of the market).

5. The various factors which influence vacancy

The 'Free-market-system' makes the real-estate office market interesting to review. The difference between supply and demand stimulate the office owners (investors) to make their offices attractive in comparison with their competitors. Different factors which influence when a tenant will or won't rent a specific office are filtered out different reports/ articles.
To a create a starting point for this research, first the present market situation in the province of Noord-Brabant will be stated to give insight in the system. After this different findings out of other studies will be reviewed to filter out the most important variables for the real-estate office model.

5.1. The state of the art in the Province of Noord-Brabant

To provide insight in the market share of the province Noord-Brabant, a brief summary of the total amount of office supply within the Netherlands (Ranking kantoorlocaties, 2010, Jones Lang LaSalle).

Overview of the real-estate office market			
Region	**Office supply**	**% of total**	**% vacancy**
The Netherlands	36.446.000 m^2	100%	16,48%
Province of Brabant	3.556.000 m^2	9,75%	12,59%
Randstad area (Amsterdam, Rotterdam, Den Haag, Utrecht)	15.116.000 m^2	41,47%	15,48%

The development of the supply and demand side ultimately led to the growth of the structural vacant stock. For this the different trends remarked in the research framework are reasons for the changes in both. In the next paragraphs the past developments will be briefly reviewed to figure out the current state of affairs.

5.1.1. The supply side of the market

There is much market information to obtain, it is only difficult to determine which the context of the numbers is and how to use the different numbers in relation to each other. For the supply side there need to be set up a strict border between new supply (new developments) which mostly has got already a tenant. The supply of new developments and existing buildings is marked as total supply.
Supply of newly build offices:

- Within the province Brabant the office stock is increased with 9,4% between the years 2002 – 2010, divided into the regions the numbers are:
  - Breda: +8,8%.
  - 's Hertogenbosch: +7,1%.
  - Tilburg: +0,42%.
  - Eindhoven: + 9,4%.
- The average supply of newly build office stock in the Brabant between 2002 – 2010 was 70.600 m^2/ each year. Most in 2002 (179.000 m^2), least 2010, (45.000 m^2).

Supply of vacant offices (total supply):

Within the province Brabant the supply off offices is in general increased. The total new supply of office space between 2007 - 2011 is 505.100 m^2, (more specific in Table 2)

City	Average Supply (2007-2011)	Supply in 2011
Breda	72.700 m^2	97.000 m^2
Tilburg	43.100 m^2	53.500 m^2
's Hertogenbosch	86.400 m^2	101.000 m^2
Eindhoven	156.700 m^2	214.500 m^2

Table 2: Total supply of offices

5.1.2. The demand side of the market

Within the province of Brabant the demand for offices is in general descended (on a fluctuated way). The average demand of office space between 2007 - 2011 is 141.100 m^2, in 2011 129.000 m^2, (more specific in Table 3).

City	Average demand (2007-2011)	Demand in 2011
Breda	24.200 m^2	21.500 m^2
Tilburg	6.900 m^2	13.500 m^2
's Hertogenbosch	27.400 m^2	21.000 m^2
Eindhoven	44.200 m^2	47.500 m^2

Table 3: Total demand for offices

5.1.3. Rental prices

Most of the statistics preformed are based on realized rental transactions. These prices are a summarization and not leading in this research. But these give a quick insight in the performance of different markets during the time. The next rental prices are representative for the province of Brabant:

Average rental prices of an existing office building					
City	2007 (€/M^2)	2008 (€/M^2)	2010 (€/M^2)	2011 (€/M^2)	2012 (€/M^2)
Breda	134	134	134	137	137
Tilburg	140	130	130	130	130
's Hertogenbosch	137	143	151	146	140
Eindhoven	135	139	139	140	135

Average rental prices of a newly build office building					
City	2007 (€/M^2)	2008 (€/M^2)	2010 (€/M^2)	2011 (€/M^2)	2012 (€/M^2)
Breda	150	160	160	n.a.	145
Tilburg	153	n.a.	n.a.	n.a.	n.a.
's Hertogenbosch	160	160	160	170	170
Eindhoven	153	157	160	150	165

5.2. The different characteristics of vacant buildings

Only the quantification of vacancy will not always be enough, the reason why an office is vacant is interesting to answer, for this the different characteristics of an office building which determine vacancy will be reviewed. All these characteristics are filtered out of previous literature which discuss research done within the Dutch office real-estate market.

Quality as quantity of an office building:

Quality category	Research Report	
	EIB* (2010)	DTZ-Zadelhoff (2012)
Category 1	*Price category A*	*Attractive offices* - State of the art architecture - The function of the offices is complementary to the environment
Category 2	*Price category B*	*Deprived offices* - Visibility or status are not the main interests - Physical quantities are giving future possibilities for transformation - Upgrade of the building increase the chance to obtain new tenants
Category 3	*Price category C*	*No chance offices* - Most offices are built between 1980 – 2000 - Mostly built as big volumes - Offices are designed out of the regular measurements (1,8 m^1, 3,6 m^1, 7,2 m^1)

* EIB = Economical institute of construction (Dutch: Economisch instituut voor de bouw)

Geographic location as quantity of an office building:

Quality category	Research report				
	EIB*(2010)	**DTZ-Zadelhoff (2012)**	**SEO**(2002)**	**Buts (2009)**	**AOS*** (2011)**
Category 1	*Central locations*	Attractive offices - Near big intercity stations (public transport) - Presence of facilities	*Centre*	*City centre*	*Grow areas* - There are possibilities to add offices to the existing stock
Category 2	*Remaining locations*	Deprived offices - Good locations within suburbs, or secondary locations within core cities	*Offices parks at the boundary of the city*	*Residential area*	*Limited growth areas* - Limited possibilities for the addition of offices
Category 3	*formal locations*	No chance offices - Unilateral applicable location	*Industrial areas at the boundary of the city*	*Industrial area*	*Balance areas* - The stock should be stay equal - New development only by withdrawal of the same amount existing stock - Focus on redevelopment of the existing stock
Category 4			*Surrounding neighborhoods*	*Office park*	*Shrinking areas* - Office stock should shrink - Accent primary on withdrawal of deprived offices - Secondary on the redevelopment of the existing stock
Category 5				*Outlying area*	

Difference factors which (might) influence vacancy:

Research report	Research report		
	DTZ-Zadelhoff/ Besselaar (2011)	**SEO** (2002)**	**NVM (2010)**
Factor 1	Demographic developments	Location (centre, office park, mixed terrain, surrounding area)	Accessibility by car;
Factor 2	Office bounded employment	Accessibility	Parking possibilities;
Factor 3	Business confidence	Parking possibilities	Accessibility by Public transport;
Factor 4	Price level	View of the building	Character of the environment;
Factor 5	Local politics	Building typology	Nearness of employees;
Factor 6	Quality of the offices	The map of the building	Expansion possibilities;
Factor 7	Aspects of the location	Price	Nearness customers/ relations;
Factor 8	The needed amount of square meters per fte.		Walking distance shops.

* EIB = Economical institute of construction (Dutch: Economisch instituut voor de bouw)
** SEO = Economical research cooperation Amsterdam University (Dutch: Stichting Economisch onderzoek der Universiteit Amsterdam)
*** AOS = Amsterdam office strategy

5.3. Employment as vacancy influence factor

The future demand of offices is an important factor for the real-estate office market. This demand can be predicted out of several different factors. Which it is important if there are companies who need space for their employees. Logic factors could be the present employment, the development of the employment, the development of the potential labour force, the absorption of office space and economic wealth. In the next paragraphs the most important one out of the province of Brabant will be shortly discussed.

5.3.1. Development of the employment in the province of Brabant

An important factor for the prediction of the office demand is the employment and the available labour force. A future prediction will not always be 100% realized but it will give an interesting view of the future situation which the different public- and private- parties can use in their plans.
For this the province of Brabant uses 4 different WLO (Dutch: welvaart en leefomgeving/ English: Wealth and environment) scenarios. These are explained on the next page.

WLO-scenarios

The WLO-scenarios are developed with 2 key uncertainties in mind:

- The willingness to cooperate international (National/ European and intercontinental);
- The converting of the public sector, the choice between public or private goods and services.

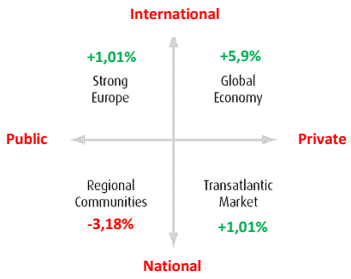


Figure 9: WLO-Scenarios

Employment forecast

The previous explained scenarios are used by the CPB (The Dutch central planning Agency) by the prediction of the employment within the province of Brabant (Table 4). The next incline could be filtered out:

- Scenario SE: + 1,01%;
- Scenario TM: + 1,01%;
- Scenario RC: -3,18%;
- Scenario GE: + 5,9%;

(x 1.000)	2001	Strong Europe 2010	Strong Europe 2020	Transatlantic Market 2010	Transatlantic Market 2020	Regional Communities 2010	Regional Communities 2020	Global Economy 2010	Global Economy 2020
West	270	281	279	292	292	270	257	299	313
Midden	193	200	201	208	210	192	186	213	225
Noordoost	302	326	332	339	346	312	303	348	373
Zuidoost	353	370	376	385	392	356	347	394	418
Noord-Brabant	1.118	1.176	1.188	1.223	1.239	1.130	1.094	1.254	1.329
Gelderland	827	850	855	878	877	815	788	900	944
Zuid-Holland	1.580	1.573	1.590	1.610	1.601	1.506	1.459	1.653	1.740
Zeeland	144	151	151	156	156	145	140	160	168
Limburg	483	492	479	510	493	474	443	521	527
Nederland	7.341	7.474	7.541	7.703	7.708	7.174	6.939	7.915	8.343

Peildatum: 2010 | Bron: CPB

Table 4: Employment forecast 2001 - 2020

Labour force predictions

Besides employment there need to be labour force available. A repeated argument is vacancy of labour force in specific fields. E.g. in craftsmanship. For this the upcoming greying could also an influence factor in the labour force. The province of Brabant has made a future prediction which there is a small increase till 2015 and a negligible increase till 2020 (Table 5).

Predictions of the future labour force				
Index numbers (2008 = 100%)	2008	2010	2015	2020
Noord-Brabant	100	100,5	103,7	103,8
The Netherlands	100	101,4	101,4	106,0
Reference data: 2010, Source: Province of Noord-Brabant				

Table 5

The determination of the growth in labour force will give not a direct relation to the use of office space, this because it is a general variable. It only indicates the demographics of the province of Brabant which will be sufficient the full the present employment. Which nevertheless a lower growth need to be determined in comparison with the average of the Netherlands.

5.4. Influence flow chart

Out of the previous paragraphs (market information and vacancy influence factors) there could be filtered out the method of working in the free-market-system of the real-estate office market. In the next figure the most important aspects are visualized.

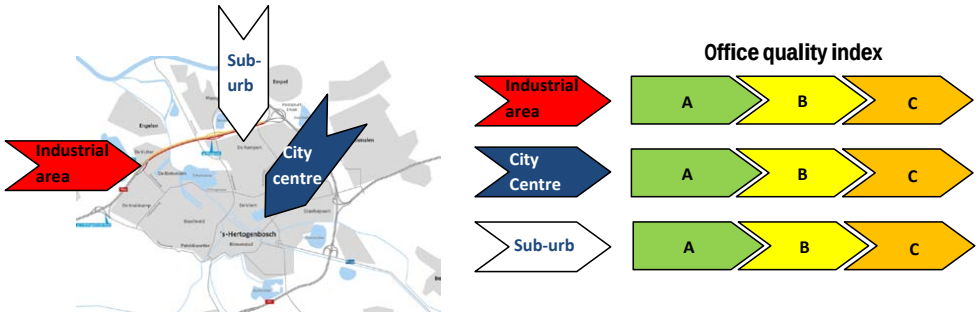


Figure 10: Influence factors geographical location and quality index

5.5. Influence aspects within the real-estate office model

Out of different researches several factors could be stated and put in the model, the question is if these will represent the realistic world. These because several influence has got other importance and interact with each other. For this there is chosen to use the geographical location and quality to make different sub-categories. Which the quality should be the best modeled with energy label (this because the energy label is direct related to operational cost) which price is an important factor of choice. Because just 36,3% off all office buildings is labeled (Senternovem, 2012) the different quality factors are expressed in building year which overcome almost all of them.

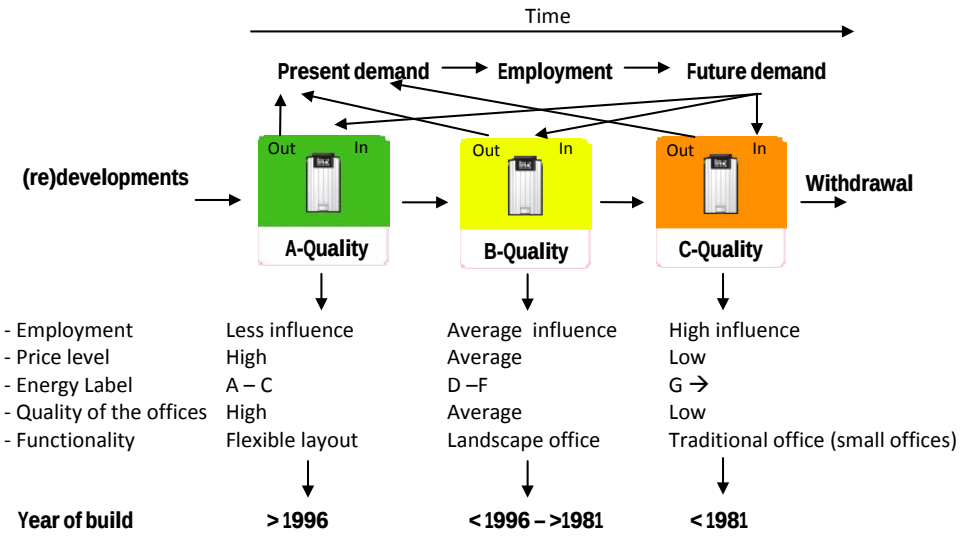


Figure 11: The office influence factors scheduled

5.6. The present state of the art

The most actual numbers out of different reports are presented in the previous chapters and paragraphs. Within this research the present numbers for the province of Brabant will be determined by the combination of the datasets of the Kadaster, a large brokers agency, and the province itself. These numbers can be found in part 3 and 4 of this research.

6. The life cycle of real-estate, the ageing part

Some possible origins of vacancy are already determined in the previous chapter, these factors are partly depended of soft factors (governmental policies, economics). Within these chapter the hard factor: 'the life cycle of a building' will be reviewed, which is easier measurable on the basis of technical and economical quantities.

The influence of the technical quality could be subscribed by the quote of the Amsterdam office strategy (Werkgroep kantorenstrategie, 2011):
'Quantitatively there is enough office space to fulfill the need till 2040. However a lots of the vacancy is unusable, which redevelopment not always could be the solution. The withdrawal of the underside of the market is therefore necessary.'
Within the Amsterdam office strategy there is also made an interesting deviation between favorable offices and no-chance offices (Figure 12).

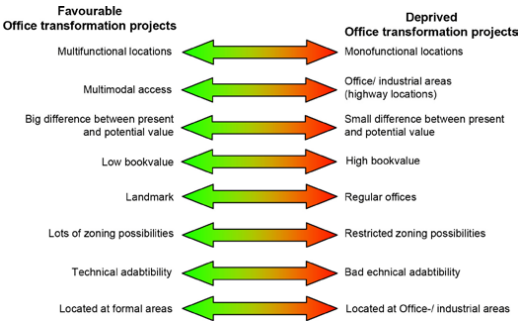


Figure 12: The properties of favourable and deprived offices

6.1. Technical ageing, the technical life cycle of real-estate

Technical life cycle of an office building could be defined in several ways, in different units. The latest one is the carbon footprint (in the operational phase combined by a renovation or redevelopment), for this the Dutch Environmental agency (Agentschap-NL) has done research in different scenarios, which should be the most beneficial. The next scenarios are calculated (Anink, 2010):

1) Operate without any improvements;
2) Small renovation
3) Heavy renovation
4) Demolish + new development
5) Vacancy + demolish + new development

In all the scenarios the lifespan of a newly build office is standard 50 years determined by the national standard. Figure 13 gives an impression of the environmental load (carbon footprint).

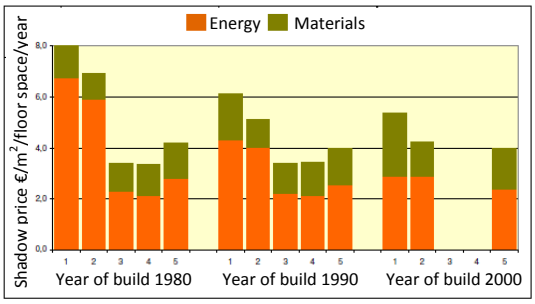


Figure 13: CO^2 footprint of buildings, different years of build

The life cycle of a building
The general (technical) life cycle of a building is mostly estimated around 50 years. To extent this life cycle there could be intervene by a renovation. The intervene (action) is on the first hand needed to consolidate the quality. Which this will influence the (technical) performance of materials and the building. The next variables are important to judge this renovation:

- The present lifetime;
- Achieved lifespan extension of the building (extension is positive);
- The ratio between replacement or preserve (preserve is positive);
- Long- or short cyclical components in the building (by the replacement of long cyclical components is the lifetime longer);
- The amount of new used materials;
- The choice of materials by new components.

Relevant variables:

- The year of build has proven to be an important variable. There is a connection between material load and energy related load in opposite directions.
- The improved energy performance of buildings could be explained by the stricter legislation (energy label).

6.2. Economical ageing

Economical ageing is related to the different valuation methods which are determined in chapter 3.2. each valuation method gives other input if and how much an office is aged. The difference could be made between static (Full rental method) and dynamic (the net present value method), which the last gives more prices input.
To overcome the ageing part of office real-estate at field (area) level. The economical institute of construction (EIB) developed an 'office model' which should create an equilibrium in supply and demand, Figure 14.

The office model (EIB, 2011)

1) The segmentation of the office market to location and quality categories;
2) The monitoring of the present stock, the planned developments, and an estimation of the development of the stock in the different segments;
3) An estimation of the demand. First quantitative and second qualitative, which the estimation is divided in the different segments;
4) A combination of supply and demand in each segment. Which there could be conclude an under- or overstock.

Figure 14

The step-by-step plan determines not the age, but step 3 indicates the most important feature for economical ageing, the difference between quantitative supply of offices and qualitative supply of offices. Which the demand of offices in the office market could be described in a quantitative and a qualitative way, which:

- The quantitative aspect is the absolute size of the office demand, this can be determined by the employment and the office space use of each employ.
- The qualitative aspects are the users preferences with respect to the offices. Relevant are: Trends in office use, changing preferences, technical possibilities, and location preferences.

If the supply eventually met the qualitative standards will always be a question which depends of different factors, which mostly are users preferences. Within the respect of the different standards an office knows different types of ageing, namely:
Normative aging: If an office not meet the actual quality standards of users, this could have a relation with technical aging, but also with changed demand of users.
Economical ageing: If the exploitation of an office is no longer profitable. When 'economical aging' will be used to quantify the development of rents the next conclusion can be made out of the period 1990 – 2010. Offices with repeated sales has a lagging rent development on building level in comparison with the rent developments in the market. This means in the quality segmentation a shift from category A towards B, B towards C. Office will drop down on the ladder of quality. When offices are definitive 'economical' obsolete they will possible be demolished. In general there will be demolished 1 building by the build of 8 new offices(Bak. R.L., 2011).

Out of the transaction database of 1990 – 2010 there could be concluded that the 'economical' ageing differs by the location. By central locations is the lagging rent development (0,5% each year) of the building in comparison with the market rent (2,2% each year) the less. remaining locations has a lagging rent development of 0,9% each year. The most withdrawal (demolish/ restructuring) will be done in central (61%) and formal (27%) locations. The most buildings will withdrawal in the B and C segment .

6.3. Economical and technical depreciation translated to the office model

In the previous paragraph there is stated a technical and economical depreciation in qualitative way. The technical depreciation means the ageing of building techniques (building physics and materials) and the economical depreciation has the best relation with the functionality (layout of the building), which both has relation which each other. To translate these facts to the 'free-market-system' of the office real-estate market, the economical institute of construction (EIB) has expressed the economical ageing in hard factors, namely the shift towards lower (price) segments, divided in different geographical locations:

- *Central locations*, 0,5% of the stock will shift towards a lower segment;
- *Remaining locations*, 0,6% of the stock will shift towards a lower segment;
- *Formal locations (Industrial/office areas)*, 0,9% of the stock will shift towards a lower segment;

6.4. Influence flow chart

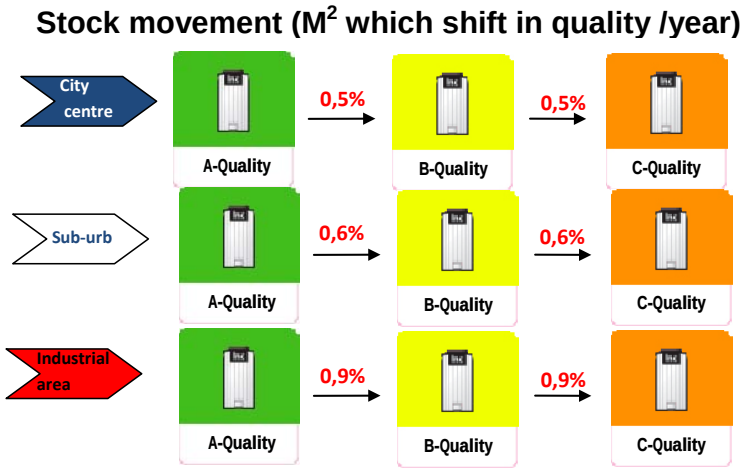


Figure 15: Stock movement factor

6.5. Influence aspects within the real-estate office model

The stock movement factor out of Figure 15 will be taken a long in the System Dynamics model of the office real-estate model.

7. Governmental policies

The process of land development is interactive and dynamic, with several different involved actors, factors and stakeholders. Within the last decades the government has tried to fine-tune this process and get benefit out of the phenomenon of the 'Dutch' planning and development law. In this process the government is acting simultaneously private as well as public in this present system of land development. This conflict of interest (In Dutch: 'Het twee petten probleem') gave the government the advantage to create value in the past, but also the disadvantage to create problems which occur at the moment and in the future. To find out which legislation out of the past has caused a structural vacant overstock of office buildings and how the present governmental system could give possible solutions the Dutch planning and development law is reviewed.

Example: 'Mode of operation, the conflict of interest' ('het twee petten probleem')
With the system of 'trias politica' the government can create their own cash flow by value creation in land development. When they use their public and private instruments simultaneously they can act with prior knowledge in the market. This mode of operation is punishable of you were a private party. Figure 16 gives insight in this process.

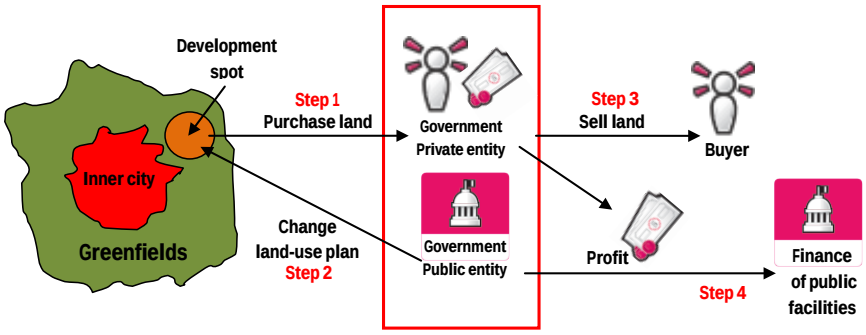


Figure 16: The mode of operation of the Dutch government

Example: *'Because of the economical growth the government plans to unroll new development locations to fulfill the demand of dwellings, offices, and industrial areas. (e.g. by the fourth memorandum of Spatial Planning Extra, Dutch: VINEX). First they determined the best suitable locations to extend and then they purchase land as governmental private entity, after this they change the land-use plan as governmental public entity, which allow other functions (living, industry, etc.) on the bought greenfield land. This made the land more valuable (sometimes 30 times more valuable), for this profit they only need to construct public facilities (sewage, infrastructure)'.* With this jump in value lots of public facilities could be financed, namely: eldercare, childcare, libraries, etc..

The disadvantage of this way of value creation is the possible decline of demand for space, which the game of greenfield development is over. This results in no cash out of land development profits to finance the public facilities, this could lead to a bankruptcy (some municipalities are already under supervision, Dutch: 'artikel 12 procedure').

7.1. Various instruments of control, by the government, passive or active

The above standing mode of operation can only be done if the government is acting active. During the last decades the possible way of acting by the municipalities could be active or

passive. By active land development land will be bought and governmental instruments will be used to control the total process of urban development. By passive land development the government is only facilitating the (private) land developers with their governmental instruments, they don't have land in possession, this means no risk, but also less influence. Active acting makes the conflicts of interest out of the previous paragraph possible, but could also be used to try to solve the present problems in spatial planning. The next paragraphs gives insight in the use of instruments, and how it could be used to solve present problems.

- WRO, spatial planning act;
- WvG, pre emption right, and Expropriation/ compulsory purchase;
- GREX, land development act,;
- Different legal forms to recoup, agreeing or collaborating.

According to: 'Planning and Development Law in the Netherlands' (Hobma & Schutte Postma, 2011):

To understand the present mode of operation of land development and to figure out possible solutions in the Netherlands the difference between policy and legislation need to be taken in mind:

Legislation (laws and regulations): *Legislation creates boundaries which the different entities may act or may deviate from (public and private parties as well as individuals). There could only be deviate conform a special set up procedure.*

Policy: A *policy rule regulates the policy which need to be preformed, Policy rules are intend to give a consistent and systematically substance to the power of an authority.*

Both policy and legislation are interactive and complementary, which the fairly rigid legislation will be performed by the more flexible policy. In the next paragraph first the legislation will be elaborated, after this the present policy will be reviewed, and after this the possible solutions in the office real-estate market will be proposed. Within the separate text blocks possible scenarios based on the vacancy agreement and rumors out of the market are suggested.

7.2. WRO, spatial planning act

Legislation:

Spatial Planning Act, (Dutch: Wet ruimtelijke ordening) this act does refer to the statutory land-use plan. Shortly, the land-use plan points out what can be built where and which regulations apply. This takes place by way of a map showing the land-use objectives (Dutch: bestemmingen), the objectives indicate the allowed land-use. Examples of land-use objectives are: residential area, industrial area or agricultural use, the most important functions of a land-use plan are:

- Prevention of undesirable spatial developments in the area covered by the plan;
- Guiding desirable spatial developments;
- Offering certainty to land own ers about the ownership restrictions.

The land-use plan can be used for very different planning purposes: to enable desired changes in land-use (such as urban expansion), or to consolidate an existing situation (such as nature conservation area or realized residential district).

Policy:
In positive way the new WRO and old Wro have been beneficial to the development of the Dutch Economy and environment. The last decades different municipalities allowed a lot of developments by new spatial plans, which helped to place the population growth, and new business (out of other countries). The booming economy gave the municipalities occasion to develop greenfields as expansion area, which sometimes the present ageing brownfields were ignored. This speculation of growth did not take possible stagnation of this growth along. For this the spatial planning act may be used to much, which there now is an overstock of planning capacity and also of office and retail real-estate.

Possible solutions:
Specific solutions by the use of brilliant and difficult models could be used to perform influence by the use of flexible land-use plans, and strict policies. But the essence of the present situation is to create scarcity and a supply which meets the need of the companies in the province of Noord-Brabant (also in the Netherlands). This could possibly be done by national and regional consultations.
In practice the WRO could be coupled to the present stock, and should be used more by brownfield and inner city redevelopment instead of greenfield development. At the present state of overstock of planning capacity and office buildings the WRO should be give

Scenario, Development credits (construction claim): The origin of this solution is the game between project developers and the municipality. By a proposed urban development there could occur a land possession of a project developer which could self realize the land development. Because of public interests to guide the urban development the municipalities are mostly eager to coordinate the land development. For this the developers export their land in exchange for a construction claim. The claim is a serviced plot, which the developer only need to do the real-estate development instead of the total development (land-development + real-estate development).
The scenario 'development credits' has similarities with the present phenomenon of the 'construction claim'.

flexibility. For an easy change of the present destination in the land-use plan, and the flexibility to shrunk down plan capacity.

7.3. Expropriation, and pre emption right

Legislation:
WvG, pre emption right, (Dutch: Wet voorkeursrecht gemeenten):
Establishment of pre-emption rights means that the governmental authorities appoints specific parcels of privately owned land on which the right is applicable. The consequence of establishment of pre-emption right is that, if the owner of the appointed land is willing to sell his property, he must offer it to the municipality. Thus, the municipality is the first party to enter into negotiations with the landowner to buy the land (and buildings on it).
The establishment of pre-emption right does not imply that the owner has to sell his land to the municipality. It just mean that, if he is willing to sell, he has to offer it to the municipality and cannot offer it to another party.

Expropriation/ compulsory purchase (In Dutch: Onteigeningswet):
Sometimes, regulating the use of (private) property in a given planning area by means of a land-use plan, is not enough to reach policy goals. Sometimes 'absolute' governmental control of land is necessary in connection with intended developments. Such as the construction of a new public motorway. In such cases, the government can purchase the land under private law.
The construction establishes that expropriation may occur when it is in the public interest and only after prior assurance of indemnification, according to regulations set forth under national legislation.
The expropriation act compliments the spatial planning act by allowing the possibility of expropriation for either (1) executing the land-use plan or (2) maintaining the status quo to be in accordance with the land use plan. The land-use plan is the most important planning instrument of the spatial planning act that can serve as a basis for expropriation.
The landowner in case of expropriation has a right to complete compensation. The compensation is either based on the value of his land and buildings erected on it under the current use.

Policy:
Both laws are elaborated together in this paragraph, this because both has got the same aim, namely governmental coordination. Pre emption right is mostly used in the past by greenfield development, expropriation by (brownfield)/ inner city development, both procedures are long lasting.
Today municipalities are using planning procedures that were suitable for greenfield development for the redevelopment of brownfields or inner cities. The consequences are that plans only partially executed or with higher percentage of red functions ore a higher exploitation cost. (Buitelaar et al., 2008) Have shown that the success of urban (re)development in the Netherlands has a direct relationship with the financial success of the plan. That's why we recommend the application of property aware planning practices. In this research there is a focus on the redevelopment of the present stock which equals brownfield redevelopment.

Possible solutions:
Because the pre emption right is more used by greenfield development and expropriation more by inner-city/ brownfield development, expropriation is more suitable. But both could help to offer solutions for the real-estate office market, benefit of them only can be reached by an active participation of the municipality. Which the government could obtain physic office buildings or hard planning capacity to create an artificial equilibrium in the market. An important clue is the height of the financial compensation. *'The compensation is either based on the value of his land and buildings erected on it under the current use'*. Which there should be not used the 'bookvalue' or 'OZB-value' but the net present value method like the 'discounted cash flow method'.

Scenario, Development stop:
By this scenario the market will be dictated by the government. Owners of vacant offices will be expropriate for the present NPV-value (if possible to determine). Beside this the government has got a hierarchical approach by the distribution of plan capacity. If private parties are owning positions with already a destination (hard plan capacity) the government can within this scenario scrap the plan capacity without the recoup of plan damage.

7.4. GREX, (land development act), BIZ, Business investment zones

Legislation:

GREX, (land development act), (Dutch: grond exploitatiewet extra). The land development act is an agreement to recoup the municipal costs for land development, it can be seen as the financial transcription of a spatial plan.

The land development act is introduced in 2008. This to give the municipalities an extra instrument if they want or be forced to act passive (urban development without land positions). For this the government can recoup financial resources by the land-owner during the procedure of the environmental permit (building permit). Which the GREX is focused on real-estate development but refers to land development. Land development and real-estate development are two different process, both with another focus. But both will influence each other, which a well done land development with an interesting urban development and good infrastructure will gain more revenue for the real-estate developer, but the land developer will not share in this (financial) benefit, but they invest in this transition (financial and legal). For this there is set up legislation which helps municipalities to recoup land development costs during the legal procedures of real-estate development.

Legislation:

BIZ, Business investment zones (Bedrijfsinvesteringszones), the (concept) legislation of the business investment zones is just tried out in the Netherlands, within the retail market and industrial areas. The idea is quite similar compared with the GREX, only the instrument can be operated by entrepreneurs and/or real-estate owners. The instrument has the aim to stimulate the entrepreneurial climate within a specific area. When there is enough commitment (50%, need to vote, 2/3 of the votes need to be positive) to cooperative invest in improvements in the area the other entrepreneurs (without commitment) will be urged to join in this investment. Since the start in 2009 of the project until the end of 2012, already 112 investments with the BIZ are done, by the construction of the legislation there were just 30 estimated.

Policy:

Both laws are elaborated together, the collective interest is to fund money which will be used to invest in beneficial collective facilities. Both laws are relatively new (2008, 2012), which there is more experience in the GREX which is directly coupled linked to land (re)development, and the BIZ is more linked to the (operational) management of companies, it has its origin in park management.

Possible solutions:

Different legal forms to recoup, agreeing or collaborating

Instead of the exact execution both laws could be in advance arranged by collaborating. Which there could be made an agreement or established a separate entity, which a limited partnership is incorporated on the basis of an agreement between parties. That agreement also prescribes that a private limited company will act as sole active partner (of the limited partnership).

In case of the GREX the legal entity is mostly labeled as a 'Land development company' (Dutch: grondexploitatie maatschappij; GEM), this separate entity represents the joint-venture of public private partnership.
In case of the BIZ the Brabantse Ontwikkelings Maatschappij is trying to set up a 'market manager model' (marktmeester model). In short: 'there will be constructed a separate entity which the present owners bring their real-estate in as deposited, and the 'market manager' will facilitate all their needs'.
Summarized means this: 'with the help of one of the instruments GREX (land development) and BIZ (existing market) there could be create a fund to stimulate the office market'.

Scenario, Regional office fund: The construction of the office fund can easily be constructed if it is voluntary, which each party is free to join financially or do nothing. This mostly cause the 'free riders' problems, which the overall benefit of the fund is difficult to quantify. For this the government could be the direction of the fund, by forced money collection. For this there already proposed several forms of money collection, especially the Vacancy Tax and Environmental Tax.
Vacancy tax: There is proposed to tax each vacant office, on the first hand to urge office owners to ask more market representative rents and to make their office more attractive, on the second hand to collect money for the regional office fund (to demolish or transform offices).
Legality: normally tax will be collected on beneficial cash flows, the profits of a company will be taxed, the losses of a company won't be taxed, companies could even compensate this losses by profits in an upcoming year.

7.5. The present state of the art in the office market, awakening to adaption

In this paragraph the present state of awakening to adapt will be connect to the previous scenarios, this scenarios will be tested in the modeling part of this research (part 3). The vacancy agreement (Schultz van Heagen, M. et al., 2012) and market rumors are used for the present state of the art.

Regional office fund: For the construction of an regional office fund there are proposed a vancay tax (similar to the BIZ regulation), and an environmental tax (similar to the GREX regulations).
Vacancy tax: There is proposed to tax each vacant office, on the first hand to urge office owners to ask more market representative rents and to make their office more attractive, on the second hand to collect money for the regional office fund (to demolish or transform offices).
Legality: normally tax will be collected on beneficial cash flows, the profits of a company will be taxed, the losses of a company won't be taxed, companies could even compensate this losses by profits in an upcoming year.
Environmental tax: There is proposed to tax each newly build offices to compensate their impact on the present office market, and also the environment.
Legality: The tax already exists by the sale of electronics, it is just difficult to determine the exact impact on the complicated office market and environmental tax.

Development credits: The development credits helps to fine-tune the supply and demand, the next is proposed:
Fine tuning of supply and demand: Last but not least the fine tuning of the supply and demand of offices in the different regions local (provincial) and national is proposed as a

solution. On the first hand this is more an organizational solution. But there are more influential factors within this solution. This because the municipalities are creating value by land development, and occupied offices generate tax income in the form of company profits and real-estate taxes (OZB-tax). To fine tune the different forms of plan capacity and possible withdrawal (supply and demand) of offices there need to be constructed a fair system which consider the interest, power and possibilities of each municipality local and regional.

Development stop: This scenario is based on rumors out of the market.
To make this possible there first need to be made an inventory of the present hard plan capacity and the present office stock. In general there are planned lots of new office developments, which are based on a growing economy, more specific a growing demand of offices. By a possible demand decline there occur a lot of legal problems to stop the development by shrinking down the plan capacity. Because the land is already owned by private parties and there is mostly a land-use plan is operative the municipality cannot stop the development. This because the last mean of control is the system of the environmental permit (building permit). This is a summarization of restrictive and mandatory grounds of refusal. This means if the plan of the real-estate developer pass the land-use restrictions, building regulations, and building act, the municipality cannot stop the development.

Part 3 – Modeling process

8. GIS – modeling

8.1. The different databases which are been used

First of all, there is quite some information available in the databases delivered by the Kadaster, Jones Lang LaSalle, and the province Noord-Brabant. The Kadaster has provide data on Netherlands National coordinate system and 6 position postal code + address, the databases of Jones Lang LaSalle is provide on 6 position postal code + address, the data of the province only on 6 position postal code. Which the kadaster database serve as base database, the other one are added or use to do to some comparative analysis.

Modeling approach

Figure 17: Data modeling approach

8.2. Results

The benefits of GIS-analyses are the geographical maps that could be produced combined with different data-sheets. The aim of this approach is to provide insights into the vacancies within the different geographical locations. First some data about the city of 's Hertogenbosch is provide, after this the corresponding geographical maps is presented.

Table 6: Office real-estate factsheet 's-Hertogenbosch

Label summarization					
Geographical boundary: City centre					
Quality type	**Amount of offices**	**Amount of vacant offices**	**(M2) offices**	**(M2) vacancy**	**Vacancy %**
A	7	6	35.265	4.990	14,15%
B	11	5	31.376	3.876	12,35%
C	42	7	92.488	11.413	12,34%
Geographical boundary: remaining locations					
Quality type	**Amount of offices**	**Amount of vacant offices**	**(M2) offices**	**(M2) vacancy**	**Vacancy %**
A	19	2	43.575	3.405	7,81%
B	32	2	94.970	4.702	4,95%
C	65	3	150.843	1.819	1,21%
Geographical boundary: formal locations					
Quality type	**Amount of offices**	**Amount of vacant offices**	**(M2) offices**	**(M2) vacancy**	**Vacancy %**
A	41	12	149.903	25.643	17,11%
B	43	16	228.047	41.159	18,05%
C	20	3	125.749	8.952	7,12%
Total	280	56	952.216	118.252	12,42%

The overall result (by the different districts) are added in appendix E. The geographical representation of vacancy (Figure 18) within the different districts and the geographical representation of the quality of the buildings is (Figure 19)are plot on the following pages.

8.3. Consistency check

Because of the different modeling decisions, which are made, the GIS-datasheet need to be checked on consistency. For this I use the database produced by R.L. Bak (published 2011) commissioned by the NVM. The datasheet provide by the Kadaster uses 2011 as last reference, and Bak uses 2010, within the modeled datasheet all the office built in 2011 are filtered, which is 2518m^2. Which the model represents 949.698m^2 and the NVM 953.000m^2 a deviation of 3302m^2 (0,3%).

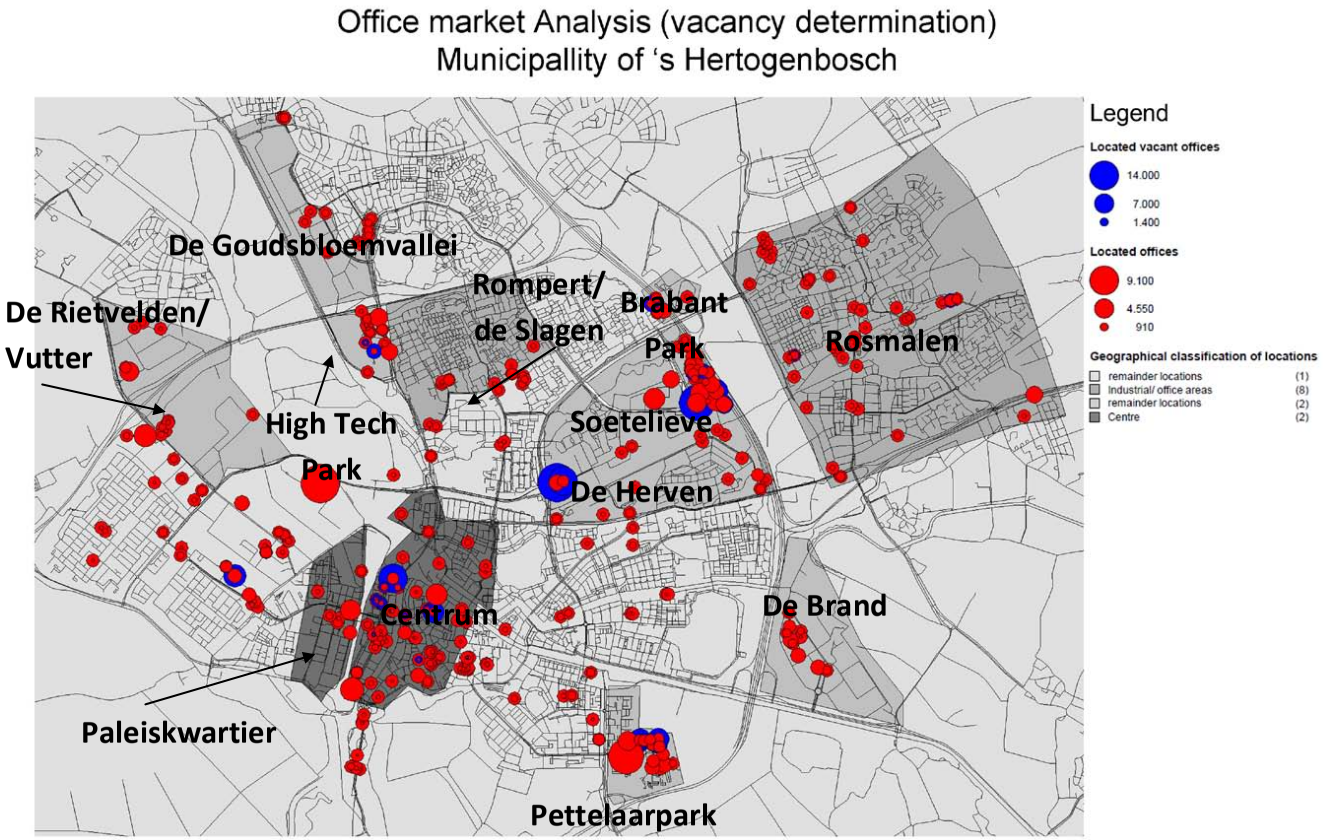


Figure 18: Representation of the vacancies in 's Hertogenbosch

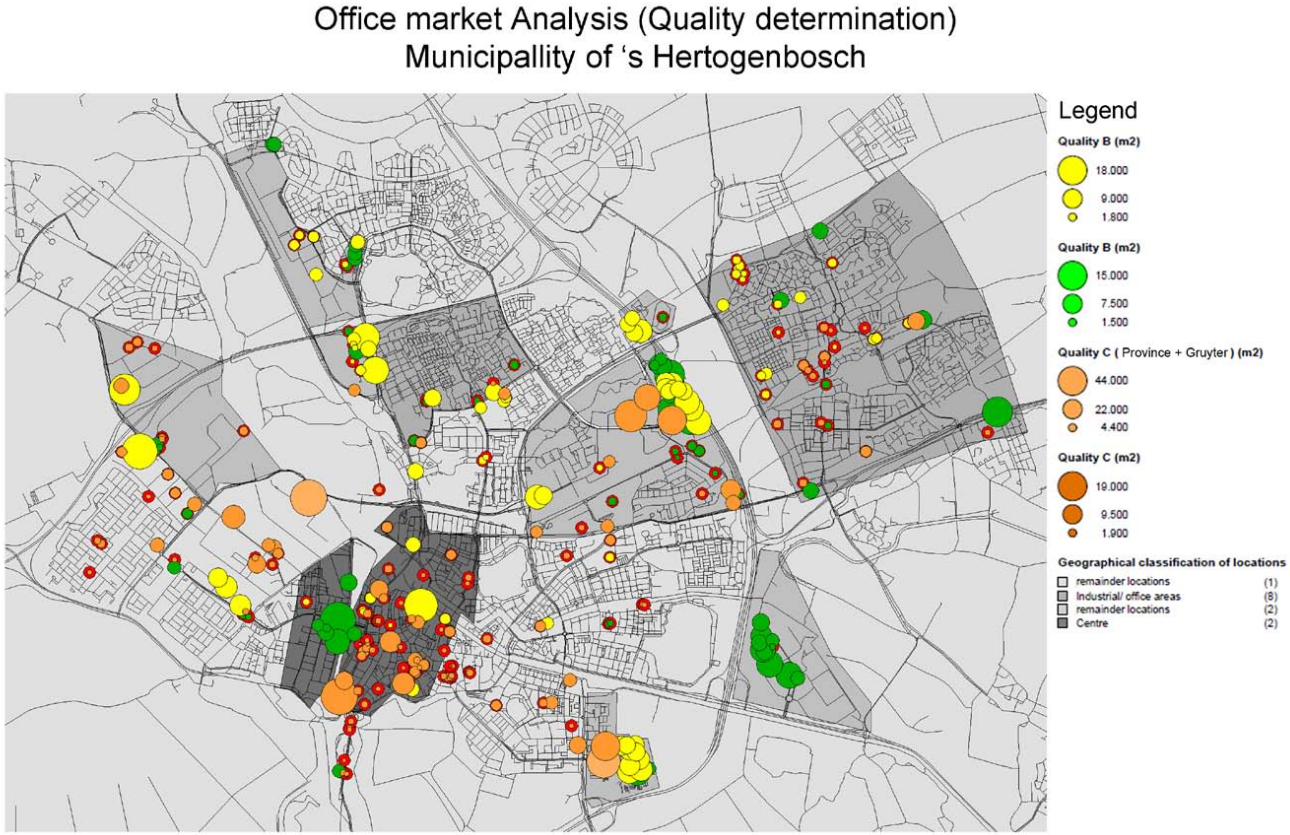


Figure 19: Representation of the different quality groups in 's Hertogenbosch

8.4. General conclusions out of the GIS-analysis.

Out of Figure 18, Figure 19, and Table 6 some first global conclusions can be made:
The benefit of a geographical representation is to visualize the size of each office building. Out of the maps there can be filtered out:

- The office of the province is together with the old Gruyter factory the biggest office in 's Hertogenbosch, In the analyses they are classified as a low quality building, the question is whether this is representative. Because the past renovation of the Gruyter factory and the high standards during the building process of the house of province, they are separate represented on the map.
- The location 'De Brand' is the last office development location, but not with a biggest amount of offices in stock, and certainly not a high vacancy percentage. A reason for this could be the during rent contracts which are signed by completion and the high quality because of the young stock.
- Mixed use park 'De Herven' has got the most amount of square meters A-quality stock, this because the most stock is situated within this neighborhood. Within this neighborhood there is also a high vacancy rate determined.
- As expected the most of the C-quality is situated in the old city centre and the remainder locations.
- Rosmalen can be reviewed as a remaining location because there is no specific concentration of offices on a specific industrial area (only Brabant park which is already separated in the analysis).
- Pettelaarpark has also to deal with a structural amount vacancy (46% of A-quality and 20% of B-quality), which in the future could continue to the C-quality.

9. System Dynamics Modeling

9.1. The Real-estate office market, modeled as a system

The Boundary of the model

The System Dynamics model is based on the Municipality 's Hertogenbosch, this because of the 'pipeline' effect, not all the information of the province of Brabant will be available at the same time. The conclusion out of the System Dynamics analysis and the Game Theory analysis will be based on 's Hertogenbosch. By the recommendations of this research suggestions for other municipalities will be done.

Data input and data behavior

To construct a model about the real-estate office market some present quantities out of the market need to be represented in the System Dynamics model. By the previous literature research (Part 2) there are filtered out different data sources which gave input for the exogenous variables, these variables are out of the model and have got a direct influence on the model (stocks, flows, variables). There are also filtered out endogenous variables, these variables are established within the model and have got a direct influence on other variables in the model. In the next paragraphs the origin and the behavior of the variables will be brief explained. Figure 20 gives a simple representation of the exogenous and endogenous variables.

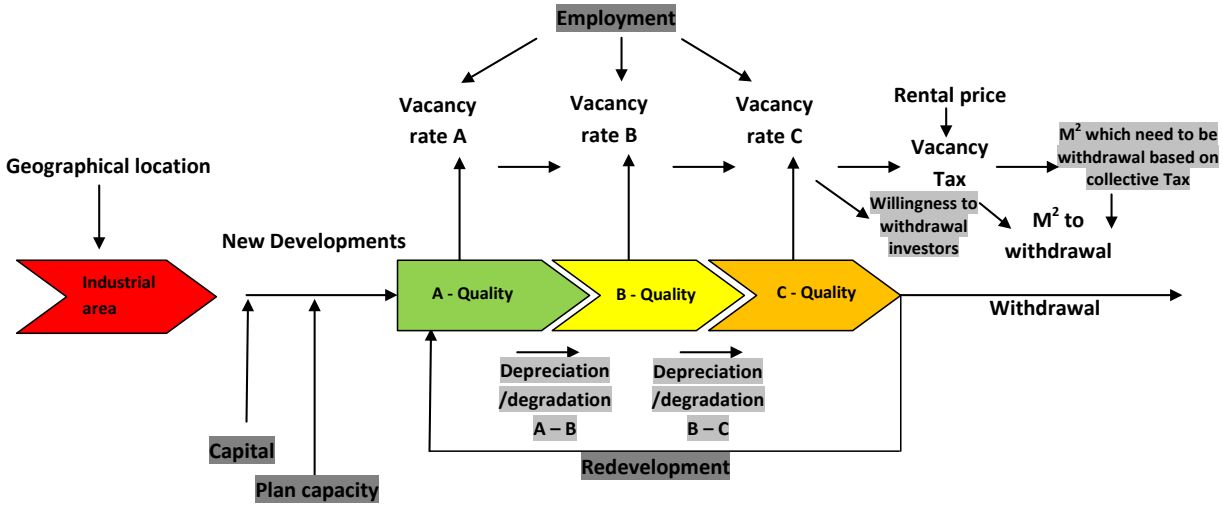


Figure 20: Simple representation of the System Dynamics model

In the next paragraphs the Data input (Exogenous variables) and the data behavior will be shortly explained.

Data input (exogenous variables)

Quality of the buildings:

Out of different researches (Part 2 of the research, state of the art) there is quality determined as an important characteristic which influence the possibility to be a vacant building or not. For this quality need to be expressed in a factor. Several different variables could indicate the quality. E.g. *Rental price, Energy label, building year, functionality, architectural value*, and so on. To use this value within the model, first it need to be fully available (because the analysis will be done at building level/ 6 position postal code), second, the value need to be measured objectively e.g. architectural value is not very consistent to define.

By the previous quality definitions Energy label should be fit the best to determine quality. One of the benefits is the direct relation with the energy use, which contribute to the total cost of use.

Unfortunately there is no availability of energy labels on postal code (building level). Out of the governmental database the amount of the already labeled office buildings are filtered out, represented in Table 7 and Figure 21.

Database of labeled offices in the Netherlands (Senternovem, 2012)										
	A++	**A+**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**Total**
1000-1900	5	1	7	4	8	24	13	20	180	262
1901-1950	1	1	13	5	12	29	29	28	196	314
1951-1974	4	4	34	24	67	67	83	72	325	680
1975-1990	43	54	124	100	204	237	262	190	377	1.591
1991-1999	3	17	137	148	283	224	215	118	130	1.275
After 2000	10	66	477	180	227	85	47	18	16	1.126
Total	66	143	792	461	801	666	649	446	1.224	5.248

Table 7

If this numbers will be reflected to the amount of offices involved in the GIS-analysis of 's Hertogenbosch, the next comparison can be made (next page).

's Hertogenbosch

Amount of offices : 280

Amount of m^2 offices : 952.216 m^2

The Netherlands

Amount of m^2 offices : 49.129.000 m^2

Estimated offices :

(49.129.000 m^2/952.216 m^2)*280= +/- 14.446 offices in the Netherlands.

Labeled offices in the Netherlands

Amount of offices : 5248

% offices labeled : 36,3%

(estimation)

Labeled offices in the 's Hertogenbosch

Amount of offices : 102

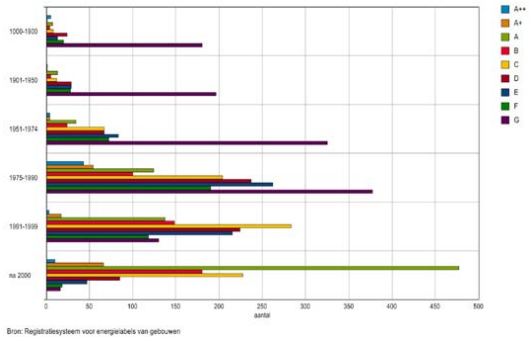


Figure 21: Histogram of labeled offices in the Netherlands (Senternovem, 2012)

Because only general numbers of energy labels are available, and not a total database at postal code level there is chosen to use building year to determine quality. This because most of the energy labels are related to building year (Table 7), only a (sustainable) renovation is difficult to figure out, this is at the moment not taken along in the model.
To use the energy label as an obliged mean to urge real-estate owner to be more efficient with energy-use the European Union has set up legislation. Unfortunately the Dutch government has refused the proposed legislation. (Het wetsvoorstel kenbaarheid energieprestatie gebouwen is op 20 november 2012 door de Tweede Kamer verworpen)[6].
Because of the above standing establishment of the unsuitability of energy labels within a model on postal code level, the next groups are determined .

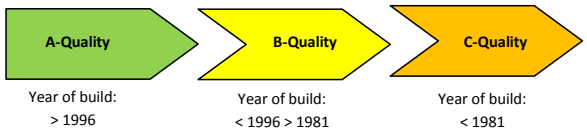


Figure 22: Quality groups within the office real-estate market

Geographical location:
Out of different researches (part 2, state of the art) there is location determined as an important characteristic which influence the possibility to be a vacant building or not. To determine the exact location of an office building the database of the Kadastre is used to determine which quality in which amount is located at what kind of location, this is done by a GIS-analysis. To determine the type of location the classification of different areas of Jones Lang La Salle is used (kantorenmonitor, 2012), which the different boundaries are filtered out with Google Maps, represented in Figure 23.

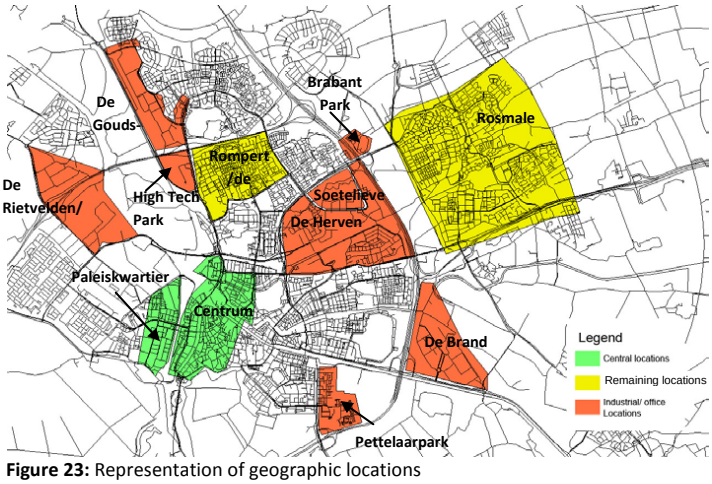


Figure 23: Representation of geographic locations

[6] http://www.agentschapnl.nl/programmas-regelingen/epbd-energielabel

Present amounts of office space (A/B/C- Quality):

The present amount of office space (m^2) is determined with the help of the Kadaster database. Based on the BAG-files (basic administration buildings). The GIS-model helped to filtered out the different stocks and their amounts in the different geographical (Centre/ suburb/ Industrial area). and quality (A/B/C) boundary. The exact numbers are represented in Table 8.

Present amount of office space 's Hertogenbosch			
Quality	Geographical location		
	Centre	Suburb	Industrial area
A-Quality	35.265	43.575	149.903
B-Quality	31.376	94.970	228.047
C-Quality	92.488	150.843	125.749

Table 8: Present amount of office space (m^2)

Present amount of used office space (vacancy):

Only the exact determination of the present stock is not sufficient to determine the exact vacancy. For this study the approach to determine whether a building is offered or not is chosen, this because the approach to determine occupancy only can be accomplished by field research, which is infeasible during the time period of this research. Jones Lang LaSalle has set their datasheet of the B5 available for this research. This datasheet is add to the GIS-model which is used to determine the amount of office space which is in use, so the same groups are used by the analysis (quality and geographical location). The exact numbers are represented in Table 9.

Present amount of used office space 's Hertogenbosch			
Quality	Geographical location		
	Centre	Suburb	Industrial area
A-Quality	30.275	40.170	124.260
B-Quality	27.500	90.268	186.888
C-Quality	81.075	149.024	116.797

Table 9: Present amount of office space (m^2)

Employment forecast:

The System Dynamics model will be used to predict the future of the real-estate market, for this there are several factors which influence the office real-estate market. Out of literature research (part 2, state of the art) employment is encountered as one of the most important factors. Out of the analysis of the EIB the next coherence of Employment and office vacancy could be stated.

Figure 24: Coherence of employment and office demand

As mentioned not only the employment is important as factor to determine the demand of offices, but also a specification to office jobs and the demand for square meters. For this the regular employment is considered and the demand for office jobs (Figure 25). Which it is difficult to determine the exact share of a specific type of office job in the specific market.

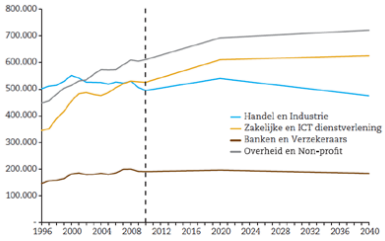


Figure 25: Office Jobs development in the Netherlands, divided in sectors

The future demand of offices in the constructed System Dynamics model is directly coupled to the different scenarios, for this there is no translation made with the type of work in a specific area. This because of two reasons. First the office use per employee could not be predicted because the LISA-datasheet gives only insight in the employment of the total area which retail, production and other functions could disturb the different ratios. (Only office areas with exclusively offices could give interesting insight). Second the employment in- or decrease is only predicted on a global scale, which make it not feasible to make an exact predication by location or location type. Within the system dynamics model the scenarios out of Figure 26 are used.

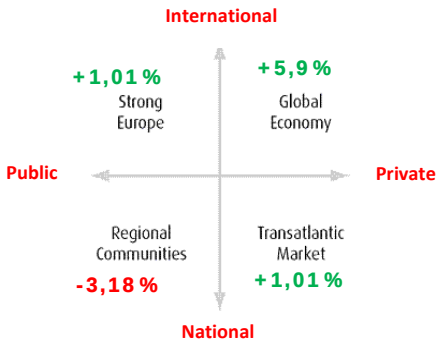


Figure 26: WLO-Scenarios

Plan capacity (available development space):

Within the field of area developments there are several definitions of available development space. Which the most provinces indicates this by a Hard planning capacity (space with land-use plan) and a soft planning capacity (space without a land-use plan). The project developers determine mostly the Hard capacity with a building claim or planning permission (Buick Consultants, 2011). In the System Dynamics model the numbers of the province are not directly used because there is zoomed into the city of 's Hertogenbosch, but the numbers giving interesting insight in which the minimum development space is the hard planning capacity and the maximum development space is the soft planning capacity.

Development space	Province	B5 (assumption ¾)
Minimum (hard planning capacity):	753.000 M^2	564.750 M^2
Maximum(soft planning capacity):	1.820.500 M^2	1.365.375 M^2
Total	2.573.500 M^2	1.930.125 M^2

Table 10: Global plan capacity of the Province of Noord-Brabant

For the model the next specific information about 's Hertogenbosch is used (Kantoren- en bedrijventerreinen beleid, 2011).

Plan capacity 's Hertogenbosch					
Location	**Hard/soft**	**Location type**	**Amount M^2**	**Timeline**	**Time length**
Geographical centre (only hard)	Hard	A	99.000	2010 - 2025	16
Geographical remaining (hard)	Hard	B	35.600	2010 - 2020	11
Geographical remaining (Soft)	Soft	B	200.000	2018-2030	13
Geographical formal (only soft)	Soft	C	10.000	2015-2025	11

Table 11: Plan capacity 's Hertogenbosch

To visualize the plan capacity during the timeline there is made an estimation of the possible output, divided per each different location type (A = city centre, B= suburb, C=industrial/ office area).

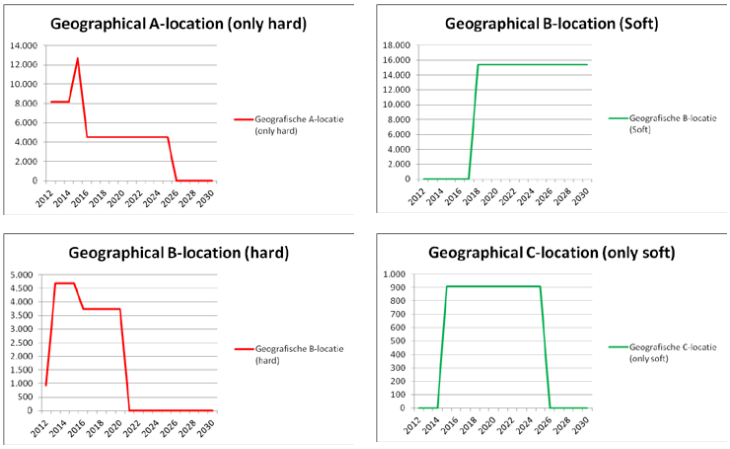


Figure 27: Plan capacity 's Hertogenbosch, divided per location in Time

Depreciation (period):

Out of the literature research there is found a quality segmentation and a segmentation in geographical location. Which is real-estate immoveable, so there is only a shift in quality, this is the depreciation of quality in technical way, this occur because of new innovations in new developments, e.g. a more efficient and comfortable heat and cold system. The EIB has defined a ratio in the shift in quality (Zuidema, 2012).

Depreciation	Central locations	Suburb/ other locations	Industrial areas
Economical/Technical (A towards B/ C towards B)	1,5% will shift each year	2,5% will shift each year	3% will shift each year
Physical withdrawal 1990 – 2010 (Province of Brabant)	60.000 M^2 3.000 M^2/year	67.000 M^2/year 3.350 M^2/year	13.000 M^2/year 650 M^2

Table 12: Depreciation ratio and withdrawal of office stock

Redevelopment rate:

As mentioned before, during the Economical lifetime of a building there could be take place a redevelopment in the form of an actual redevelopment (demolishing and new building) or a (drastic) renovation. For this the numbers of the NEPROM are used, within their publication: 'newly build commercial real-estate' (2012) they monitored the (re)development projects in the office and retail market. Namely, the planned projects (planning permission), the realized projects, and the redeveloped projects. For this there is a redevelopment rate of 1% of office real-estate within the city of 's Hertogenbosch, this percentage is used in the System Dynamics model.

Data behavior (endogenous variables)
A System Dynamics model is dynamic which means the different stocks, flows and variables will influence each other. Which there are simple relations (more demand, is less vacancy) but also more complicated effects (e.g. a rebound effect). For the modeled System Dynamics model there are different endogenous variables which represent several effects which occur in the model, this depend of the behavior of other variables, the most important effects are the: degradation effect, movement ratio, and the willingness to withdrawal by investors. Within the next paragraphs they will briefly be explained.

Degradation effect:
The extreme variant of this effect is the 'ghost city', for this there is assumed if there is a high percentage of vacancy at a certain location present real-estate will drop in value, for this the depreciation ratio in the model will increase. These factor occurred in Detroit after the department of the large amount of industry. Because there is less reference research available there is made an estimation of the degradation effect. The next assumptions are made:

Location	Degradation effect A-B		Degradation effect B-C	
	Vacancy %	Depreciation Accelerator	Vacancy %	Depreciation Accelerator
City Centre	No degradation	1	No degradation	1
Suburb/ remaining location	0% – 5% 5% – 10% 10% – 20% 20% – 30% 40% –>	1 1.25 1.5 1.75 2	0% – 5% 5% – 10% 10% – 20% 20% – 30% 40% –>	1 1.5 2 2.5 3
Office-/ industrial area (formal location)	0% – 5% 5% – 10% 10% – 20% 20% – 30% 40% –>	1 1.5 2 2.5 3	0% – 5% 5% – 10% 10% – 20% 20% – 30% 40% –>	1 2 2.5 3 3

Movement ratios:
The endogenous variable 'Movement ratio/ movement factor' is used to bring the different type of stocks which are occupied in a realistic form. These factor causes a redistribution of the users when there has taken place a shift in quality (depreciation period) or there is a withdrawal of offices. The movement ratio by the shift in quality is equal with the movement ratio of an office towards another quality, the users will move 'automatically' towards another quality category when the building does. Beside this there will be stimulated a movement effect, for this there is assumed a (partly) occupied office which will be taken out of the market. Hereby will 60% of the square meters get a new contract which 50% of them will move towards an A-quality building, and 50% towards a B-quality building. The other 40% exists out of vacant stock which is taken out of the market. For this there could also be stimulated a movement to a specific area.

Withdrawal of offices:
The development of employment, and the availability of plan capacity are determining the future, for this future there is a last trump. Several parties obtain to withdrawal offices. For this there are three possibilities to withdrawal offices modeled, namely: Governmental withdrawal (Collective Tax), Governmental withdrawal (Hierarchal approach), Withdrawal by investors (construction claim model). They all will briefly explained on the next page.

Governmental withdrawal (Collective Tax):
Within this variable, there will be first collect Tax over the rent of each existing office in the model ('s Hertogenbosch). Legally this could be done by an increase of the OZB-tax. These collected financial resources will in the model be collected in a stock. If these are sufficient to withdrawal offices there will be taken offices out of the market. The amount of M^2 which can be taken out of the market will be calculated by the present rental price, which will be capitalized to determine the market value (full rental approach).

Governmental withdrawal (Hierarchal approach):
Within this variable there won't be collected money to do a withdrawal. There will be directly invested in the withdrawal of offices. In practice this means direct funding by the government, for example by a debt financed by the central government. The M^2 which can be taken out of the market will be calculated on the same way as by the collective tax method.

Withdrawal by investors (construction claim model):
The basics of the construction claim is simple. If office owners will take their office out of the market (e.g. another function or demolish it) they can bring their present tenant along to a possible new development at a better suitable location. Hereby could the government have a participating role or a coordinating role. Participating by buying the office which should be taken out of the market and transform it, or coordinating by connecting different parties together. E.g. if a leaving investor should not have enough resources to transform the building or sell it for only the book value. The municipality could find the right market party which wants to transform/ develop, and to invest in the old building.
The previous description is in the System Dynamics modeled as follows. By a vacancy percentage (>5%) office owners are willing to withdrawal 45% of the vacant stock. Instead of the stock which is taken out of the market, there can be build 60% on other locations (plan capacity). Both percentages are high, but it keeps the market running (construction market), and the quality of the stock high.

9.2. Visualization of the System Dynamics model
The physic visualization of the top model is added in appendix D.

9.3. Verification and validation of the System Dynamics model

'It has been said that before a model undergoes verification and validation, it is just a toy; after a model undergoes verification and validation, it is a tool' (North and Macal, 2007).
To proof the verification and validation of the Systems Dynamics model in this research, first there is reviewed different literature, to determine the right verification and validation methods.
Both verification and validation provide the possibility of falsifying the proposed model. Models are like hypotheses; a model presents a possible explanation of the way the world works, but the explanation must be tested. Proving a model to be false can be as simple as showing that it rests on an invalid assumption. It is impossible to completely validate or verify a model (Grimm and Railsback, 2005).
It is well demonstrated that, by their nature, SD models do not predict specific individual values of output variables ('point direction'), but they predict major time patterns of concern ('pattern prediction') (Barlas, Y., 1989).
The statements made by Barlas means another approach for verification and validation in case of the regular statistic consistency tests. In short, it is often said that a System Dynamics model must generate 'right output for the right reason'(Barlas, Y., 1996).
In the next paragraphs there will be done a verification and validation of the constructed office real-estate model for this research.

9.3.1. Verification

Within the present constructed System Dynamics model, an expert validation test will be done, experts will validate the working method of the model (Stock and flow diagram).

Expert walkthroughs (structure verification)
Verification of a System Dynamics model primarily means validity of its internal structure and the recent relativist/ holistic philosophy argues that valuation of the internal structure cannot be made entirely objective, formal and quantitative (in the sense that even scientific theory confirmation has informal and subjective aspects) (Barlas, Y., (1989)). For the purpose of this study the next experts are consulted:

Expert	Function	Company	Secondary activities
Ir. P. Vismans	Director	Regional development company Drechtsteden	Former director Dutch office fund (pension fund ABP)
Drs. J.F.L.M.M. Dagevos	Assistant professor, researcher.	Telos (research institute UvT)	Supervisory board of BOM
M. van Elp MSc LLM	Researcher	Economical institute of construction	unknown

General findings:

- It is a model in the future, this means a prediction in the future;
- A pure vacancy Tax on vacant office buildings is not feasible. For this only a collective tax could be taken along (e.g. a raise of the OZB tax);
- The legal aspect of both interventions are both 'stumbling blocks' which the government as regulatory power needs to deal with;
- What happens when there will be a development stop.

Model changes:
On the basis of the expert opinions the next model changes are made:

- Vacancy tax will not be calculate over vacant buildings, it will be done over the total stock;
- Within one of the scenarios a stop of plan capacity will be modeled;
- Legal aspects are difficult to model, within the Game Theory analysis, these will be taken along.

9.3.2. Validation

Once validity is seen as 'usefulness with respect to the purpose', then this naturally becomes part of a larger question, which involves the 'usefulness of the purpose' itself. Thus, in reality, judging the validity of a model ultimately involves judging validity of its purpose too, which is essentially non-technical, informal qualitative process (Forrester 1961).
Validation of simulations models in general, and System Dynamics (SD)models in particular consists of two types of validity tests:

1) Structural validity tests (pattern prediction), the function of which is to check whether the structure of the model is an adequate representation of the real structure;
2) Behavior validity tests (structurally orientated behavior tests), the function of which is to check if the model is capable of producing an acceptable output behavior.

Standard statistical tests are not applicable to the SD-type of pattern predictions; and second, one of the most frequent criticisms of SD methodology is that it lacks formal/ quantitative predictive ability tests. (Barlas, Y., 1996)

Simulation of the past (structure validity test)
The at the moment estimated factors are in the past already realized. This fact will be used by this structure validity test, what may be appointed as the simulation of the past, the next approach will be used:

1. Determine the influential variables
2. Figure out their development progress out of the past
3. Adjust the model to this settings
4. Compare the past (year -15) with the present (year 0)

The exact determination of the past and the approach of collecting the variables are explained in Appendix F. In the next paragraphs the actual validation test will be reviewed.

The actual validation of the model, running of the model out of the past:
Running the model with the data out of the past should give an impression of the accuracy of it. In the next analysis of the validation model the next variables will be reviewed:

- Vacancy development;
- Stock development;
- Depreciation effect;
- Redevelopment rate.

Vacancy and Stock development:

Overall vacancy and stock development:

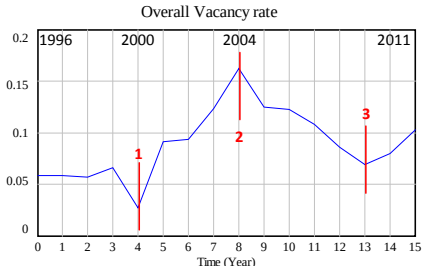


Figure 29: Development of vacancy in 's Hertogenbosch (validation model)

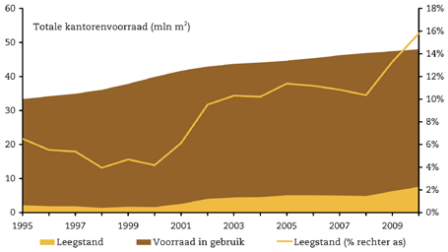


Figure 28: Development of vacancy in the Netherlands (EIB, 2010)

By the first analysis of the overall vacancy rate the office model seems to act quite similar as the actual development of vacancy in the Netherlands. Some explainable influences could have less or more effects in the model. On the first hand because of the specific market conditions in 's Hertogenbosch in comparison with the Netherlands. On the second hand because of the different approach to determine vacancy. Within the model there is used a bottom up approach, by the analysis of the EIB there could be used another kind of approach (e.g. instead of an analysis on building level an area analysis).

The second analysis will review some market trends (marked in Figure 29), namely:

1) Dot-com bubble
2) Pig-cycle, tipping point between supply and demand
3) Double hit of the crisis

Dot-com bubble: Because the market value of internet companies (Dot-com companies) was much higher than the actual book value during the end of the 20th century by speculating, there arose a big 'internet-bubble' which was burst during the years of 2000-2001. This in combination with the new Euro value, and a new Dutch Tax system let collapse the total (Dutch) economy. This effect is very good to trace out of both the graphs. After the year 2000 the vacancy in the real-estate office market is extremely increased.

Pig-cycle: The second trend is more specific for the municipality of 's Hertogenbosch. Because of the pipeline effect (also called as the 'pig cycle') developers were not eager to initiate new developments of office around the year of 2000. This effect can also be remarked in the supply of new offices. During the years after 2000 the supply is decreased till the years 2002 and 2003, after this the Dutch economy began to recover, this resulted in a new supply of offices, which at the year of 2004 was reached the fulfillment of

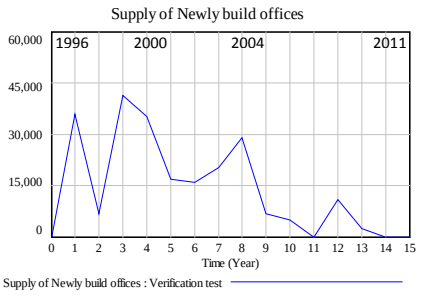


Figure 30: Supply of newly build offices

demand and supply (the tipping point), so also a stop of developments. This resulted in less supply, followed by a vacancy decrease, the market was still healthy.

Double hit of the crisis:
The last trend is one of the reason of the present disequilibrium in the market. Because of the mortgage crisis in America and the Euro-crisis the economy is shrinking and lots of companies go bankruptcy. This means a decrease in employment this result in a lower demand of offices. Figure 29 shows a growing vacancy beginning in 2009 and Figure 30 shows a decrease of the developments started in 2004 and 2008.

Vacancy and stock development in the centre location:
The previous graphs are not as representative as the overall vacancy and stock development graphs. But they do help the current problems in the market. And they endorse the imperfection of the model. This because of the next phenomena which depends of the unpredictability of human, namely the psychological trigger. By the development of a newly build offices tenants will be pulled away out of lower quality offices at less attractive geographical locations, by the use of incentives. This 'movement factor' is taken along as general factor in the model. In real this factor should be representative if it should be taken along on individual building level. The unpredictability of the movement factor makes the estimation difficult, beside this the availability of specific movements of tenants from the old to the new location and also if there were incentives involved by a movement is difficult to obtain. Despite of the imperfection in the vacancy rate (Figure 31) the behavior of the stock (Figure 32) meets partly the expectations, overall the total amount of offices in the centre is the same as the System Dynamics office model, only the A-quality buildings have too much stock, and the B and C-quality buildings too less. This means a too low depreciation rate, and maybe a too high redevelopment rate.

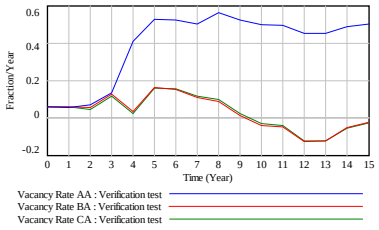


Figure 31: Vacancy rate validation model central locations 's Hertogenbosch

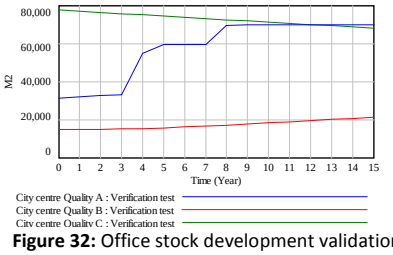


Figure 32: Office stock development validation model central locations 's Hertogenbosch

Extreme condition test (structure orientated behavior)
Extreme condition (indirect) test involves assigning extreme values to select parameters and comparing the model-generated behavior to the observed (or anticipated) behavior of the real system under the same extreme condition (Barlas, Y. (1989)).

Each adjustable variable in the model could be tested on consistency, but this should be an overkill test (which some variables has less influence in comparison with others). The next variables are selected to test at their extreme values:.

Testing variable	Extreme negative value	Extreme positive value
Employment	-8,5 %	+ 8,5 %
Withdrawal rate	0 % of vacancy	45 % of vacant buildings at geographical B and C locations in the C-quality stock.

Because both variables (2 scenarios) will be tested at a negative and positive value (2 scenarios), totally 4 possible scenarios will be simulated. Starting point of all these simulations are the quantities of the present market. All simulations will be judged on the total vacancy development and stock development.

Scenario	Employment	Withdrawal rate
1	+ 8,5 %	45 % of vacant buildings
2	+ 8,5 %	0 %
3	-8,5 %	45 % of vacant buildings
4	-8,5 %	0 %

Simulations:

Out of the extreme value simulations the next conclusions can be made:

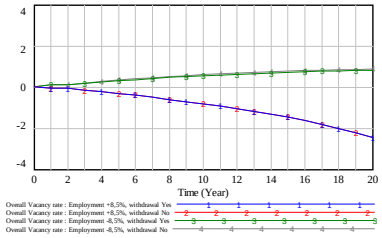


Figure 34: Extreme value test, overall vacancy rate

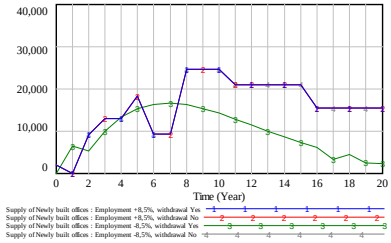


Figure 33: Extreme value test, supply of newly built offices

- Figure 34 shows a direct relation with office vacancy and employment, decreasing employment means rising vacancy;
- Figure 33 shows a lower development rate only by a decreasing employment and office withdrawal (less offices, less redevelopment);
- Figure 33 shows no lower development rate by a decreasing employment and office withdrawal, this because there is no decrease of office stock, which means mean no decrease in redevelopment.

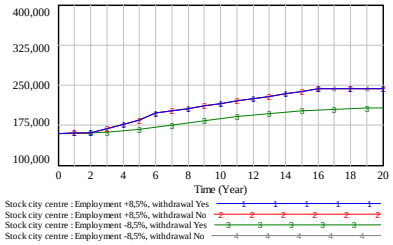


Figure 36: Extreme value test, stock office-area

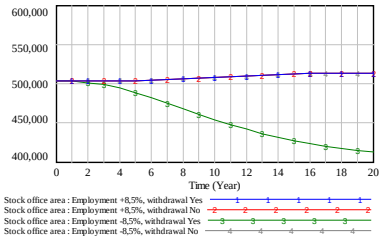


Figure 35: Extreme value test, stock city centre

- Figure 35 shows a lower stock by a decreasing employment and an office withdrawal. This because the withdrawal only occur by office vacancy (Figure 34);
- The observation above also occur by the office-area locations, only the decrease of stock is bigger, this because the stock will be directly taken out of the market at this specific location.

Why no sensitivity analysis?
Sensitivity analysis normally determines when a parameter will change or not. For example a product development model. Which it is important to judge what an adjustment on the process will do. Which all the variables easy to influence.
In the real-estate model of this research there are some endogenous variables which are difficult to influence, e.g. the employment cannot be influenced, beside this an urged withdrawal, or a change in legislation has to deal with difficult unpredictable decisions of the government, especially in municipalities, hereby the local town council should approve change, and or investment. This legal difficulties are already reviewed in the state of the art of this research (part 2).

10.Game Theory analysis

Before explaining the behavioral aspects of the different variables to adjust the System Dynamics model, the simple 2x2 game which will be played in this research will be explained.

Game Theory models

Game Theory is a widely used scientific research method. In part 2 of this research the different type of games are already elaborated. But there is not determined how the game will be played. Within the non-cooperative 2x2 game different scenarios will be presented to each respondent (policy makers). These players need to determine their preference for each scenario. When they play the game, they need to decide if they prefer to play the game AA, AP, PA, PP. How they need to lay the game is explained in Table 13, beside this the different game types will be explained.

Rank the preferences of each player

Scenario 1		Investor	
		Active	Passive
Government	Active	A,A	P,A
	Passive	A,P	P,P

Table 13: Possibilities in the 2x2 game between investors and the government

Game Explanation:
Both parties **Investor** and **government** should indicate their strategy related too each proposed scenario.
All the strategies need to be filled in with the numbers 1 till 4. The most preferred scenario get the number: 1, the least preferred the number 4.

What are the alternative strategies available for the players

AA – active investor participation, active government participation: Both players are intended to accept and take the measures and future predictions of the proposed scenario. The ultimate aim of them is to solve the structural vacancy in the real-estate office market.
AP – active investor participation, passive government participation: The investor is intended to confirm to the proposed scenario. The government will take up a passive position in the proposed scenario.
PA – passive investor participation, active government participation: The investor will take up a passive position in the proposed scenario. The government is intended to confirm the proposed scenario.
PP – passive investor participation, passive landowner participation: Both players will take up a passive position in the proposed scenario. The aim of solving the structural vacancy will not be achieved with this scenario.

10.1. Different Game Theory scenarios for simulating the System Dynamics model

The variables used in the model are market information out of the past. These data is measured and cannot be manipulated. But there could also be modeled different governmental or investors influence to adjust the market in the future.
To predict the impact of different influences (measures), and adoptions in governmental policies as well as the investors behavior there are constructed different scenarios which are based on the next exogenous (not a direct relation with other variables in the model) and endogenous variables (a direct relation with variables in the model).
Because all these influences are predicted in the future, the possible behavior of the variable is determined in the most probable outcome possibilities, which in the model the concerning factor can be changed to the different outcome possibilities.

The basic needs for an area development are: available space, planning permission, capital, (users), and future value. An important role is played by these factors in the model within the different scenarios. Which the state of the art (part 2 of the research) has given insight in the intervention possibilities. The impact of different interventions could be measured by a scientific analysis.
In this research this will be done the other way around, there will be measured which solution will be preferred within the interactive decision making between the government and investors. Interventions with measurable effects in the real-estate office model (possibilities to adjust the model), and some interventions which has no direct model influence are involved. Table 14 represents the different interventions, in the next paragraphs they all will briefly be explained.

Nr.	Factor	Represented as	Different possibilities to adjust the model			
1	Employment	WLO-scenario	GE (5,9%)	SE/TM (1,01%)	RC (-3,18%)	
2	Available capital	Willingness to invest	Available	Not available		
3	Available development space	Plan capacity	Hard	Soft	None	
4	Depreciation of office buildings	Transparent taxation	Obliged	As usual		
5	Removal of office buildings	Withdrawal	Governmental payment	Collective Tax	Development credits	None
6	Plan damage	Governmental policy	Present method	Hierarchy		

Table 14: The different important influence factors

10.1.1. Factors which only can be assumed (no direct model influence)

In the model some factors out the future can only be assumed and not directly influenced by an easy policies. For the propose of the Game Theory analysis they will be assumed.

Employment:
The earlier discussed WLO-scenarios will be used to construct the different Game Theory models. For this all the 4 scenarios will be assumed to be direct related to the development of employment. GM (5,9%), SE (1,01%), TM (1,01%), and RC (-3,18%).

Degradation effect, obscured by transparent taxations:
If there is a high vacancy at some type of geographical location (e.g. industrial area) the attractiveness of the location will decrease. This can also be called the degradation effect of a location. This effect is difficult to observe because a lot of un-transparent valuations of offices. (discussed in part 2 of this research).
In general, there is a standard depreciation period which a part of the office stock will move from quality A towards B and from B towards C. Beside this there could be simulated an acceleration effect. By a high vacancy percentage the depreciation will be accelerate till a maximum of thrice as normal. The boundary for this 'acceleration' effect is from 5% (frictional vacancy) till 30% vacancy.
For this 'depreciation fact' there will be taken a long a mandatory taxation by an independent assessment body, which it can reduce the artificial high rental prices, and stimulate the depreciation of buildings, this should result in a more healthy stock, this could be monitored by the distribution of the quality types within an area. Unfortunately the introduction of the mandatory taxation cannot directly be modeled to figured out the effect, nevertheless this is taken a long in the Game Theory survey.

Plan damage:
The difficulty by the adjustment of the future office market is the adjustment of the plan capacity, if there will be shrink down hard planning capacity present land owners of this plan capacity could start up legal procedures to gain plan damage. For this the government is not eager to shrink this plan damage down. To give the government within this research a possibility to shrink the hard plan capacity down new legislation could be proposed. They has got the possibility to act as an in depended entity which can made hierarchal decisions (eliminate plan damage). Because the effect of these policy is not clear it will only be taken a long in the Game Theory survey.

10.2. Factors in the models which could be adjust by policies

Willingness to invest/ available capital:
The availability of capital has caused problems in the past –because of the overstock of capital and the eagerness to invest in real-estate–. Mostly there is capital available somewhere, but the investors need to have their 'trust' in the real-estate office market to introduce capital. For this purpose the rate of vacancy is coupled to the eagerness for investments.
Representation in the System Dynamics model:
The vacancy rate is calculated by the difference in office space and the use of office space. Which there will be taken a boundary of 6%, (5% frictional vacancy + 1% margin). When the vacancy rate exceeds the boundary the willingness to invest will be put on 0. New developments with already a renter with incentives are not taken along in the model. This because it is already an outdated mean of seduction.

Available plan capacity:
The availability of hard and soft plan capacity has also caused problems in the previous period. – because of the eagerness of municipalities to develop agriculture land to a function with more value, this to generate money–.
Representation in the System Dynamics model:
The governmental land development policy is modeled as a variable which could be switched on and of on a certain date, there could be no plan capacity/hard plan capacity/soft plan capacity. Three land development policies are constructed, they are called: Money making policy, Reserved policy and the total stop policy.
Because there occur a pipeline effect by land-development, the soft and hard capacity is equally divided on the estimated time length of the different projects by the government. For this the information out of the office and industrial area policy constructed by the municipality 's Hertogenbosch are modeled (Kantoren en bedrijventerreinenbeleid, 's Hertogenbosch 2011).

- *Money making policy:* This means the inflow of the soft and hard (all) planning capacity during the period of the policy, this scenario only occur when there is capital available. The inflow of square meters office real-estate depends on time.
- *Reserved policy:* This means only the inflow of hard planning capacity during the period of the policy. The inflow of square meters office real-estate depends on time.
- *The total stop policy:* This means zero available plan capacity till the market is brought back in an equilibrium.

Removal of office buildings:
One of the most discussed solutions at the moment is the removal of different office from a specific quality at specific locations. By the withdrawal of vacant offices in quality segment B or C the government could have a stimulating role. The removal of office buildings is modeled as a variable based on the scenarios out of the state of the art of this research (part 2, chapter 7- Governmental policies).

- *Governmental payment:* The offices which will be taken out of stock to bring the market back in an equilibrium will be bought by the government, for this they should gather financial resources out of their financial resources or debts. Within these step of the variable there are no costs for office owners, perhaps they don't get the best price for their office which will be removed out of the market.
- *Collective tax:* Within the model there is chosen to Tax the total market which is in use (this is easy to achieve by a increase of the OZB-Tax) or to use the rental price as Tax basis, which the last one is modeled in the model. This intervention also solves the artificially high rental prices.
  The collected money is proposed to use for the withdrawal of the offices. Only the question arise: 'For which value the offices will be bought?'. At the moment these are coupled on the Gross Yield capitalization factor (BAR), this to make the model not too complicated, and the rental prices can be used to calculated the vacancy Tax and also the amount of square meters which can be taken out of stock.
- *Development credits(construction claim):* Developers and office owners will be rewarded if they take offices out of the market (demolish them). For this they get development

credits as change for a demolished office. In the model there is stated a ratio which determined the amount of M^2 office which can be developed for removed M^2 office. In the model 60% of the removed office could be reconstructed.

10.3. The construction of different scenarios

Some of the variables in the System Dynamics model are possibilities to intervene in the office real-estate market and extracted out of different sources. Therefore the preference in which the variables will be execute in the future need to be measured by the different influential parties (public and private). Because you cannot let an individual party be responsible for a problem which is collectively caused there are made combinations of different measures (the input for the variables) which have advantages and disadvantages for both.
In the Game Theory approach the preference for the interventions will be measured by the consideration of public and private parties. To achieve the best result, the different variables will be first judged on the possible power and interest of each party, after this there are created balanced scenarios, which some could be more public preferred, other more private or both, these scenarios will be used for a further analysis.

10.3.1. Power versus interest grid (determine the scenarios)

Just set up some scenarios out of the blue is not the right method of doing research. By the interactive decision making process of spatial planning there is always a trigger for both opposite players. For this the vacancy influence factors out of the System Dynamics model (presented in Table 14) are mapped. For each factor the present power and the interest of the different stakeholders in the process are determined.
This exercise give interesting insights in the preferences of each stakeholder, but it also help to construct the different System Dynamics scenarios. With the help of the 'power versus interest grid' there could be construct balanced scenarios, which each different scenario has more advantage or disadvantage for the different stakeholders, and opposite.
Table 15 and Figure 37 (next page) are giving insight in the power versus grid analysis. In appendix G all matrixes to construct the different scenarios are represented. The exercise is done with the next players in mind: project developer, private investor, institutional investor and the Governmental legislature.

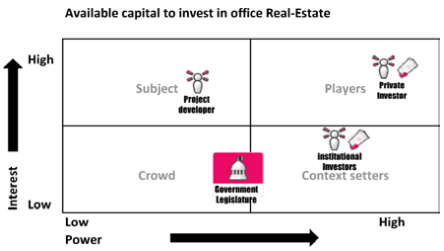


Figure 37: Example power versus interest grid

Available capital to invest in real-estate			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	Cash	High return on investment	Investments in new offices in bad markets
Institutional investors	Cash	balanced return on investment	Investments to secure money
Project developers	Low (only expertise)	Selling/ developing profitable projects	Developments without any need
Governmental legislature	Low (some legislation)	Low, only the balanced return of investors	Coordinate the investments

Table 15: Example stakeholder analysis (Input, **Figure 37**)

10.3.2. Physical modeling of the scenarios

The input out of the previous paragraph is used to construct 6 different scenarios which will be simulated in the System Dynamics model, the different possibilities to adjust the model are represented in Table 16.

Scenario	1) WLO-scenario		2) Willingness to invest	3) Plan Capacity	4) Taxation	5) Withdrawal	6) Governmental influence
	Year 1-5	Year 5->					
1	GE	GE	Depends off vacancy %	Soft	As Usual	None	Present Method
2	TM/ SE	TM/ SE	Independent off vacancy %	Soft	As Usual	None	Present Method
3	RC	RC	Independent off vacancy %	Hard	As Usual	None	Present Method
4	RC	TM/ SE	Depends off vacancy %	None	Obliged	Governmental payment	Hierarchy
5	RC	TM/ SE	Depends off vacancy %	Soft	As Usual	Development credits	Present Method
6	RC	TM/ SE	Independent off vacancy %	Hard	Obliged	Collective Tax	Present Method

Table 16: The different Game Theory scenarios

The 6 different scenarios are translated to a decision criteria profile, these profiles are used in the Game Theory survey. In Table 17 first the principle (starting point) will present to the respondent. After this Table 18 provides information out of the System Dynamics model about future office market development if the assumptions out of Table 17 are met.

Stated criteria of the scenario	value	
	Year 1 – 5	Year 5 ->
The growth of employment each year	-3,18%	1,01%
Depends the availability of capital off the amount of vacancy	Yes	
The availability of plan capacity	None	
The type which present real-estate need to be valued	Obliged	
The withdrawal which will be done	Governmental payment	
The governmental procedure in case of plan damage	Hierarchy	

Table 17: Market situation scenario 4

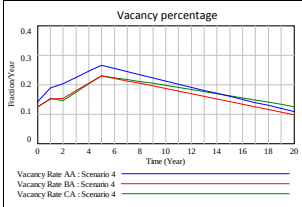
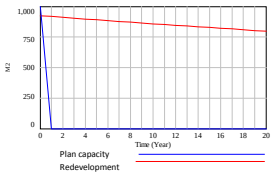
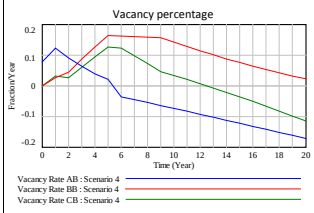
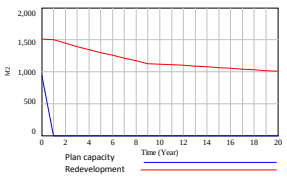
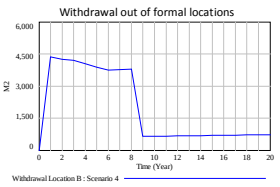
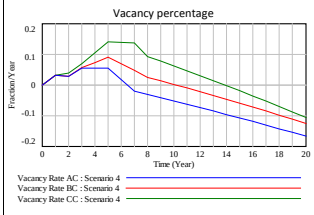
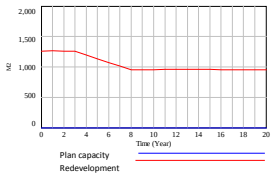
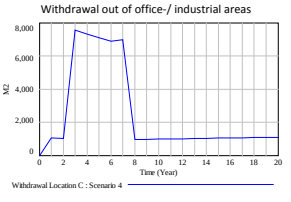
Centre locations		
Vacancy graph	Plan capacity graph	Withdrawal graph
		**Within this area there takes no withdrawal place**
Remaining locations (Suburbs)		
Vacancy graph	Plan capacity graph	Withdrawal graph
		
Office-/ industrial – areas (formal locations)		
Vacancy graph	Plan capacity graph	Withdrawal graph
		

Table 18: System Dynamics output of scenario 4

Table 16 determine each scenario by the quantities of their decision criteria profile. Because there is also a rational reasoning behind each scenario, they will all shortly be explained.

Scenario 1, Global Economy, years of growth (Before the crisis)

This scenario is based on the previous optimistic approach of the public parties in the last decades. The most soft planning capacity is namely planed while the economy was booming and the plan capacity was planned with the WLO-scenario: 'Global Economy' in mind. These scenario is constructed to test if the plans made with the assumptions based on the 'Global-economy' scenario match with each other. Beside this it is interesting to figure out the preference of this ultimate welfare model which is beneficial for the public parties to maintain the expensive government costs, and to maintain the eagerness of the investors and project developers.

Scenario 2, Transatlantic market/ Strong Europe (present situation)

This scenario is based on the present situation, which the municipalities already shrunk down their plan capacity and write possible financial benefits off their balance. In this scenario the economy is stabilizing with a growth of 1,01%.

Scenario 3, Economical contraction, combined with hard planning capacity

In this scenario the effects of economical contraction are visualized. The planning capacity will be shrunken down to the hard capacity, to avoid possible claims of plan damage not all the plan capacity will be scraped. In this scenario the economy is shrinking with a decline of - 3,18%.

Scenario 4, Economical contraction, followed by a small recovery (governmental coordination)

In this scenario the metaphorical 'Bal' is in the hands of the government. All the responsibility is shift to them. They will control the market on a hierarchical way. Within the model there is assumed a total stop of plan capacity. To avoid plan damage there is purposed new legislation which eliminated the possibility to claim plan damage.

Scenario 5, Economical contraction, followed by a small recovery (Collective Tax)

This scenario could be seen as the best of both worlds, the government will acknowledge the problem, and manage the different measures/ influence factors. In exchange the investors should pay an extra Tax over its present occupied properties.

Scenario 6, Economical contraction, followed by a small recovery (Development credits)

In this scenario the metaphorical 'Bal' is in the hands of the office owner. All the responsibility is shift to them. If they want to develop new offices, they need interchange an certain amount of square meters. Beside this the already plan capacity will be fully given in the hands of the market.

Part 4 – Outcome

11.The real-estate office model results

The input and the actual working method of the different research methods is already discussed. In this paragraph the results will be discussed, as well as the research questions.

11.1. Geographic information results

The GIS-analysis helped to give insight in the present situation. Hereby can the next research question be explained on a static way (this because the GIS-analysis is a snapshot of the data in time):

Sub question one: 'How big is the structural vacancy in the province Noord-Brabant (especially 's Hertogenbosch), is this an equilibrium or unbalance?'.

Table 19: Office real-estate factsheet 's-Hertogenbosch

Label summarization					
Geographical boundary: City centre					
Quality type	**Amount of offices**	**Amount of vacant offices**	**(M2) offices**	**(M2) vacancy**	**Vacancy %**
A	7	6	35.265	4.990	14,15%
B	11	5	31.376	3.876	12,35%
C	42	7	92.488	11.413	12,34%
Subtotal	60	18	159.129	20.279	12,74%
Geographical boundary: Remaining locations					
Quality type	**Amount of offices**	**Amount of vacant offices**	**(M2) offices**	**(M2) vacancy**	**Vacancy %**
A	19	2	43.575	3.405	7,81%
B	32	2	94.970	4.702	4,95%
C	65	3	150.843	1.819	1,21%
Subtotal	116	7	289.388	9.926	3,43%
Geographical boundary: Formal locations					
Quality type	**Amount of offices**	**Amount of vacant offices**	**(M2) offices**	**(M2) vacancy**	**Vacancy %**
A	41	12	149.903	25.643	17,11%
B	43	16	228.047	41.159	18,05%
C	20	3	125.749	8.952	7,12%
Subtotal	104	31	503.699	75.754	15,04%
Total	280	56	952.216	118.252	12,42%

By comparing the factsheet with the standard percentages of frictional vacancy (6%), there occurs structural vacancy at centre locations, approximately 12% - 14% within all the quality types, there also occurs structural vacancy at the formal locations, the most within the A and B quality groups, taking into account that the C-quality could possibly have a lower vacancy percentage because of long term rent contracts.

If the market share of the formal locations will be compared with the total market these could be labeled as the most problematic. First because of the high vacancy rate, second because of the total share in the market (53%). Furthermore the biggest share within the formal locations is B-quality, in the next 15 years lots of these offices will require a qualitative renovation, if not they will shifts towards the most unattractive C-quality.

After all an unbalance can be recognized in the municipality of ‘s Hertogenbosch. If the previous analysis will be used within the province of Noord-Brabant. Lots of dangerous threats are within the formal locations. Because vacancy depends on the future development of the market there is made a future prediction with the previous and present market standards (scenario 1,2,3) and with different possible interventions (scenario 4,5,6). For this the results of scenario 1,2, and 3 in the next paragraph gives on a dynamic way answer to sub question one.

11.2. System Dynamics results

Because the long-term process of decision making is interactive just one scenario is not the waterproof solution. For this the result of the different scenarios will be discussed with the research questions in mind. As already discussed this System Dynamics model gives insight in the present market situation, but also in possible interventions (proposed governmental measures). With the System Dynamics results the next research questions be explained:

Scenario 1/2/3:

Sub question one: ‘How big is the structural vacancy in the province Noord-Brabant (especially ‘s Hertogenbosch), is this an equilibrium or unbalance?’.

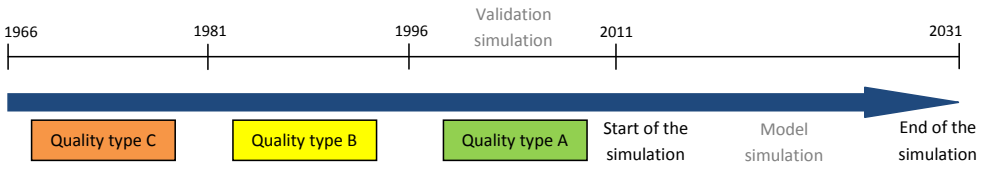
Scenario 4/5/6:

Sub question Two: ‘How will react the office real-estate market on the ‘vacancy tax’ and 'development credits/ construction claim’? Are there other suggestion by the market?’

Sub question three: ‘Which governmental policies are the most beneficial to take offices out of the market or improve it sustainable?’

Because it is not interesting to present all the graphs, there is chosen to show the vacancy percentage, plan capacity, withdrawal of m^2 offices, and the stock development in appendix H. In this chapter there will only presented the most important graphs. Before discussing the results the timeline which give insight in the modeling process, validation simulation and actual model simulation need to be take in mind, the graphs which present the results are starting in 2011 and stop in 2031.

Model timeline



11.2.1. The determination of the present situation

Scenario 1: Global Economy, years of growth (before the crisis)

Employment development		Willingness to invest	Plan Capacity	Taxation	Withdrawal	Governmental influence
Year 1-5	Year 5->					
5,9%	5,9%	Depends off vacancy %	Soft	As Usual	None	Present Method

The System Dynamics simulation of this scenario should prove the model of spatial planning works well by economical growth. Out of the graphs there can be conclude a fast decline of vacancy, this result in a negative amount of vacancy (after approximately 4 (2015) years)(Figure 38). This effect is understandable because of the high growth (+5,08%). Which the plan capacity in the city centre (Paleiskwartier), and at remaining locations (Willemspoort) slightly meet the growing economy. The disadvantage of this scenario should be a growth disturbance, because the real-estate office market is to slow to react.

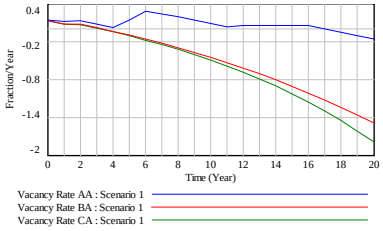


Figure 38: Vacancy development in the city, scenario 1

Scenario 2: Transatlantic market/ Strong Europe (present situation)

Employment development		Willingness to invest	Plan Capacity	Taxation	Withdrawal	Governmental influence
Year 1-5	Year 5->					
1,01%	1,01%	Independent off vacancy %	Soft	As Usual	None	Present Method

The System Dynamics simulation of this scenario expose the impact of stabilized growth and plan capacity. The model assume a moderated growth (+1,01%). This should reduce the vacancy at all the locations. In general this effect is visible in the first 2/3 year (2013/ 2014) at the centre and remaining locations. Because the proposed big amount of soft planning capacity at the centre (Paleiskwartier) and the remaining locations (Avenue 2/ Willemspoort). The model will be quick brought in an extra disequilibrium. After a decline a big incline takes place after the release plan capacity of Avenue 2. It should be said that the vacancy at formal areas will develop negatively in the A-quality. This because of the less planned developments at this location. Overall the vacancy first will decrease and stabilize, after this the total vacancy will growth because of the release of all soft planning capacity.

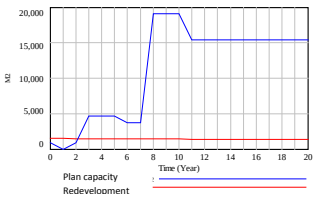


Figure 39: Plan capacity remaining locations

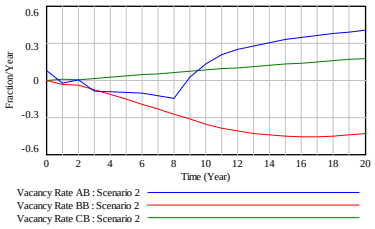


Figure 41: Vacancy development remaining locations

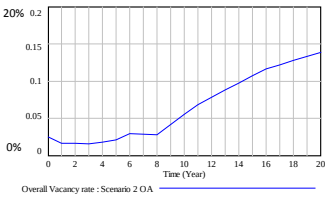


Figure 40: Overall vacancy rate scenario 2

Scenario 3: Economical contraction, combined with hard planning capacity

Employment development		Willingness to invest	Plan Capacity	Taxation	Withdrawal	Governmental influence
Year 1-5	Year 5->					
-3,18%	-3,18%	Independent off vacancy %	Hard	As Usual	None	Present Method

In this scenario the effect of scraping the soft planning capacity is visible. By only releasing hard plan capacity in the city centre (Paleiskwartier) and remaining locations (Avenue 2/ Willemspoort) a huge increase in vacancy is visible at both the centre and remaining locations when there is released plan capacity. Because of the eagerness of present tenants in formal locations for new offices at a better geographic location they will move towards centre and remaining locations (modeled by the movement factor). These movement gives a side effect of increasing vacancy in formal locations.
Overall the vacancy will go towards infinity (Figure 42). This is easy to explain because of the negative development of employment and still released plan capacity.
This scenario makes visible what will be happen if the economy will become in a negative spiral, for this the development of employment are very negative estimated.

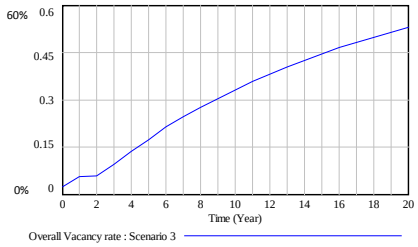


Figure 42: Overall vacancy development scenario 3

11.2.2. The reaction on different governmental policies

Scenario 4, Economical contraction, followed by a small recovery (Coordinated by the government)

Employment development		Willingness to invest	Plan Capacity	Taxation	Withdrawal	Governmental influence
Year 1-5	Year 5->					
-3,18%	1,01%	Depends off vacancy %	None	Obliged	Governmental payment	Hierarchy

This scenario directly provides insight in the stop of plan capacity and a direct withdrawal by the government. First the vacancy will increase (this because the negative employment development in the first 5 years, 2011 – 2016). After this the vacancy quick return back into an equilibrium. There will even occur a scarcity for offices around year 10 (2021) in the model by this scenario. This can directly be remarked out the office withdrawal (Figure 44). Within the 10th year of the model the withdrawal will directly drop to a natural amount. These scenario looks interesting and beneficial, but is has also big (financial) disadvantages. The government will take the offices out of the market with the use of their own financial resources. This means for the first 9 years (2011 – 2020) a withdrawal of 23.839 m^2 at remaining locations and a withdrawal of 32.811 m^2 at formal locations. By a calculation with an average rental price of €170/m^2 and a discount rate

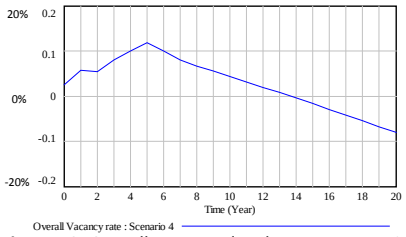


Figure 43: Overall vacancy development scenario 4

(BAR) of 6% a total cost of 170/ 0.06 = €2.833,- per m^2 office. This result in the next total withdrawal cost:
Remaining locations: €2.833,- * 23.839 = €67.535.887,-
Formal locations: €2.833,- * 32.811= €92.953.563,-.
This scenario seems to be drastic, but it helps to figure out the boundaries of the model, and so the real-estate office market.

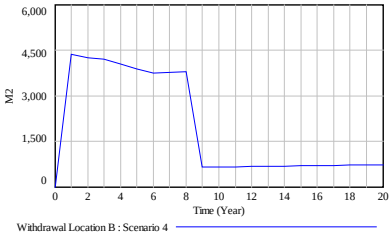


Figure 44: Withdrawal formal locations

Scenario 5, Economical contraction, followed by a small recovery (Model collective tax)

Employment development		Willingness to invest	Plan Capacity	Taxation	Withdrawal	Governmental influence
Year 1-5	Year 5->					
-3,18%	1,01%	Depends off vacancy %	Soft	As Usual	Collective Tax	Present Method

This scenario gives interesting insights in proposed solution concepts (vacancy Tax). Advantages of this scenario is the gradually market adoption. In the model the overall vacancy (Figure 45) is going towards an equilibrium and it will not fluctuate or go into a huge unbalance. Beside this the costs for this solution will be jointly supported by the office owners in total, there is made no difference if an offices is occupied or not.

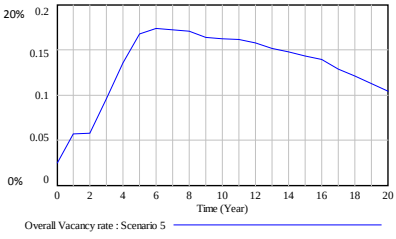


Figure 45: Overall vacancy rate scenario 5

The disadvantages of this model can be discovered if the different qualities of the stock of each geographic location will be reviewed. Because the withdrawal of offices makes newly developments possible (soft plan capacity in this scenario). There still will be released to much plan capacity in comparison with the development of employment. Which the effect is the best visible at the remaining locations (Figure 46). In the first years the vacancy looks to stabilize and shrunk down (till the 3rd year, 2014), after this a the plan capacity will be released, this means a big increase of vacancy. Finally the withdrawal of offices has got influence, it shrink down the C-quality stock, and stabilize the B-quality stock.

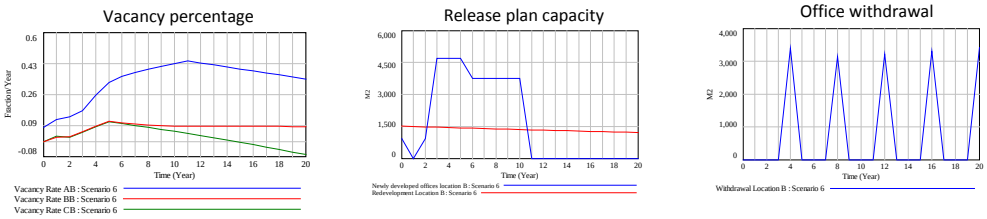


Figure 46: Development of the remaining locations, scenario 5

Beside this the jointly supported solution will give 'the best boys out of the class' a ticket for their good behavior the last decades. For this the question could arise if there in the real-estate market in the Netherlands are investors and owners with a good conscience, this ethical question cannot just be answered with the build of a model and the simulation of scenarios. Finally the next financial resources will be collect, for the purpose of office withdrawal.

Geographic location	Collected Tax*	Office withdrawal
City centre	€ 19.198.476,-	0 m^2
Remaining locations	€ 38.959.416,-	16.459 m^2
Formal locations	€ 28.353.797,-	14.074 m^2
Total	**€ 86.511.689,-**	**30.533 m^2**

*= assumptive price of purchase = €2.833,- per m^2.

Scenario 6, Economical contraction, followed by a small recovery (Model development credits/ construction claim)

Employment development		Willingness to invest	Plan Capacity	Taxation	Withdrawal	Governmental influence
Year 1-5	Year 5->					
-3,18%	1,01%	Independent off vacancy %	Hard	Obliged	Development credits	Present Method

The effect of this scenario has the aim to create 'scarcity', this because there first need to be taken more offices out of the market, whereupon there only can be redeveloped 60% at another (better suitable) location. The withdrawal stops by a vacancy percentage of 5%, Figure 47 shows a negative vacancy percentage at year 20 (2031), this is because of the pipeline effect which often occurs in System Dynamics models.

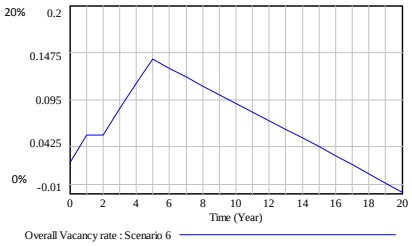


Figure 47: Overall vacancy development scenario 6

In this scenario there can be remarked a double effect, which can be created by development credits (construction claims). Namely by the coupling of the withdrawal of offices with the release of plan capacity, this scenario locks the model (office real-estate market) with two valves. Because the vacancy increase in the first 4 years (2011 – 2015) there can be remarked an eagerness to withdrawal offices (Figure 48, office withdrawal), which directly will be followed by the release of plan capacity (Figure 48, release plan capacity). Because the market quick stabilize at year 10 (2021) the withdrawal of offices stops at that time. At that point the market should allow new developments.

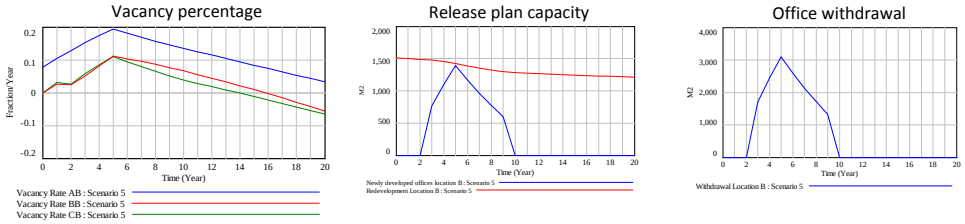


Figure 48: Development of the remaining locations, scenario 6

Within the base points of this scenario this is not taken along, but it should be add in further modeling.
Finally the next numbers can be converted out of the model:

Geographic location	Office withdrawal	Released plan capacity
City centre	0 m^2	4.406 m^2
Remaining locations	15.003 m^2	6.751 m^2
Formal locations	14.375 m^2	6.469 m^2
Total	**29.978 m^2**	**17.626 m^2**

Control calculation: 29.978 m^2 (withdrawal) x 60% = 17.626 m^2

11.1. Game Theory results

Note: By reading this chapter the next starting points need to be taken in mind:

- The game is played between the government and office owners;
- The survey is taken from the viewpoint of the government, within the scenarios there are advantages and disadvantages for both players;
- The first 3 scenarios (1/2/3) are used to determine the present state of the art without possible solutions (current market). The last 3 scenarios (4/5/6) will each represent another kind of solutions. The specific description of the scenarios can be found in chapter 10, Game Theory analysis.
- In this chapter first the overall results will be presented (all the scenarios). After this there will be zoomed in to the specific scenarios with the solutions.
- The survey is only conducted by the government;
    - The respondents are all responsible (together) for the decisions about the real-estate office market in the future. They can influence the plan capacity and perhaps the withdrawal of offices;
    - The respondents profiles are add in appendix I.

Consistency note:
The statistic consistency cannot be fully proven. This because of the time period of this research. Nevertheless the approach of this research give interesting results in the mode of operation of the office real-estate market. The data out of the Game Theory analysis are giving insight in the possible interaction between the government and office owners. If the results will be used for further analysis more respondents should be involved in the Game Theory analysis. Because the current respondents are policy makers out of B5 region an extreme value test could be passed. Beside this a bigger sample size, should give more detailed information. By acquiring new respondents the next things need to be taken in mind:
It is an extensive task to approach the specific owners of office which have portfolios with a high amount of vacancy and financial problems. For this an extensive selection could prevent huge deviations and extreme values.

The next analysis of the results will figure out when a played game is in an equilibrium. The analysis will find out when the best possible outcome for both players is achieved. This not directly mean the highest payoff for both players, the payoff could be significantly lower than the other in the equilibrium. If this deviation of equilibrium and best outcome occurs this is called a conflict situation. Within the research of Game Theory, several different Game Theory strategies could be filtered out. With the Game Theory results the next research questions be explained:

Sub question five: 'Which governmental policies are the most preferred?'

In this research there is a focus at the strategies of both dominant players. Beside this the iterative dominant strategies of both players will be reviewed. To analyze the filled in matrixes different rule sets will be used. To make the rule sets easier to understand, first the different individual participation preferences will be visualized, after this the combination of the preference is visualized.

Scenario 1, Growth		Investor/ Developer	
		Active participation	Passive participation
		A	P
		A	P

Scenario 1, Growth			
Government	Active participation	**A**	**A**
	Passive participation	**P**	**P**

Table 20: Individual participation preferences

Scenario 1, Growth		Investor/ Developer	
		Active participation	Passive participation
Government	Active participation	A,**A** →	P,**A** ↓
	Passive participation	A,**P** →	P,**P**

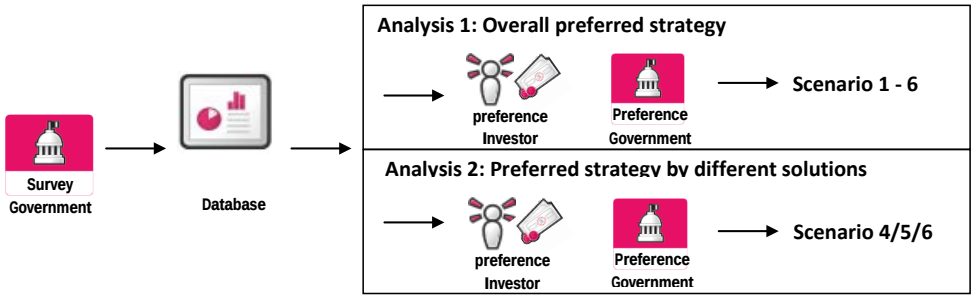
Table 21: Predicted combined preferences

Each of the respondents has by the review of the different stated criteria of each scenario filled in their preference to participate active or passive within this scenario, which the participation means the agreement with the proposed criteria in each scenario. E.g. withdrawal of offices by a collective Tax, and/or the stop of plan capacity, and more (based on the scenario description). Depended of the strategies there will occur an equilibrium by the combination of strategies. The next rules are used in this analysis. (the smallest outcome is the best).
Equilibriums predicted by dominance:

- Active dominant strategy investor (AA<PA) and (AP<PP);
- Passive dominant strategy investor (PA<AA) and (PP<AP);
- Active dominant strategy government (AA<AP) and (PA<PP);
- Passive dominant strategy government (AP<AA) and (PP>PA).

By playing the game dominant by both players, there could occur an equilibrium. To explain the way of analysis one type of game will be explained. (by dominant games there are 4 equilibrium possibilities)
An equilibrium by a dominant passive strategy (PP), the government has a dominant passive strategy ((AP<AA) ↓ and (PP>PA) ↓), the investor also ((AA<PA) → and (AP<PP) →), so the equilibrium arise in PP (passive/ passive), Table 21 visualize this.
Beside the equilibriums predicted by dominance, there could occur an iterative dominance situation. Iterative dominance is almost similar to a dominance situation, except for one of the two players that has a clear dominant strategy. This dominant strategy will leave the other player to choice between two less interesting options.
To give more insight in the analysis method in appendix J the different rule sets including the visualizations of the matrixes are added.

Every detail of the Game Theory survey could be sorted out, but the means must be in proportion of the aim. For this knew how the market will be approach in general by the government and Investors, and
second which of the purposed measures is the most proffered. For this the next approach will be used:"



Analysis 1: Overall preferred strategy:

Dominant strategy government	Frequency	Percentage	Cumulative
Active	17	40,5%	40,5%
Passive	15	35,7%	67,2%
None	10	23,8%	100%
Total	42	100%	

Table 22: Governmental strategy

Within this analysis the data will be reviewed from a helicopter view, till a detailed view. In general it is interesting to review the overall strategy of the government. Out of the 42 possibilities (7 respondents x 6 scenarios) the government is purposed to participate active in 40,5% of all the game matrixes (Table 22), in 35,7% of the matrixes they prefer a passive role and in 23,8% there is no dominant active or passive strategy. This table determines the willingness to participate active in the system of spatial planning and urban development. Out of the second analysis a more specific answer will be given by which instruments they prefer to participate.

Game theoretical prediction. Based on dominant or iterative dominant strategy.	Frequency	Percentage	Cumulative
AA	8	19,0%	19,0%
PA	6	14,3%	33,3%
AP	2	4,8%	38,1%
PP	11	26,2%	64,3%
Investor-IDAA	2	4,8%	69,0%
Investor-IDPA	2	4,8%	73,8%
Investor-IDAP	0	0,0%	73,8%
Investor-IDPP	0	0,0%	73,8%
Government-IDAA	0	0,0%	73,8%
Government-IDPA	1	2,4%	76,2%
Government-IDAP	7	16,7%	92,9%
Government-IDPP	0	0,0%	92,9%
None	3	7,1%	100,0%
Total	42	100%	

Table 23: Game Theory prediction of interactive decision making by both players

Only determining the attitude is not the aim of the Game Theory analysis. Both players are play the game interactive with perfect information. Because of this it is interesting how they both act, in general the following results can be remarked out of Table 23:

- A cooperative strategy by both players having the same aim (both active participation or both passive participation) is most preferred AA (19%), PP (26,2%).
- Besides the possible dominant strategies a governmental-Iterative dominant strategy is preferred the most. By an active participation by investors with a passive participating government occurs the most iterative equilibriums, the following can be concluded:
  - In the previous and present situation (scenario 1/2/3) the government is eager to give the coordinating role to the market (developers/ investors/ owners);
  - In the future situation the government wants not to be the problem owner and shift the responsibility to the market (developers/ investors/ owners);

Analysis 2: Preferred strategy by different solutions:

Because most Game Theory outcomes occur if both players act dominant, only the dominant games are reviewed. The results showing the best market knowledge (or game knowledge) if the both players has got the same strategy (AA/PP), Table 24.

In this second analysis the behavior of both parties within the solutions scenarios to bring the office market back in an equilibrium will be reviewed (scenario 4/5/6). First the overall strategy will be considered, after this each scenario will be separately considered.

Dominant strategy government	Frequency	Percentage	Cumulative
Active	11	53,8%	52,4%
Passive	5	23,8%	76,2%
None	5	23,8%	100%
Total	21	100%	

Table 24: Governmental strategy (within the solution scenarios 4/5/6)

Out of the 21 possibilities (7 respondents x 3 scenarios) the government is purposed to participate active in 53,8% of the game matrixes, by 23,8% passive and by 23,8% there is no dominant active or passive strategy (Table 24). In comparison with the governmental strategy in all the scenarios (Table 22) the government seems to act more towards an active role.

Game theoretical prediction. Based on dominant or iterative dominant strategy.	Frequency	Percentage	Cumulative
AA	2	9,5%	9,5%
PA	6	28,6%	38,1%
AP	0	0,0%	38,1%
PP	5	23,8%	61,9%
Investor-IDAA	1	4,8%	66,7%
Investor-IDPA	0	0,0%	66,7%
Investor-IDAP	0	0,0%	66,7%
Investor-IDPP	2	9,5%	76,2%
Government-IDAA	0	0,0%	76,2%
Government-IDPA	0	0,0%	76,2%
Government-IDAP	2	9,5%	85,7%
Government-IDPP	0	0,0%	85,7%
None	3	14,3%	100,0%
Total	21	100%	

Table 25: Game Theory prediction of interactive decision making by both players (within solution scenarios 4/5/6)

To first review were the game will be played all the outcomes of dominant games and iterative dominant games are determined. These analysis shows most of the equilibriums by dominant games. This means both parties get the best outcome by a dominant game. To see which scenario in combination with which strategy is the most preferred by the different players. And how the implementation of the scenario the best could be executed. The Game Theory outcome for each scenario is separately reviewed in Table 26.

Game theoretical prediction. Based on dominant or iterative dominant strategy.	Frequency	Percentage	Cumulative
AA-scenario 4	0	0,0%	0,0%
PA-scenario 4	3	14,3%	14,3%
AP-scenario 4	0	0,0%	14,3%
PP-scenario 4	1	4,8%	19,0%
Scenario 4-Total	4	19,0%	
AA-scenario 5	1	4,8%	23,8%
PA-scenario 5	1	4,8%	28,6%
AP-scenario 5	0	0,0%	28,6%
PP-scenario 5	2	9,5%	38,1%
Scenario 6-Total	4	19,0%	
AA-scenario 6	1	4,8%	42,9%
PA-scenario 6	2	9,5%	52,4%
AP-scenario 6	0	0,0%	52,4%
PP-scenario 6	2	9,5%	61,9%
Scenario 6-Total	5	23,8%	
Iterative Dominant	5	23,8%	85,7%
None	3	14,3%	100,0%
Total	21	100%	

Table 26: Game Theory outcome for each solution scenario (4/5/6) separately

Before filtering the best scenario with the best strategy, a brief determination of the scenarios:

- *Scenario 4 Governmental coordination*, The government will finance the withdrawal of office, but also restrict the plan capacity on a hierarchical way.
- *Scenario 5 Collective Tax,* an increase of the OZB tax will finance the withdrawal of offices, the plan capacity will not be restricted.
- *Scenario 6 Developments credits (construction claim),* plan capacity will only be released of offices are taken out of the market (demolishing or transformation).

Outcome of the Game Theory matrixes:

Scenario 4:

Within scenario 4 an equilibrium occurs the most if the investors are participating passive and the government is participating active (PA). This is plausible because the office owners don't have any possibilities to conduct influence. There also occurs an equilibrium if both parties are participating passive. This passive attitude of the government is plausible because the execution of the scenario will cost the government lots of money. So it is doubtful if this scenario give the best result.

Scenario 5:
Scenario 5 predicts more what the most harmful scenario is instead of the most beneficial. If investors will participating active and the government will participate passive this scenario will never be executed (AP), which the same problem occur if both players are participating passive (PP). Out of these results there can be concluded a preferred active strategy by the government. Hereby is the outcome of being both passive contrary to the aim of this scenario. Because the outcome is fairly flat and tends to be going towards a passive participation of both players it is doubtful if this scenario will give the best result.

Scenario 6:
In scenario 6 occurs the most equilibriums, but these are also divided over several possible strategies. Which there is a small prevalence for an active participating government (AA and PA), which a passive participating investor in combination with an active participating government (PA) could be in line of the aim of this scenario. Hereby should the government be active by only the release of plan capacity in exchange for offices which taken out of the market. The office owners should be passive in the development of new offices, but active in the qualitative improvement of offices.

Note: Within all the scenarios there can be remarked a passive outcome for both players. Out of these equilibriums can be concluded a passive attitude concerning the scenarios to vanish the present overstock in the office real-estate market. Within the first judgment of the governmental strategy (passive/ active) in Table 24 there is remarket a more active strategy (53,8%) instead of the passive strategy (23,8%) by the government. These discrepancy can be explained by the next phenomena:
The dominant AP strategy (active participating investor and passive participating government) never occurs by the 3 scenarios with solutions. This means the government prefers to do both nothing (PP) or to have a dominant role (A,A), (P,A).
In comparison with the dominant strategies there occurs a remarkable fact by an iterative dominant passive government than the investors prefer to act passive. These strategy mostly occur in the first 3 scenarios (present state of the art).

12.Conclusions

12.1. Geographic information systems

Is the market in an equilibrium or unbalance? (static approach of research question 1)

At the moment 's Hertogenbosch has to deal with the next vacancy.

- Central locations: 13% vacancy;
- Remaining locations: 4% vacancy;
- Formal locations: 15% vacancy.

Beside this there occur a huge amount of lower C-quality offices at the remaining locations +/- 150.000 M^2 (15%) and at the formal locations +/- 228.000 m^2 (24%) B-quality and 125.000 m^2 C-quality (13%). Depended of the future market development the lower quality office can no longer met the qualitative demand. This means an unbalance in the real-estate office market, especially in the central and formal locations.

12.2. System Dynamics conclusion

Is the market in an equilibrium or unbalance? (dynamics approach of research question 1)

If the market will improve like the numbers in scenario 1 (growth scenario), then the market will be in an temporary unbalance, and will quick become in an equilibrium (after 2 year, in 2013) and it will change again to a disequilibrium. This because the planed hard plan capacity will not be sufficient for the employment growth (5,9%).

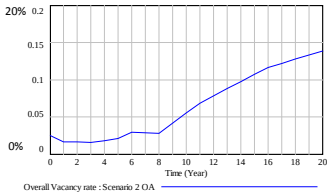


Figure 49: Overall vacancy rate scenario 2

If the economy will become in a stabilized growth of 1,01% like the numbers in scenario 2 the model goes to an equilibrium, the model stays in this equilibrium till year 8 (2019)(Figure 49). After this the release of the proposed plan capacity will bring the market once again in a disequilibrium. From this point of view the low release of plan capacity in the first 8 years helps to recover the market temporary.

If the economy will go into a negative spiral like scenario 3, (negative employment development). The market never will become in an equilibrium, the release of only the hard planning capacity will only increase the vacancy.

Because there are taken hard starting points within the model during the upcoming 20 years the exact answer of the present market situation is between both. For this the scenarios are giving interesting information of the different trends.

Concluded, the market is in unbalance by a stabilization of the economy. This mean there is enough quantitative supply only the qualitative supply will be disturbed if there takes no renewal of office stock place.

Further in this conclusion there will be zoomed in at the situation with the influence out of the different discussions with experts.

How will react the office real-estate market on the 'vacancy tax' and 'development credits/ construction claim'?

The previous constructed scenarios are used to answer the above standing question.
Scenario 4, Withdrawal coordination by the government
Scenario 5, Withdrawal financed by a collective Tax
Scenario 6, Withdrawal in exchange for development credits (building claim model)

Scenario 4, Governmental hierarchical coordination: This scenario surely has got effect on the office real-estate market. For this there should only be wondered if this strict hierarchal approach to create scarcity is not to rational. This because the model direct shows a pipeline effect which result in a negative vacancy (scarcity of offices). Last but not least it is also a form of capital destruction. At the moment there are calculated high costs to take the offices out of the market*, namely:

- €67.535.887,- to withdrawal offices out of remaining locations;
- €92.953.563,- to withdrawal offices out of formal locations.

(*Within the System Dynamics model there are offices taken out of the market until a vacancy of 5%.)
These costs will all be made by the government (hierarchal coordination). This means a huge financial impact on their financial resources. The other public stakeholders in the process don't have a financial stake because they not had the big benefit out of land development. The consequence for the office owners is a possible withdrawal of their office out of the market or the cancel of plan capacity which they have in possession, which they can't recoup cost for plan damage.

Scenario 5, Model collective tax:
The model of collective tax is beneficial on two ways, it gains money to take offices out of the market, and it will create space for new office developments. Again there takes place capital destruction. The biggest remark need to be made by the release (inflow) of plan capacity. Because there is expected a demand stabilization or shrinkage of the economy the planned soft plan capacity is quantitatively too large, the release of this capacity in this short amount of time (approximately 20 years) is not aligned with the life cycle of an office building, and in a broader context the supply chain of the real-estate office market.
Within this model the government only has a coordinating role, for this they only need to put in human effort. The office owners on the other hand will be taxed extra. A possible negative spiral of extra taxing is a threat of this scenario.

Scenario 6, Model development credits:
The use of development credits seems to be efficient and beneficial with less (public) disadvantages. The model will become quick in an equilibrium because of the link between the outflow of offices and the inflow of new plan capacity. Because this link between released plan capacity and withdrawal of offices the inflow (build of new offices) will be strong restricted. This model has also disadvantages beside the quick market equilibrium, namely a low amount of

newly office developments, which could have financial consequences for the municipality and stagnation of the qualitative renewal of the office stock.
In this model there are advantages and disadvantages for both parties. The municipalities will be restricted in the release of plan capacity (land development), the office owners will be urged to be responsible for the office which they left. Beside this both parties will have disadvantages by the low amount of new developments (less quality inflow). For this they need to improve the quality of the present stock (sustainable). The advantage for both is the equilibrium in the market which will be quick reached.

12.3. Game Theory Conclusion

Before discussing the preference for different future scenarios it is interesting to see if the attitude of both the government and investors has caused the present problems. Namely both the eager to develop, or even more the active participation of speculating project developers and investors.
By playing the game both as dominant player there are small difference in preferences to remark. But overall the active and dominant strategies balance each other.
But as already remarked in the results, if the government play an iterative dominant passive role (Government ID-AP) there occurs in the first three scenarios more equilibriums than in the other iterative dominant games.
In practice this means, if the government will act passive in land development the speculators (project developer/ speculators) see payoff possibilities by playing active. This will usually occur when there are market opportunities and all the parameters are positive as in scenario 1 and 2 (employment growth/ available capital/ low vacancy).

'Which governmental strategy is the most preferred to bring the real-estate office market back in an equilibrium?'

The answer to this question is difficult by only predicting the 'hard scenarios' with Game Theory, this because there are also factors involved like the political midterm (Dutch: ambtstermijn), which in the politics positions of power sometimes be abused.
By reviewing the different solution scenarios games in the Game Theory analysis the next conclusions can be made: An exact most preferred scenario cannot be filtered out this simple Game Theory research. But different trends giving insight which strategy should be beneficial or harmful by which scenario. The next trends need to be taken into account by making policy decisions about the real-estate office market.

Scenario 4, Governmental hierarchical approach:
The approach for reducing the structural vacancy will only succeed if the government will active participate in this scenario and the investors will participate passive. If not speculators and/or investors will actively speculate if an office is purposed to taken out of the market, this could lead to high purchase costs.

Scenario 5, collective Tax:
There occurs no equilibrium (best common payoff) if investors will participate active. Beside this the most equilibriums occurs if both parties participate passive. In practice the government is not very eager to increase taxes. The commotion concerning the OZB-Tax (municipal real-estate tax) and a possible negative influence of taxing more and more is not seen as the most interesting. Despite the easy organizational implementation of this scenario.

Scenario 6, Development credits (construction claim):
Within the Game Theory analysis there seems to be chances for this future scenario. First of all the most equilibriums (best common payoff) occur in this scenario. Beside this there can be figured out a governmental eagerness to participate active together with investors (AA), or in combination with passive participating investors (PA). This scenario also has opponents. In practices the government could be less eager because the shrinking release of future plan capacity, this explains the equilibriums by participating both passive (government and investor).

12.4. Conclusion out of interviews

During the last phase of this research the scenarios are discussed with the responsible policy makers concerning the real-estate office market in 's Hertogenbosch and Tilburg. Out of these discussions the political and legal stumbling blocks are filtered out.

'How could the proposed policies be carried out?'

First the political and legal stumbling blocks out of the proposed policies in the scenarios will be discussed. After this the possibilities within the Dutch legislation (spatial planning act) will be brief reviewed.

Both the municipalities ('s Hertogenbosch and Tilburg) are dealing with the structural vacancy problems. They are dealing with relatively high vacancy percentages. Besides this it has to be noted that the presented stock not fulfill the present qualitative needs but it will be sufficient to fulfill the future demand. For the qualitative renewal both municipalities are planning to release plan capacity in the future. Given the current market conditions they already plan to shrunk down the unsuitable formal locations (office areas) if they were in their ownership.
To achieve the release of plan capacity and the renewal of the quality of office building both municipalities focus on inner-city (re)development. Which the adding of new square feet of offices not fits by possible shrink scenarios. For this the municipalities are not eager to active take offices out of the market. They have a reserved attitude, a municipal hard intervention by the withdrawal of offices will only be in the picture if the air bubble is out of the prices. Their opinion on the possible solutions:

Hierarchical approach by the municipality:
- No financial resources available;
- Disturbs the free market system;
- Separate land development entities make municipalities dependent of other (private) parties.

Tax-charge (vacancy-Tax):

- 'Why should office owners/ developers who has developed a well functioning sustainable office pay for other owners/ developers/ speculators which has earned lots of money in the past'.

Development credits (construction claim model):

- Interesting model, which is possible applicable, only with active process management with a pioneering role for the municipalities/government.
- The government/ municipality should not be financial involved in this scenario, except for a lower release of plan capacity.

Out of the interviews the next legal instruments should be used and/or adapted.

- *Plan damage*, For flexibility in urban development speculators should not be rewarded for their speculating activities by plan damage. For this there could be constructed an intervention act.
- *Plan capacity* (land development act), instead of a fee-driven system of land development, there should created a demand driven system, which the destination of the location will be determined just seconds before the release of the plan capacity.
- *Flexibility is helpful* by the plan capacity, but also by the present office stock, the government should be flexible by the change of destination.

12.5. Overall conclusion

In this paragraph the last research question will be answered:

'Which governmental policies are the most beneficial to take offices out of the market or improve it sustainable?'

The office market is stuck, it is like a difficult domino game, the market depends off different chains which all influence each other, a missing link could let collapse the total market. The most important links are visualized in the next figure:

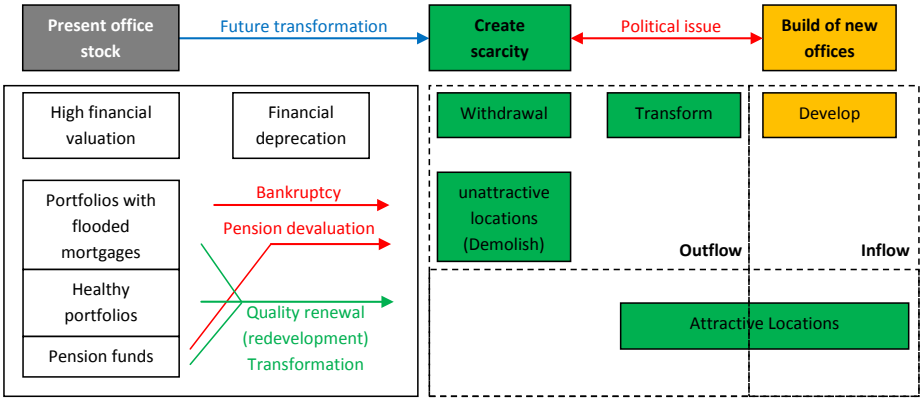


Figure 50: Real-estate office market overview

The present problems can be the best described as a wrong system. The inflow is too high (plan capacity), the present stock has a wrong quality distribution, and there is a low outflow. This could be simple adjust by change the inflow of new quality offices and the outflow of less quality offices. It is interesting to review the market behavior by possible changes (System Dynamics analysis) and how the government could behave in the market (Game Theory analysis).
Hereby there are 3 important stumbling blocks, namely*, the political issue, financial depreciation, and renewal of quality, they all will shortly be explained*:

- The political parties determine the policies, during this research I often heard the next sentence:
  'The first two year of their term of offices political parties, be ambitious and seek to realize ambitious projects, after these two years they dare to do nothing'.
  The above standing fact remarks the difficulties in the decision making process of urban development. The political just not fit by the real-estate life cycle.
- Financial depreciation, the market need to depreciate the high values of their office real-estate, if not the market cannot adopt to the present economic stabilization. The danger of this process is the side effect of the devaluation of lots of pension Dutch pension funds, in the past they used to secure money in the office real-estate market.
- The renewal of quality, a market which just is focused on real-estate to secure money will not survive in the future. In the future office need to be flexible to adjust to demand. To achieve this there need to be taken place lots of transformation and redevelopment, and the demolish of offices is unavoidable.

To answer the research question of this paragraph, I conclude on the basis of the System Dynamics analysis, Game Theory analysis and expert interviews the use of the scenario of the development credits as the most beneficial. Not only because of the quick result, but also because of the most fair trading system. The construction claim will shortly be explained.

Best solution: Construction claim model to trigger both office owners and government

The basics of the construction claim is simple. If office owners will take their office out of the market (e.g. another function or demolish it) they could take their present tenant along to a new office development at a better suitable location. At this location 60% of the left offices can be rebuilt, in this solution the office owner is fully responsible for the withdrawal of the left office. Here it is not important whether the old office will be demolished or transformed to another function.

By comparing the Game Theory results with the System Dynamics results together, an extra advice need to be formulated. Out of the municipalities behavior there also occurs a passive participating role by passive acting of office owners in this construction claim scenario. Out of this viewpoint there should be add an extra dimension within this scenario to make the municipalities more eager. The municipalities are probably not eager to shrink down their plan capacity and couple it to the existing stock. To solve this passive acting there should be add

extra triggers within this concept. Which there could be an interesting role by the province. If the construction claim model will be restricted by the province, the municipalities could be more eager to active participation in this scenario, in order to stimulate the withdrawal of offices, hereby can the municipality release more plan capacity.
The last problem what you cannot to afford to miss is the qualitative renewal off office stock. The construction claim will only renew the overstock, this is approximately 14% - 6%(structural vacancy) = 8% quality improvement + 1% redevelopment. In this respect if the equilibrium is reached after approximately 10 years there only will take place redevelopment (1% of the stock will improve in quality). The total cycle in case of the technical (quality) life cycle would be 100 years. With this fact in mind there is a major challenge for the redevelopment of offices (quality improvement). The government should construct resources to urge office owners. For this an obliged energy in combination with an obliged renovation after a certain cycle (for example 25 years), could bring the market in an equilibrium of qualitative good stock.

With above standing conclusions in mind the different governmental bodies have different tasks and different stakes in the participation in the construction claim solution. In the recommendations these tasks and stakes will briefly be described.

13.Discussions

A critical view to work of others and also the work by yourself helps to improve the product and bring it to the next level. I am convinced that there always opportunities for improvement. Finally if the effort will exceed the benefit of the improvement, it is called a final version. This does not mean a total vanish of all the improvement opportunities. For this purpose some short discussion about the System Dynamics modeling approach, the Game Theory analysis, and the legal aspects will be brief discussed.

13.1. Discussion about the System Dynamics approach (and GIS-input)

As mentioned in the validation several System Dynamics models can be constructed on several ways. It is a human interpretation of the real world simulated in the real world. Despite the accuracy and lots of links to the real world there is always space for improvement.

Discussion about the modeling approach

I started the research with a financial focus, because of my technical background (construction management), and the less availability of financial data the model is more focused on spatial development and employment growth (economical growth) instead of a total financial System Dynamics. Probably a final research of an economical master student should also encounter these difficulties, this should for them be a gigantic challenge.
The GIS-analysis of the quality of offices is done by the use of building years as dominant characteristic. Which a representation by energy label should be more realistic.
The validation of the model is proven by expert opinions, and also the comparison of past simulations with future simulations. By this last validation some extra model adjustment could be done, hereby there need to be obtain more data.

13.2. Discussion about the scenarios

The scenarios are constructed with the power versus interest method. These more practical method directly focus on solution concepts. By a sensitivity analysis and an expert workshop extra information could be obtained to create more specific scenarios. These long-term projects need weighted against the benefit.

Discussion about the Game Theory approach

Game Theory is a research method for interactive decision making, this suits perfect by the game between the government and office owners. Unfortunately the problem is so complex that is too large to figure it out in one master thesis research.

General discussions about the method

By the execution of the Game Theory analysis the difficulty of the method revealed. Because the respondents has to empathize themselves in their opponent and the interest of them. To gain quicker and more results an easier survey could be constructed, disadvantages of this survey is the other insights which they provide.

Discussion about the decision profiles

The used scenarios are practical solutions. In a more extensive Game Theory research a broader scope should be used to make the research more fundamental, instead of the used focus.

Discussion about the questionnaire

The questionnaire is executed with a small group of respondents. This because the time issue, and the specific kind of knowledge which was required to fill it in. The group of respondents could be extend with office owners or investment companies. If extend the questionnaire should have a broader context and a significantly larger sample size. Within the group of investors there are playing more issues and interests.

14.Recommendations

The results and the conclusion of this research are already presented. Now there are possibilities to discuss how different parties in practice can use this research (BOM, municipalities/ Province Noord Brabant, office owners). Beside this other researchers can use this research as starting point, or just the underlying numbers for their research. Because the real-estate life cycle and the tension of the free market system or dynamic and interactive this and new research will be relevant for the upcoming decades.
First I will discuss what other parties could do, this will be done with the next perspective in mind:
'What should I do if I were a consultant (process/ project manager)', after this recommendations for further research will be given.

14.1. A process manager approach

BOM

The BOM (Brabantse Ontwikkelings Maatschappij) especially the department 'Business locations' always deal with different interest and the tension between new supply, (re)development, and a market equilibrium, the market effects which the System Dynamics model present are interesting to take in mind. Beside this there also occur vacancy at the projects in their portfolio. This research approach to interactive decision making could give them insight in the stumbling blocks.
With respect to their core business and capabilities the BOM could invest risk capital (in a revolving manner), and they could manage the process of urban development. In the upcoming years both businesses could be carried out. If I were the process manager I should take the next steps:
Investment capital to transform offices (revolving fund),
Under the next conditions I should do an investment proposal:

- The involved offices should be appraised by a DCF-method (based on their present cash flow);
- Future value need to be a prospect, financial and/ or social value;
- In no way just the demolition of office should be financed, a participation in the transformation or improvement of offices should be one of the strengths, broadly, there are two opportunities to participate:
    - Transformation to another function, which there will be create value;
    - Qualitative improvement (improvement of energy label), which leads to lower operating costs, these improvement should gain financial benefits for the revolving fund.

Manage the process of urban development:
The BOM could intervene as advising party, the next steps should I take as process manager:

- Map the surroundings/ environment with the next factors in mind;
    - Ownership (Land and real-estate possessions);
    - Quality of the location and building (energy label);

    - Potency of the present location;
- Construct different scenarios to predict the future;
    - Employment development;
    - Harmful influence factors.
- Map the planning capacity of the involved municipalities:
    - Hard planning capacity;
    - Soft planning capacity;

Based on the previous market analysis a draft proposal to bring back the structural vacancy with potential contenders to transform and potential hopeless to demolish.

Municipality

The main aim of the municipality is to create a good business climate with a balanced office market. As mentioned the quantitative supply is sufficient, so their focus should be at the qualitative improvement of the market. The next steps should I take if I were a policy maker:

- Mandatory labeling of offices (energy label);
- Urge office owners to improve their office energy efficient;
    - By Tax-benefits;
    - Free valuation of labels.
- Flexible legislation in order to transform offices towards another function.
    - Change of zoning plan;
    - Accelerated procedure of building permit.

Province

By this recommendation the Dutch spatial act need to be take in mind. Because these try to arrange everything decentralized by the municipalities, they are the point which the journey against structural vacancy start. Unfortunately this decentralization has also cause the problem partly by less regional coordination. For this the next future steps could be taken by the province.

- Inventory of the total state of the art of the office market
    - Vacancy inventory on building level;
    - Financial analysis of office portfolios with a high amount of vacancy
- Inventory of the present plan capacity, the (in)potentiality of the present hard and soft capacity
- Setting up a pilot project with development credits (construction claim) in combination with transformation or demolishing of the left office building (stock).
- Focus zones in the Province of Noord-Brabant, to coordinate and accelerate specific developments in the province of Noord-Brabant.

Beside this the province could overrule the power of the municipality which they have by the use of the spatial planning act. Hereby they can create a natural trigger to fine tune the supply and demand by the construction claim model. The next steps should be taken:

- Restrict the release of plan capacity by each municipality to the amount of offices which are taken out of the market;
- Coordinate all the new developments.

National government
The national government need to decisive instead of weak agreements. They need to facilitate the municipalities and provinces by correct (new) legal instruments which the local government could use in the journey against structural vacancy.

Office owners
If office owners in this market think in threats they will never survive in this difficult market. They need to look for opportunities, first they need to start with an analysis with the next aspects in mind:

- Make an inventory of the present owned office stock and potential;
- Try to concentrate all the owners of offices at central and remaining locations;
- Renovate offices with potential good locations (centre) sustainable.

14.2. Recommendation for further research

As already mentioned this research could be used for further research. For this the next researches are purposed.

Energy label database
A better inventory of the Quality of the buildings related to an energy label, including the geographic location gives more insight in the state of the art, redevelopment possibilities, and withdrawal possibilities. The next research could be performed:

- Inventory of the present state of the art of energy labels in the office market
- GIS analysis of the spread of labeled office in the province of Noord-Brabant

Life cycle analysis of an office
The previous recommendation was more on spatial development level. On the other hand there could be zoomed in to the technical, economical and functional life cycle of a building. Other functional/ technical/ financial approach could make the use of an office building more efficient and the valuation of it more realistic. The next research could be performed:

- Maintenance cost weighted against demolishing cost.
- The exact depreciation period of offices
    - Technical depreciation
    - Economical depreciation
    - Functional depreciation

The interactive influence of different office markets in different regions
The last recommendation is more on the policy level. The interests of different stakeholders and shareholders on policy level would help to make the spatial planning more manageable. The next research could be performed:

- The strengths, weakness, threats, and opportunities in the province of Noord-Brabant

Reference list

News articles

1. Gualthérie van Weezel, T., (2012), Akkoord over sloop lege kantoren, Partijen die geld hebben verdiend aan bouw slaan handen ineen, de Volkskrant, 28 juni 2012.

Books

1. Hobma, F.A.M., Schutte-Postma, E.T., (2011), Planning and development law in the Netherlands, Delft University of Technology.
2. Millington, A.F., (1994), An introduction to property valuation, The estate gazette limited, London.
3. Rust, W.N.J., van den Berg, S.H.C., Benthum, C.J.C., (2001), Vastgoed, financiele vraagstukken, Fakton.
4. Sterman, J.D., (2000), Business Dynamics, System thinking and modeling for a complex world, Mc Graw Hill, Boston.

Scientific articles

1. Barlas, Y., (1996), Mutiple tests for validation of System Dynamics type of simulation models, *European Journal of Operational Research*, *vol. 42*, 59 – 87.
2. Barlas, Y., (1989), Formal aspects of model validity and validation in System Dynamics, *System Dynamics review, vol 12,* No. 3., 183 – 210.
3. Buitelaar et al, (2008), Stedelijk transformatie en grondeigendom; Ruimtelijk planbureau, Den Haag.
4. Buitelaar, E., Segeren, A., (2008), Privaat eigendom en de stad, De Nederlandse praktijk, Ruimte & Planning, 28, 71 – 75.
5. Erdil, N.O., Emerson, C.R., Simulation modeling of electronic health records in the U.S., (2010), Healthcare System, Department of System Science and Industrial Engineering, State University of New York.
6. Forrester, J.W., (1961), Industrial Dynamics, *Productivity press*, Portland.
7. Ghaffarzadegan, N., Lyneis, J., Richardson, G.P., (2010) How System Dynamics models can help the public policy process. *System Dynamics review, Vol 27, No.1*, 22 – 44.
8. Hjorth, P., Bagheri, A., (2006). Navigating towards sustainable development: A System Dynamics approach. Futures, Vol. 38, 74–92.
9. Kaiser, R.W., (1997), The long cycle in real-estate. *The Journal of real-estate Research vol 14, no.3,* 233 – 257.
10. Kummerow, M., (1999), A System Dynamics Model of Cyclical office oversupply. *The journal of Real-estate* Research vol 18, no.1, 233 – 255.
11. Krabben, E., (2011), Gebiedsontwikkeling in zorgelijke tijden, kan de Nederlandse ruimtelijke ordening zichzelf nog wel bedruipen? , Radbout Universiteit Nijmegen.
12. North, M.J., Macal, C.M., (2010), Mulit-scale agent-based cosumer market modeling, *centre fro complex adaptive Agent systems simulation*.

13. Sivitanides, P.S., (1997), The rent adjustment Process and the structural Vacancy Rate in the Comercial Real-estate Market. *The journal of Real-estate Research vol 13, no.2,* 195 – 209.

Publications

1. Anink, D., et al., (2010), Kiezen voor nieuwbouw of het verbeteren van het huidige kantoor. W/E adviseurs, *Agentschap NL.*
2. Bak., R.L., (2011), Kantoren in cijfers, NVM Business, Zeist.
3. Buick Consultants (2011), Verkenning en verdiepping Plancapaciteit Kantoren, Eindrapportage, opdrachtgever IPO/VNG, Nijmegen.
4. Neprom, (2012), Nieuw commericeel vastgoed in 2012, Voorburg.
5. Olden, H., (2007), Remmende factoren bij het herstructureren van bedrijventerreinen, STOGO onderzoek en advies.
6. Van Elp, M., de Kok, I., Saitua Nistal, R., Zuidema, M.V., (2011), Kantorenmonitor, Analyse van vraag en aanbod, Economisch instituut voor de bouw (EIB).
7. Werkgroep Kantorenstrategie, (2011), Kantorenstrategie Amsterdam, Kiezen en onderscheiden, Ontwikkelingsbedrijf gemeente Amsterdam.
8. Zadelhoff, DTZ, (2012). De Kans hebbers in de markt.
9. Zadelhoff, DTZ, (2012). Nederland complete, factsheet kantoren en bedrijfsruimte.
10. Zadelhoff, DTZ, (2011). Van veel te veel, de markt van Nederlands commercieel onroerend goed.
11. Zadelhoff, DTZ, (2010). Het aanbod verouderd, de nederlandse markt voor kantoorruimte.
12. Zuidema, M., Elp, M., van der Schaaf, M.J., (2012). Kantorenmarkt Noord-Brabant, Verkenning van regionale vraag en aanbod ontwikkelingen, Economisch instituut voor de bouw (EIB).
13. Zuidema, M., Elp, M., (2010). Office vacancy, problem analysis and solutions, Economical institute of construction.

Policy documents

1. Schultz van Heagen, M. et al., (2012) Convenant aanpak leegstand kantoren. Ministerie van Infrastructuur en Milieu, IPO, VNG, IVBN, Vastgoed Belang, Neprom, CoreNet, FMN, NVB.
2. Gemeente ‘s Hertogenbosch, (Januari 2011), Kantoren en bedreiventerreinen beleid, Meer aandacht voor herstructurering en transformatie, ‘s Hertogenbosch.

Graduation reports PHD-theses

1. Besselaar, M., (2011), Structurele leegstand, voorkomen is beter dan genezen, Amsterdam School of Real-estate.
2. Buts, C., (2009), Anticiperen op langdurige leegstand, Eindhoven, adstudeerscriptie Vastgoed en Makelaardij.
3. Des Rosiers, F., (1987), Fiance and Property: The role of institutional Property Investment in Britisch and Canadian Real-estate, Faculty of Business Administration, Laval University quebec.

4. Giels, R., (2012), Putting the extra in basic education, how can a more sustainable value creation within primary schools be achieved. *Graduation report*, department of construction management and engineering, Eindhoven Univeristy of Technology.
5. Kooij, J., (2009), Strategic behavior of landowners, Strategic choice in the negotiation of a land transaction recommmendation how municipaities could deal with urban landowners. *Graduation report*, department of construction management and engineering, Eindhoven Univeristy of Technology.
6. REMØY, H.T., (2010). Out of office, A study on the Cause of Office Vacancy and Transformation as a Means to Cope and Prevent, Technical University Delft.

Websites

	Address:	**Visited at:**
1.	http://www.esri.com/what-is-gis/overview	October 9, 2012
2.	http://en.wikipedia.org/wiki/Normal-form_game	October 9, 2012
3.	http://en.wikipedia.org/wiki/Private_equity	October 9, 2012
4.	http://en.wikipedia.org/wiki/Normal-form_game	November 15, 2012
5.	http://en.wikipedia.org/wiki/Extensive-form_game	November 15, 2012
6.	http://en.wikipedia.org/wiki/Institutional_investor	November 15, 2012

Spoken experts

Expert	Organization	Aim of the meeting
Drs. M.T. van Geene	Kadaster	Use of the Kadaster data
Ir. G.A.H.J. Kuijer	Kadaster	Use of the Kadaster data
Drs. M. Mollenhorst	Province Noord-Brabant	Use of province data Opinion of research approach
Drs. J.L.M. Dagevos	Telos (Tilburg University)	System Dynamics validation
M. van Elp LLM msc	EIB (economical institute of construction	System Dynamics validation
Ir. P. Vismans	Regional development company Drechtsteden	System Dynamics validation
Drs. M. van den Broek	Responsible for the office stock in ‘s Hertogenbosch (economic affairs)	Scenario validation
Drs. J. Broeders	Responsible for the office stock in Tilburg (economic affairs)	Scenario validation

Appendix

Appendix A, Example of finance and gearing, the leverage effect

The Financial leverage effect

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
Equity	75,00%	€ 10.000.000,00	50,00%	€ 10.000.000,00	25,00%	€ 10.000.000,00	10,00%	€ 10.000.000,00
Debt	25,00%	€ 3.333.333,33	50,00%	€ 10.000.000,00	75,00%	€ 30.000.000,00	90,00%	€ 90.000.000,00
Total investment	100,00%	€ 13.333.333,33	100,00%	€ 20.000.000,00	100,00%	€ 40.000.000,00	100,00%	€ 100.000.000,00
Gross profit	8,00%	€ 1.066.666,67	8,00%	€ 1.600.000,00	8,00%	€ 3.200.000,00	8,00%	€ 8.000.000,00
Cost of finance	4,00%	€ 133.333,33	4,00%	€ 400.000,00	4,00%	€ 1.200.000,00	4,00%	€ 3.600.000,00
Net profit		€ 933.333,33		€ 1.200.000,00		€ 2.000.000,00		€ 4.400.000,00
Return on equity	**9,33%**		**12,00%**		**20,00%**		**44,00%**	

The above standing scenarios are build to impress the effect of financial gearing, also known as the leverage effect. For this the tax is by all the scenarios not taken into account, this to give a clean sheet without unnecessary variables.

For all the scenarios there is a difference in the ration between equities and debts (75%/ 25%, 50%/ 50%, 25%/ 75%, 10%/90%). By a quick scan there can be seen a huge increase in the return on equity. This can be explained by the available capital/cash. The available cash can be used to make profits, if the available amount cash is bigger the profit could be much more. This profit only occur by a bigger gross profit than the interest (cost of finance). The other side of the story is the risks. The first risk is the ratio between the gross profit and the cost of finance. If the cost of finance is bigger than the gross profit the available cash has not paid off and results in a loss. The other risk is the equity, most banks accept more than only cash deposit in form of: Real-estate, good will, goods, etc.. If the value of the deposit drops the debt could be based on air, which by a long term investment (real-estate) there could not be provide capital anymore.

To make the examples more tangible the scenarios are plot in graphs. Figure 52 indicates a huge difference in the ratio between equity and debts, which scenario 1 has got less risk for the cost of finance in comparison with 4. The most interesting information can be found in Figure 53, with the same amount of equity scenario 4 could make almost the same Net Profit as the equity in the other scenarios. Which there is almost the same amount of cost of finance in comparison with the debt of scenario 1. Finally scenario 4 has got more financial benefit (by enough gross profit) but also a lot more risk.

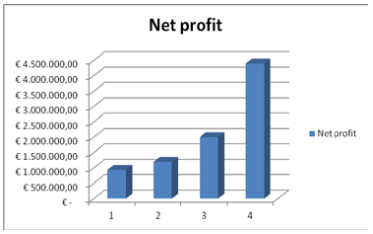


Figure 51: Net profit of each scenario

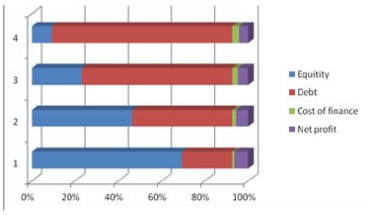


Figure 52: The ratio between Equity, debt, cost of finance and profit.

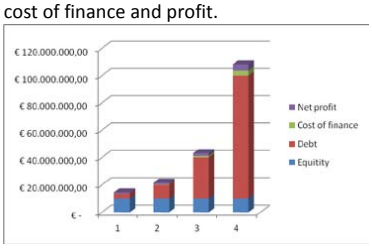


Figure 53: Leverage equation

Appendix B, Agreement vacant office approach
Between 9 important parties (3 public, 6 private) there is set up an agreement to approach the structural vacancy in the Netherlands. The most important findings are listed below:

Framework:
- There is set up an ambition between all parties to create a better functioning office market, which is in an equilibrium of supply and demand (quantitative and qualitative), improve the business climate, improve the Dutch competitiveness (to start up businesses), and to create long term value.
- Areas which are dealing with a big amount of structural vacant stock are: Amsterdam, Rotterdam, Eindhoven, Den Haag, Utrecht, and Eindhoven.

Aim of the agreement:
- The aim of the agreement is to create a good functioning office market.

Spatial and legal framework:
Municipalities and province need to tackle all the important offices region's in collaboration with the private parties within 12 months. They should make agreements on location level, to approach the earlier set up aim, this agreements need to contain:
- There need to be set up a vision about the preferred mix of offices and development locations.
- Municipalities need to monitor the amount of supply and demand in their region within 12 months, en they need to form a new 'office policy'.
- The 'office policy' need to be taken along in the future plans for newly developed office locations, and the desirable cancel of this locations.

Regional office fund:
- All the parties could take the initiative to construct a regional office fund. The fund is meant to redevelop or demolish old structural vacant office stock. The fund will compensate the office owners financially by a demolishing or a sustainable renovation.

Transparency:
- Private parties need to administrate rental prices and possible incentives (rent free periods, rent discount, and investments). Wherefore the funders and appraisers are fully up-to-date about the market.

Measures set up by the IVBN, Vastgoed belang and their participants:
- Investors will invest in the improvement of the quality and sustainability in offices on a selective way. Beside this they will focus on demolishing and transformation.
- Investors will collaborate active in transformation and demolishing.
- Investors are reserved with investments in newly build office out of the growth areas.

- By the decisions about the purchase of new offices investor need to use the most as possible the balance approach.

Measures set up by the NEPROM and their participants which develop offices:

- Developers of newly build offices could only develop new offices in growth areas, exclusively with a high level of sustainability, and flexibility.
- Within the balance-, restricted-, and transformation areas there is only a focus on redevelopment, transformation and demolishment. The aim of the NEPROM is a (re)development of at least 50% of the structural vacant stock.
- Developers do not add office space in restricted-, and transformation areas. By a deviation they are prepared to compensate this by financial support of the (regional) office fund.

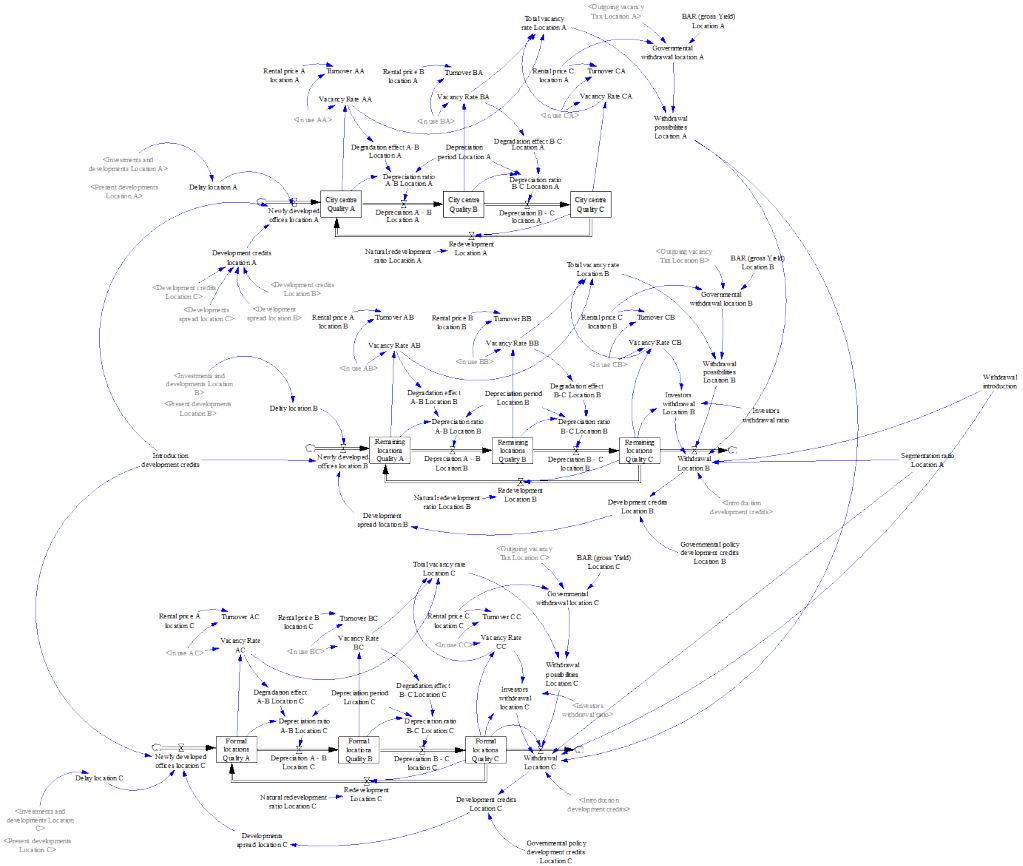
Measurements set up by the government

- The government will investigate to construct different (regional) office funds. This research will be based on a system used by the BIZ-regulation (Dutch: Bedrijven investerings zone), Company investment zone. The aim is to construct a legal foundation for the office funds.

Appendix C, Measures to force back the office vacancy:
Amsterdam is a forerunner in governmental actions to force down the structural office vacancy, within their strategy they assume the next measures (kantorenstrategie, 2011).

- By land allocation at industrial areas the calculated cost price of land will be linked on the floor space index (FSI), when the FSI is bigger than one.
- The use of governmental policies like: vacancy tax, deposit policy, and environmental tax are not the preference of the minister. The government only take some measures to make redevelopment and restructuring more easier.
- The office market is changed from a grow market to a replacement market.
- The amount of the supplied offices is quantitative sufficient but qualitative insufficient. There is a strong demand for qualitative improvements, to approach this the municipality Amsterdam has got three main focuses.
    1) Stimulate and facilitate the redevelopment of existing offices on prevalent locations;
    2) Stimulate and facilitate the transformation and demolishing of existing deprived offices;
    3) Set up restrictions for the addition of new offices.
- *Measures for the transformation, demolishment, or redevelopment of existing offices*
  The municipality Amsterdam indicates three possibilities to stimulate the redevelopment of offices:
    1) legal- and governance: find the boundaries of the construction regulations, be flexible with zoning plans, and vacancy regulations.
    2) Take a way (financial) issues by incentives (construction fees).
    3) Take a way organization problems (coordination).
- *Vacancy regulation:*
  Owners of real-estate which be longer vacant than 6 months need to inform the municipality, if not they will get a ticket of maximum € 7500,-.
- *Restrictions by new office development:*
    - Build sustainable
    - Build flexible
    - pre-rental requirement of 70%
    - Market price of land
- *Reconnaissance the policy, old for new:*
    - Transferable/ negotiable development rights
    - Transferable/ negotiable transformation contribution
    - Environmental tax
    - Quality fund
    - Land consolidation
    - Selection criteria by tenders which should accelerate the demolishing of offices
- *Characterization of office locations:*
    - Shrinking areas
    - Balance areas
    - Limited growth areas
    - Grow areas

Appendix D, System Dynamics top model



Appendix E, GIS-modeling

Modeling decisions which are made
To combine the data, the previous elaborated imperfections need to be filtered out for this different approach in excel and some trial error approaches are used. The next decisions are made:

Occasion:	Decision:	Function/method:
Combination of dwelling and office	Filter out all the office smaller than 500m^2	If then else, object size < 0, 0, object size (Excel)
Double references	Filter on unique building ref.	Advanced filter (Excel)
's Hertogenbosch specific		
Municipal buildings	Control the function by Google, and Google maps	Trial and error/ sampling
Industrial real-estate	Control the function by Google maps	Trial and error/ sampling
Religious associations	Control the function by Google, and Google maps	Trial and error/ sampling
Housing associations	Filter out the headquarter(s)/ offices, and erase all other ref.	Internet site, and goals seeking in Excel
Merging of different buildings by brokers	Do nothing because the main address contains the amount of square meters of the summarized addresses	No follow up
Mixed employment zones	Consistency check will only be done within work locations	Not sure if these factor will be taken into account.

Table 27: Office real-estate factsheet 's-Hertogenbosch (determined per restrict)

Geographic location	Neighborhood	nr.	Quality type	Amount of offices	Amount of vacant offices	(M2) offices	(M2) vacancy	Vacancy %
City Centre	Centre	1	A	1	1	2.774	1.091	39,33%
		1	B	9	5	30.361	3.876	12,77%
		1	C	42	7	92.488	11.413	12,34%
	Paleiskwartier	6	A	6	5	32.491	16.192	49,84%
		6	B	2	0	1.015	0	0,00%
		6	C	0	0	0	0	0,00%
Remaining locations	Rosmalen	12	A	7	0	28.141	0	0,00%
		12	B	18	1	28.194	1.038	3,68%
		12	C	14	1	21.375	1.461	6,84%
	Overige locaties	13	A	7	1	9.913	2.525	25,47%
		13	B	12	1	56.661	3.664	6,47%
		13	C	50	2	128.942	358	0,28%
	Rompert/ De Slagen	9	A	5	1	5.521	880	15,94%
		9	B	2	0	10.115	0	0,00%
		9	C	1	0	526	0	0,00%
Formal locations (Industrial/ office areas)	De Herven	3	A	16	5	61.963	11.724	18,92%
		3	B	14	7	82.687	24.772	29,96%
		3	C	8	3	34.320	8.952	26,08%
	De Goudsbloemvallei	4	A	6	2	15.271	4.424	28,97%
		4	B	6	0	13.189	0	0,00%
		4	C	0	0	0	0	0,00%
	Hightechpark	5	A	3	1	7.299	1.107	15,17%
		5	B	8	2	34.601	2.189	6,33%
		5	C	1	0	2.730	0	0,00%
	De Brand	2	A	10	1	48.177	710	1,47%
		2	B	0	0	0	0	0,00%
		2	C	0	0	0	0	0,00%
	Pettelaarpark	7	A	2	2	10.888	5.036	46,25%
		7	B	10	6	62.686	12.323	19,66%
		7	C	2	0	50.612	0	0,00%
	Rietvelden/ De vutter	8	A	3	1	5.126	2.642	51,54%
		8	B	1	0	13.583	0	0,00%
		8	C	7	0	12.348	0	0,00%
	Brabantpoort	10	A	1	0	1.179	0	0,00%
		10	B	4	1	21.301	1.875	8,80%
		10	C	0	0	0	0	0,00%
	Soetelieve	11	A	0	0	0	0	0,00%
		11	B	0	0	0	0	0,00%
		11	C	2	0	25.739	0	0,00%
Total				280	56	952.216	118.252	12,42%

Appendix F, System Dynamics data-collection out of the past
The establishment of the variables in the past

Past	**Present**	**Future**
Year -15	Year 0	Year +15
(Start of the validation model)	*(Start of the office model)*	

The most influential variables:	Variables to validate:	Variables needed out of the past:
Different stock quantities	Depreciation effect	The previous segmentation of office stock
Employment	Redevelopment rate	The previous vacancy rate
Withdrawal factor	Vacancy development	The previous supply of office stock
Available plan capacity	Stock development	The previous developments of employment
Amount of vacancy		

The ultimate way to validate the model is to determine the history of each variable and model these in the past. To achieve this the next sources are used: The constructed GIS-map, the database provide by the Kadaster (all registered offices), and the employment numbers registered by the province. In the next paragraphs the content of the variables will briefly discussed.

<u>The previous segmentation of office stock:</u>
By the same GIS-analysis which is done in a previous stadium of this research (Chapter 8, GIS – modeling), the previous supply of stock is determined within the earlier stated geographic locations. In this analysis the quality of the stock is determined, only the quality boundaries are set 15 years earlier.

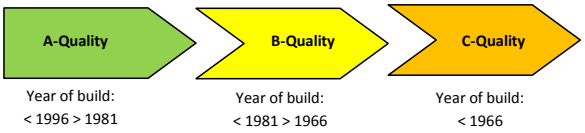


Figure 54: Quality groups within the office real-estate market 15 years ago

Out of these analysis the next stocks are determined:

Present amount of office space 's Hertogenbosch			
Quality (year of build)	Geographical location		
	Centre	Suburb	Industrial area
A-Quality (<1996 >1981)	31.376 m^2	94.970 m^2	228.047 m^2
B-Quality (<1981 >1966)	14.748 m^2	62.440 m^2	121.115 m^2
C-Quality (<1966)	77.740 m^2	88.403 m^2	4.634 m^2

Table 28: Segmentation of office stock 's Hertogenbosch (<1997)

The previous vacancy rate:

By the approach to determine the present state of the office market there is used the database of Jones Lang LaSalle. Because the time period of the validation data (15 years). It is difficult to obtain the exact data. For Example if a specific building is offered, at which time, and how long it is offered. For this the general development of the vacancy rate is used as starting point (Zuidema & van Elp, 2010), Figure 55 represents the general overall vacancy development in the Netherlands. The start of the model validation is in 1996, out of the model a vacancy rate of 5,8% can be read.

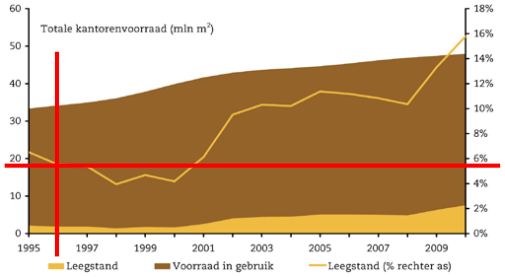


Figure 55: Development of the office stock in the Netherlands (Zuidema & van Elp)

The previous supply of office stock:

The database of the Kadaster and the GIS-map are used to determine the previous supply of office buildings in combination with the different geographic locations. The office supply of the past 15 years is reviewed. First there is judged in which area each office is located (1)Centre, 2)Remaining, 3)Formal), and second the supply of each year is determined. This result in the next graphs:

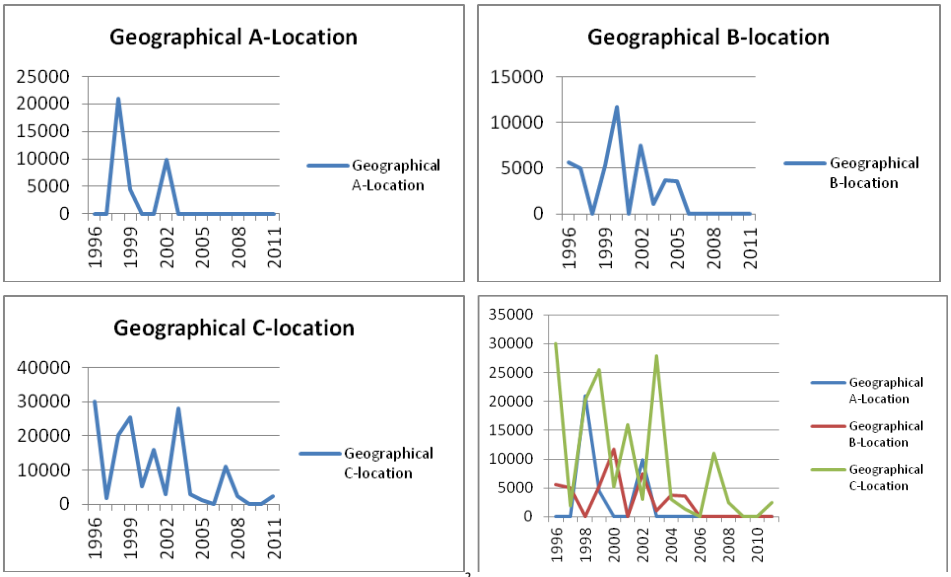


Figure 56: Supply of new offices in 's Hertogenbosch (m^2) (1996 – 2011)

The previous developments of employment:

An important factor in the System Dynamics office model is the employment. This because a change in employment changes the demand for offices, especially the office bounded employment. In this research there is chosen to review the general employment factors, this because of the next reasons:

- It is difficult to determine the exact amount of employees in a building, it is possible on area level, but within this area a part of the employees could have their job in another kind of real-estate. E.g. in the city centre there are a lot of employees in the catering and tourism;
- The new type of work could have an influence on the office use of employees, because it depends of the different type of employment it is at the moment to difficult to determine. (e.g. an architect may need more space and a fixed workstation, a helpdesk employment doesn't matter if their workplace is flexible or not).

Because geographical location is an important variable in the attractiveness and rentability of an office the previous development of employment is determined on local level by the earlier stated geographical location. First the total amount of employees within the specific 6 position postal-code of each geographical location are determined. Second the development of the employment in the past 15 years is reviewed, these developments will be used as input for the System Dynamics model.

In the GIS-analysis only the specific postal-code area where an office >500m^2 is located is taken along. This is a detailed approach, but there could also be involved employment in other kind of real-estate, therefore there is not analyzed how much space each employee will use, but the development (in- or decrease) of the employment. In some 6 position postal-code this is almost 100% representative, because there are only office buildings located (office areas like: 'de Brand' and 'Pettelaar park'), in the centre and industrial areas this could be slightly deviate. The determined developments are represented in Figure 58 and Figure 57.

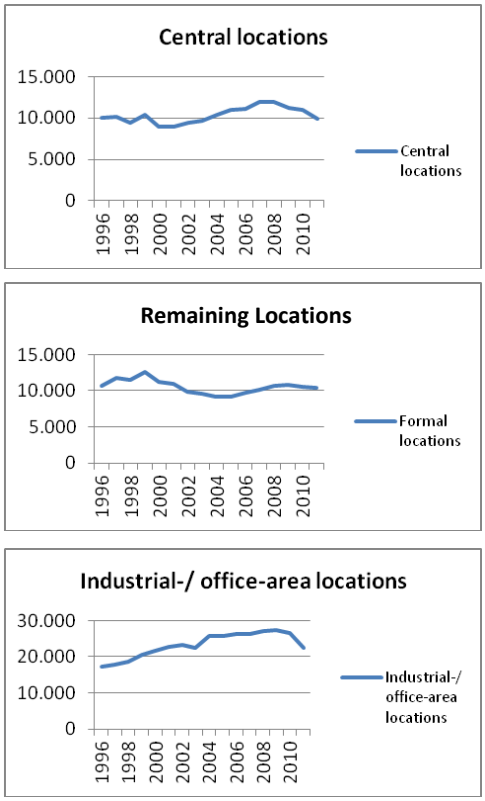


Figure 58: Employment in 's Hertogenbosch (1996 - 2011)

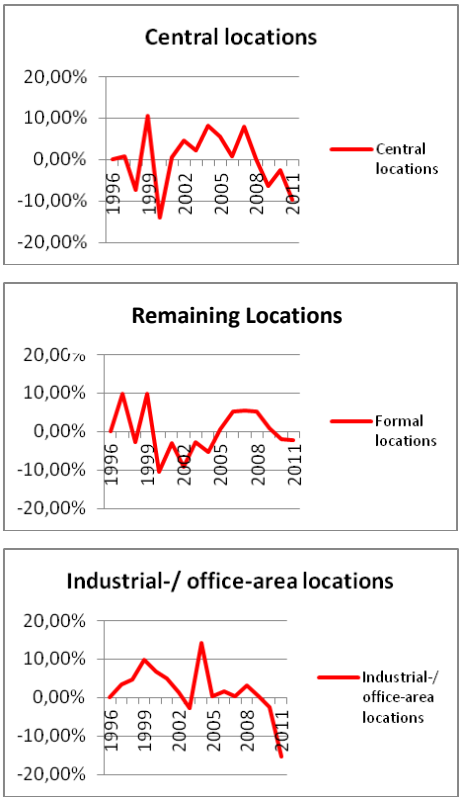
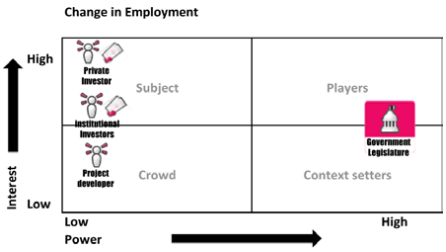
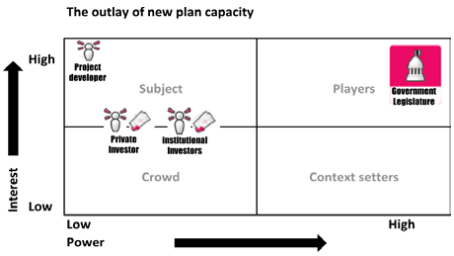


Figure 57: Development of employment in 's Hertogenbosch (1996 – 2011)

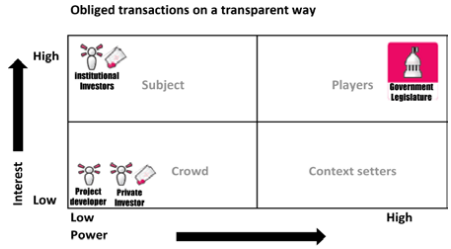
Appendix G, Power versus Grid analysis



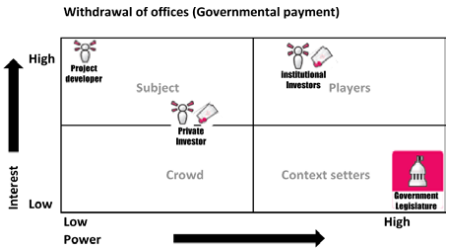
Change in employment			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	None	Low unemployment	Investment stop
Institutional investors	None	Low unemployment	Investment stop
Project developers	None	Low unemployment	Development stop (bankruptcy)
Governmental legislature	Incentives (simulating measures)	Low unemployment	- Shrink allowance - Reduce interest - Reduce (enterprise) Tax



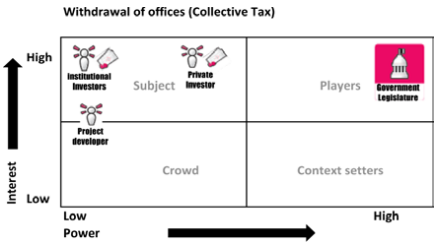
The outlay of new plan capacity			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	None	New investments	Partnerships (consortia)
Institutional investors	None	New investments	Partnerships (consortia)
Project developers	Only if (land in claim/ possession)	New developments to create value	Land acquiring
Governmental legislature	WvG*/ WRO**	The more land developed, the more income	Develop more land
*WvG= Wet voorkeursrecht Gemeente (Dutch act: With this act the municipality has got the first right to purchase land)			
**WRO= Wet ruimtelijke ordening (Dutch act: The possibility to change the land-use plan, to change the destination)			



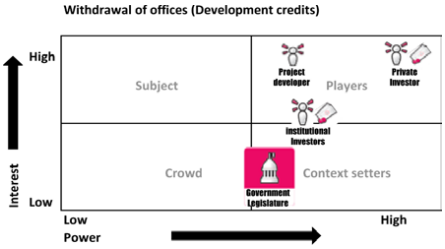
Obliged transactions on a transparent way			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	None	The stricter the valuation of a transaction the less investments with debts	None
Institutional investors	None	Transparent transactions could improve the market	Exemplary function
Project developers	None	The stricter the valuation of a transaction the less investments with debts	None
Governmental legislature	Legisla-tion	The more transparent the market the more easier to control	Obliged transparent transactions



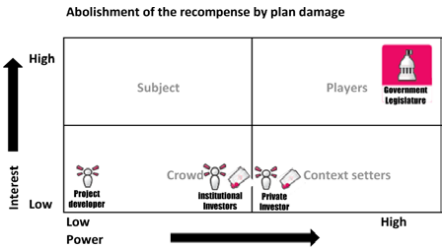
Withdrawal of offices (Governmental Payment)			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	None	Market equilibrium	Offer deprived offices
Institutional investors	Collaborate with government	Market equilibrium	Create a public office fund
Project developers	None	Market equilibrium could give more business	Coordinated developments (by government)
Governmental legislature	Legislation	Low, because it will cost extra money	Coordinated withdrawal (by government)



Withdrawal of offices (Collective Tax)			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	None	Market equilibrium	Offer deprived offices
Institutional investors	None	Market equilibrium	Offer deprived offices
Project developers	None	Medium interest, market equilibrium give more business	Coordinated developments (by government)
Govern-mental legislature	OZB* / BIZ**	Market equilibrium, should generate extra income (Tax, building permits)	Withdrawal of offices (demolishing or transformation) with collected money
* OZB = Onroerend goed zakenbelasting (Dutch act: Governmental Tax on Real-estate, extra money could be gained to withdrawal offices)			
**BIZ = Bedrijfsinvesteringszones (Dutch experimental act: initiatives of different companies which could be supported by a obliged cash charge for all companies which have benefit by the investment within an area)			



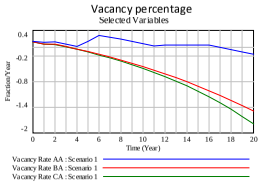
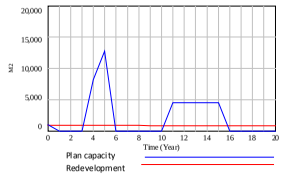
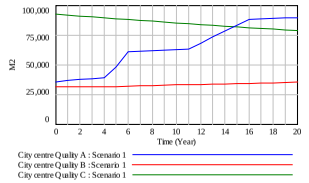
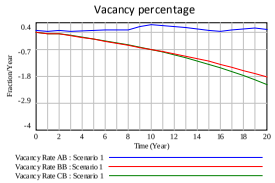
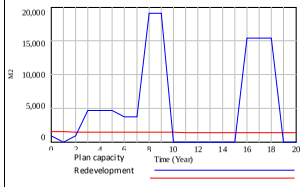
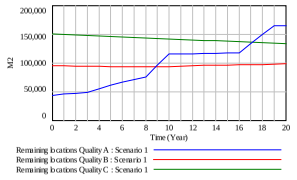
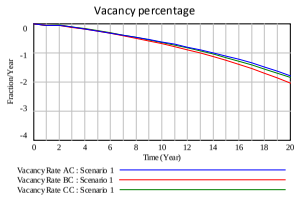
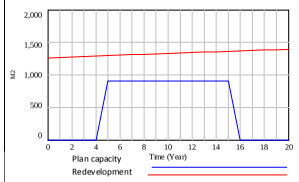
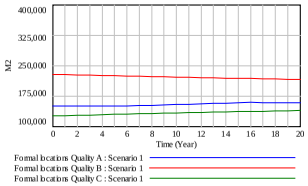
Withdrawal of offices (development credits)			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	Already owned possession	Market equilibrium, and new investment opportunities	Offer deprived offices for devlp. credits
Institutional investors	Already owned possession	Market equilibrium for the stabilization of investments	Offer deprived offices for devlp. credits
Project developers	Expertise and knowledge	New chances for developments (refreshing the stock)	Creative solutions (transformation)
Govern-mental legislature	Legislation	Market equilibrium, should generate extra income (Tax, building permits)	Give building claims for an office withdrawal



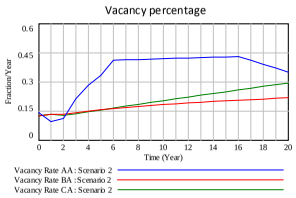
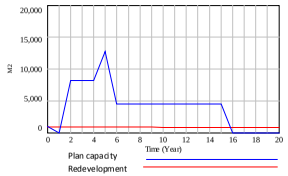
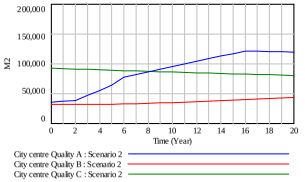
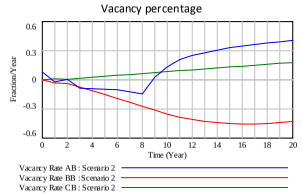
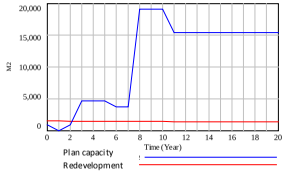
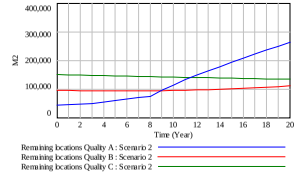
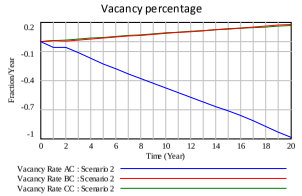
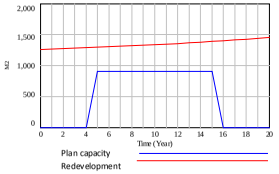
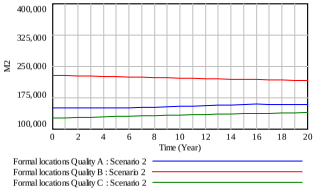
Abolishment of the recompense by plan damage			
Stakeholder	**Power**	**Interest**	**Possible action**
Private investors	None	None, owned land for developments will be worthless	Appeal procedures
Institutional investors	None	None, owned land for developments will be worthless	Appeal procedures
Project developers	None	None, owned land for developments will be worthless	Appeal procedures
Govern-mental legislature	Legislation	Compensate losses of deleted plan capacity	Set up a new hierarchical governmental act

Appendix H, System Dynamics simulations

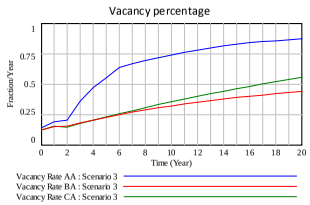
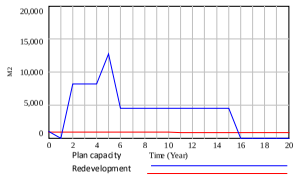
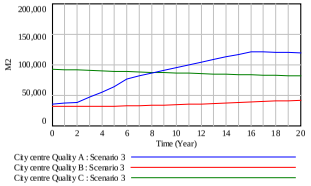
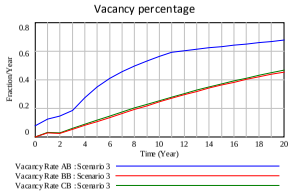
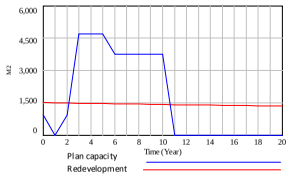
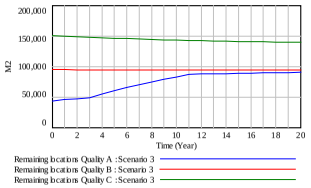
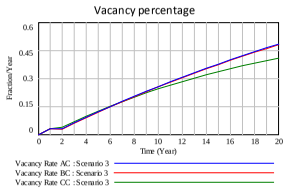
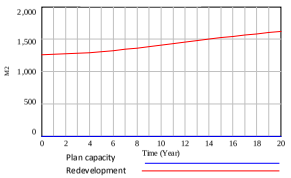
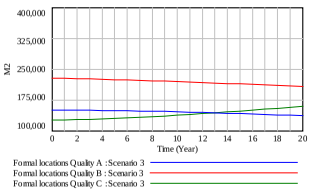
Scenario 1, Global Economy, years of growth (before the crisis):

Centre locations			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	
Remaining locations (Suburbs)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	
Formal locations (Office-/ industrial – areas)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	

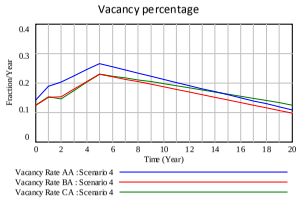
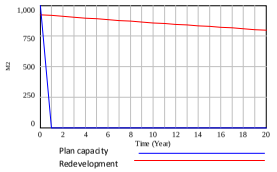
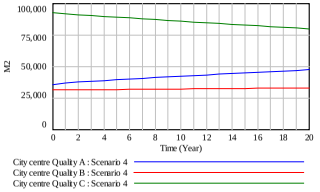
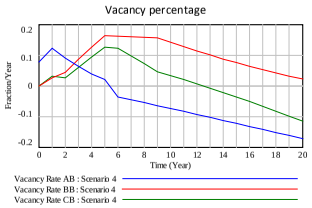
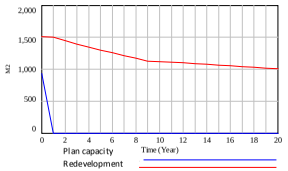
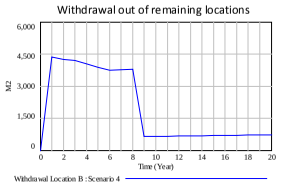
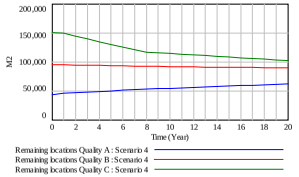
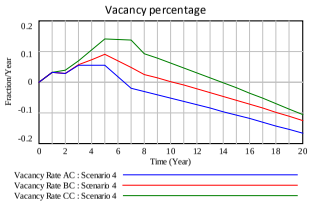
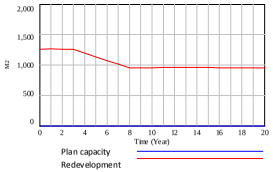
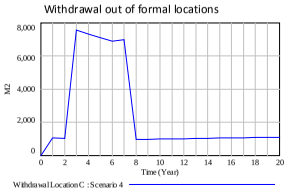
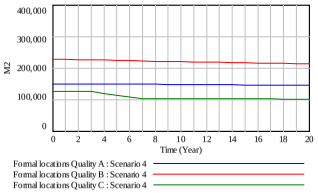
Scenario 2, Transatlantic market/ Strong Europe (present situation):

Centre locations			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	
Remaining locations (Suburbs)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	
Formal locations (Office-/ industrial – areas)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	

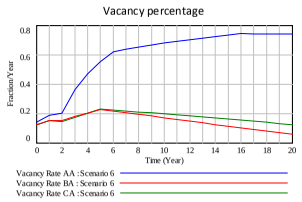
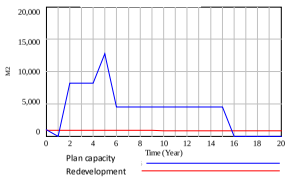
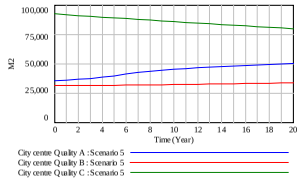
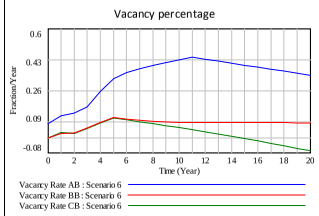
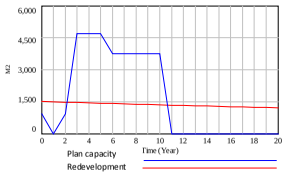
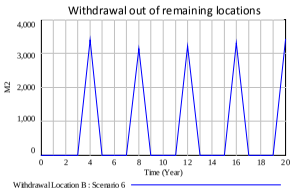
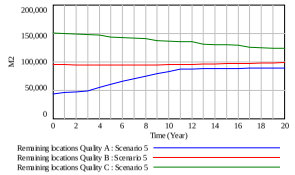
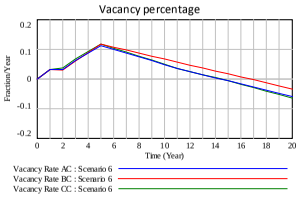
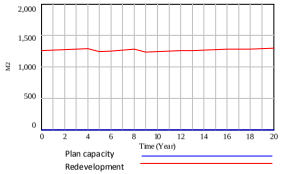
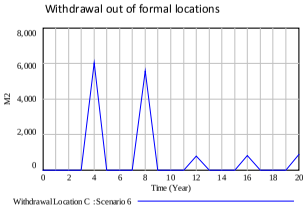
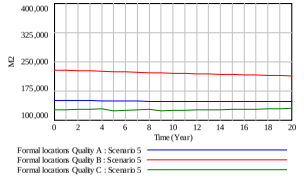
Scenario 3, Economical contraction, combined with hard planning capacity:

Centre locations			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	
Remaining locations (Suburbs)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	
Formal locations (Office-/ industrial – areas)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this scenario there takes no withdrawal place**	

Scenario 4, Economical contraction, followed by a small recovery (Coordinated by the government):

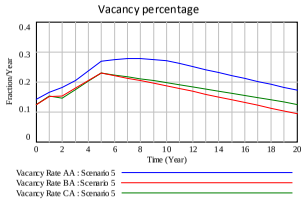
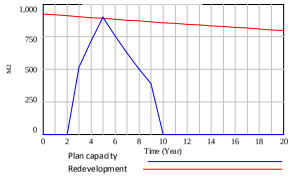
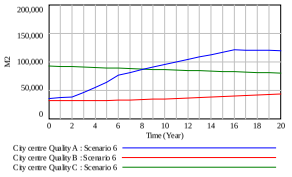
Centre locations			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this area there takes no withdrawal place**	
Remaining locations (Suburbs)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
			
Formal locations (Office-/ industrial – areas)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
			

Scenario 5, Economical contraction, followed by a small recovery, (Model collective tax):

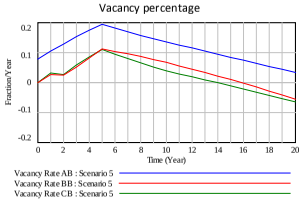
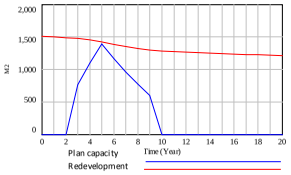
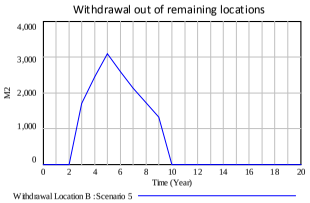
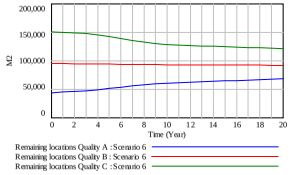
Centre locations			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this area there takes no withdrawal place**	
Remaining locations (Suburbs)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
			
Formal locations (Office-/ industrial – areas)			
Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
			

Scenario 6, Economical contraction, followed by a small recovery, (Model development credits/ construction claim):

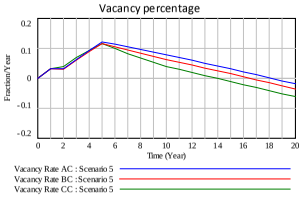
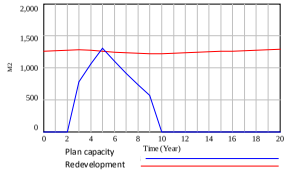
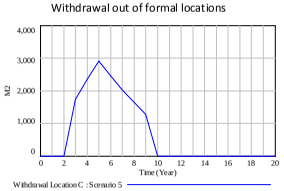
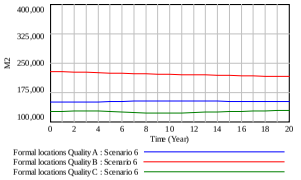
Centre locations

Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
		**Within this area there takes no withdrawal place**	

Remaining locations (Suburbs)

Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
			

Formal locations (Office-/ industrial – areas)

Vacancy graph	Plan capacity graph	Withdrawal graph	Stock development graph
			

Appendix I, Game Theory respondents

The survey is conducted by different policy makers within the province of Noord-Brabant. Both employees by the government as well as employees out of the B5 are conducted in the research. Because most of the answers will indicate the governmental strategy, only the profile of the policy makers will be represented.

Respondent 1
- Public party - Influence on policy decisions - Responsible for 1.944.500 M^2 office stock

Respondent 2
- Public party - Influence on policy decisions - Responsible for 5.300.000 M^2 office stock

Respondent 3
- Public party - Influence on policy decisions - Responsible for 465.000 M^2 office stock

Respondent 4
- Public party - Influence on policy decisions - Responsible for 200.000 M^2 office stock

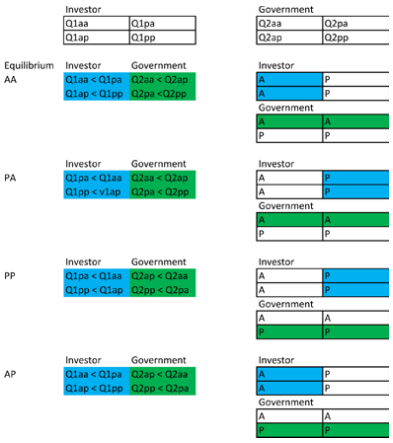
Respondent 5
- Public party - Influence on policy decisions - Responsible for 1.559.000 M^2 office stock

Respondent 6
- Public party - Influence on policy decisions - Responsible for 3.676.000 M^2 office stock

Respondent 7
- Public party - Influence on policy decisions - Responsible for n/a M^2 office stock

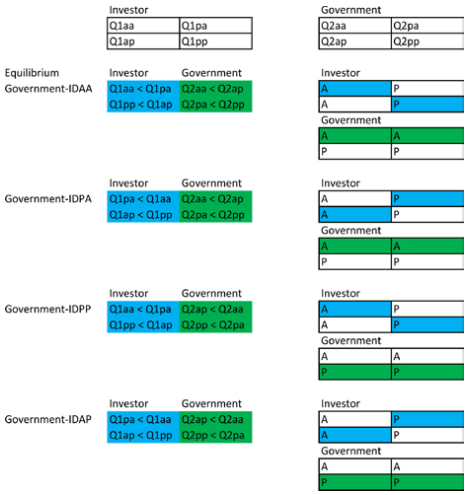
Appendix J, Game Theory rule sets

Equilibriums predicted by dominance:

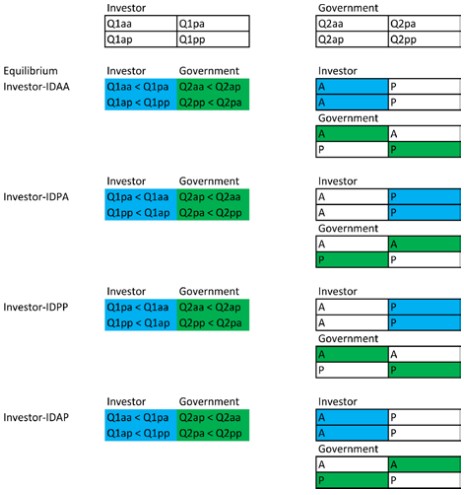


Equilibriums predicted by iterative dominance:

Government:



Investor/ office owners:



MAINTAIN A DYNAMIC OFFICE REAL-ESTATE MARKET IN THE PROVINCE NOORD-BRABANT, 's HERTOGENBOSCH CASE STUDY.

The office real-estate market, what are the effects of policies to bring back the equilibrium in the real-estate office market and vanish the structural vacancy?

Author: G.L.J.J. Lamers

Graduation program:
Construction Management and Urban Development 2012-2013
Process Engineering

Graduation committee:

Prof. dr. ir. W.F. Schaefer	(Eindhoven University of Technology)
Dr. Q. Han	(Eindhoven University of Technology)
Ir. B. van Weenen	(Eindhoven University of Technology)
Ing. A. van der Heijden	(Brabantse Ontwikkelings Maatschappij)
Drs. ing. K. de Haan	(Brabantse Ontwikkelings Maatschappij)

Date of graduation:
2013-03-12

ABSTRACT
The economical growth and eagerness to develop out of the past decades has caused the present overstock off office real-estate. By the use of System Dynamics this research predicts the effects the effect of futures measures in future scenarios (within the real-estate office market of 's Hertogenbosch). The most important factor within this process of Urban Development are: plan capacity release, employment development, office withdrawal, and quality improvement. At the end of the end of the research the future scenarios are judged by the responsible policy makers out of the BrabantStad region by the use of Game Theory.

Keywords: real-estate office market, Urban development, System Dynamics, Policies, Game Theory.

INTRODUCTION

'The dynamics of the office market'. The previous sentence could be a description of the whole real-estate office market, but it finally means nothing. It only indicates the complexity of the market. In general the office property market is clearly characterized by a succession of cycles, with expansionary and recessionary stages emerging as direct response to monetary and fiscal policies, to economical parameters, and trends in the use of offices.

The game between demand and supply of offices is interactive with always a form of tension, which it makes it interesting. To give the market 'space' (literally and figuratively) there need to be a small oversupply (if not the market is locked). A healthy vacancy rate should be 5% till 7% of the stock. There is no need for extra scientific research to demonstrate the structural vacancy in the office real-estate market in the Netherlands. But to indicate how big this problem is, some facts and figures: The office stock in the Netherlands consists of 41 million m^2 in use and 7,6 million m^2 in offer, this means a vacancy rate of +/- 15,6%. This overall rate could be divided in cyclical vacancy (the dynamics of the market) and structural vacancy (over stock, mismatch between demand and supply).

PROBLEM DESCRIPTION

In the past decades lots of new offices are built at mostly formal locations. Because of the race for the most attractive office, the available capital, the eagerness to do land development by the municipalities and the drive for developments of offices was high. Finally possible future developments of the economy are not taken into account. This has led to too much office stock, where there is a possible skewed distribution of office quality.

Research question

Out of the previous problem description the next research question could be filtered out.
Research question: 'What are the effects of policies to bring back the equilibrium in the real-estate office market and vanish the structural vacancy?'

Research objective

The aim of this research is to investigated if different measures could bring back the equilibrium in the office real-estate market. This aim is tried to be achieved with the construction of a System Dynamics model. The real-estate office market in the province Noord-Brabant (especially the municipality 's Hertogenbosch) is modeled to understand the different cycles in the market and to predict the effect of future behavior (especially the behavior of policy makers).

Research boundary

- The province of Noord-Brabant, Especially Brabant Stad (5 biggest municipalities);
  - The System Dynamics model is focused on 's Hertogenbosch.
- The willingness to cooperate by a collective solution will be reviewed, mostly measured by the responsible municipalities (Brabant Stad);
- The focus of the measurements is at the 'collective tax', 'development credits', and a 'governmental payment ' (hierarchical approach by the government);
- The willingness to take an office out of the market will be measured, if it will be transformed to another function of use or demolished will be not taken along;
- The change in land position which could arise after the demolishing of offices will be disregarded.

THEORETICAL FRAMEWORK

Financial structure of investment funds, investment behavior of office owners

The aim of real-estate investments is important to notice. In the past decades real-estate is often used to secure money. Because of a growing economy during the last decades two important developments have made the (office) real-estate market 'hot' to speculate and invest. First the stabilized growth and stability (inflation secure), and second the scarcity of development space (Kummerow, m., 1999).
Because of this, different players occur at the real-estate market, each with a different aim. An important phenomenon during the last decades in the real-estate market is the debt-driven financing. By the use of the leverage effect, lots of office real-estate portfolios are financed with a substantial high part of debts. With a growing economic and scarcity this portfolios will giving interesting revenue percentages. Which the portfolios are based on static valuation methods based on growth (Millington, A.F., 1994). By a growth disturbance portfolios with too much risks will go bankruptcy. By the above stated properties of the real-estate market structural office vacancy is a big threat for the present office real-estate market. In this research the development of vacancy in relation with urban development quantities will predict the future development of the office real-estate market (vacancy) by the use of different influence factors, the aim is to bring back the market in an equilibrium.

Vacancy influence factors

As mentioned, vacancy is a dangerous threat for the (risk geared) office portfolios. To steer the market and vanish the overstock, influence factors of office vacancy are important. The last years there are produced several researches which determines these factors in the Dutch office real-estate market. The most important are presented in Table 29, (EIB, 2011, DTZ, 2011).

Vacancy influence factor	Categories		
Geographic location*	Central location	Remaining locations	Formal locations
Quality category**	Attractive offices	Deprived offices	No chance offices

Table 29: Vacancy influence factors

* EIB research ** DTZ research

Of course there are several more factors which influence vacancy, e.g. price level, quality, operating cost, highway distance, accessibility, etc. In this research is chosen to pick out the most consistent factors to model (with complete information), and which obviate the most vacancy influence factors. Hereby are the factors out of Table 29 turned into measurable factor these are visualized in Figure 59.

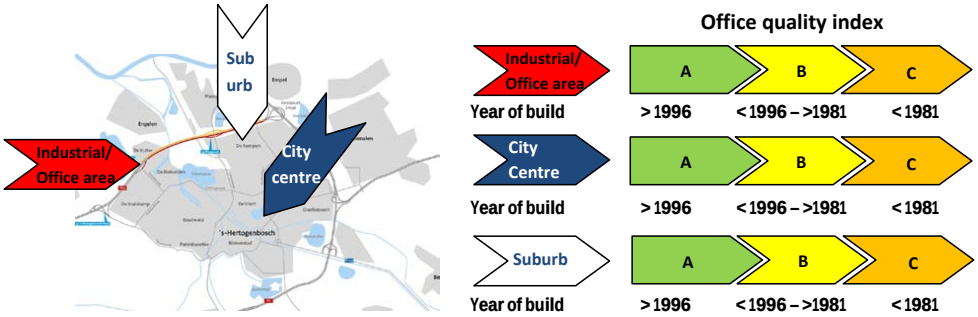


Figure 59: Influence factors geographical location and quality index

The geographic location is static and will not quick shift towards another location (only by a gigantic urban revitalization). The quality on the other hand will quick shift towards another category, these is called ageing, in the next paragraph these ageing part will be explained.

The life cycle of real-estate, the ageing part

Technical ageing

The technical life cycle of an office building could be defined in several ways, in different units. The latest one is the carbon footprint, determined by Agentschap-NL (Anink, 2010). Out of the research of Agentschap-NL the next important findings about technical ageing can be filtered out. The general (technical) life cycle of a building is mostly estimated around 50 years. To extent this life cycle there could be intervene by a renovation to consolidate the technical quality. The next variables are important to judge this renovation:

- Replacement or preserve ratio;
- Achieved lifespan extension;
- Long- or short cyclical components in the building;
- The present lifetime;
- The year of build
- Energy label.

Economical ageing
Economical ageing is related to the different valuation methods, namely static or dynamic, which the last gives more price input.
To overcome the ageing part of office real-estate at field (area) level. The economical institute of construction (EIB) developed an 'office model' which should create an equilibrium in supply and demand.
This 'office model' determines not the age, but the difference between quantitative supply of offices and qualitative supply of offices. Which the demand of offices in the office market could be described in a quantitative and a qualitative way, which:

- The quantitative aspect is the absolute size of the office demand, this can be determined by the employment and the office space use of each employ.
- The qualitative aspects are the users preferences with respect to the offices. Relevant are: trends, preferences, technical possibilities, and location preferences.

Stock movement
In the previous paragraph there is stated a technical and economical depreciation in qualitative way. The technical depreciation means the ageing of building techniques (building physics and materials) and the economical depreciation has the best relation with the functionality (layout of the building), which both has relation which each other. To translate these facts to the 'free-market-system' of the office real-estate market, the economical institute of construction (EIB, 2011) has expressed the economical ageing in hard factors, namely the shift towards lower (price) segments, divided in the different locations:

Central locations	Remaining locations	Formal locations
0,5%	0,6%	0,9%
% of stock movement towards a lower quality segment		

Governmental policies
Lots of research can be done and is done in the field of governmental policies in relation with urban (re)development. In this paragraph the major highlights of the policies and legislation which influence vacancy will shortly be discussed, According to the publication of (Hobma & Schutte Postma, 2011).

Passive and active government, difference between legislation and policy
First of all a difference should be made between legislation and policy, which the description of both prevent misunderstandings.
Legislation (laws and regulations): Legislation creates boundaries which the different entities may act or may deviate from (public and private parties as well as individuals). There could only be deviate conform a special set up procedure.
Policy: A policy rule regulates the policy which need to be preformed, Policy rules are intend to give a consistent and systematically substance to the power of an authority.
In the past are the boundaries of the legislation (spatial planning act) are used to create possibilities for growth in urban development in the Netherlands. Which the policy of most of the municipalities was to facilitate the growth active by planning lots of plan capacity, which they prefer to buy greenfield locations, because these are the most easy to develop. Some municipalities chosen a passive attitude instead of the active, they did not bought lots of greenfield locations, they just facilitate different development companies. In the Netherlands there is made a difference between hard plan capacity (already a zoning plan), and soft planning capacity (No zoning plan, mostly agriculture destination).

Plan damage
The previous active or passive way of acting by different municipalities has fed different development companies and real-estate investors to develop the office overstock. For this the (already bought) plan capacity could be shrunken down. The disadvantages of these measure is the financial disadvantage for the land owners. If this land is owned by the municipality they lose financial resources, if not the land owners could reclaim plan damage if they own hard plan capacity. This fact make the adjustment of plan capacity a difficult instrument to steer.

RESEARCH METHODS
In this research the next research methods are used because of their proposed outcome:

Determination of research method		
Proposed outcome	*Type of data*	*Research method*
Vacancy determination	Quantitative	Geographic information system (GIS)
System of supply and demand	Quantitative	System Dynamics
Willingness to take measures	Qualitative	Game Theory

Table 30: Involved research methods

Just the proposed outcome is not enough to determine why the different methods will be used in succession. All the methods are giving input to the subsequent method, practically the next relationships are there between the research methods in this research.

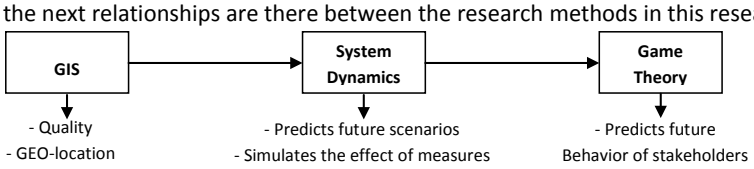


Figure 60: Research relationships

Geographic Information Systems
GIS allows to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.
The above standing quantity of a GIS-model directly define why it is involved in this research. It helps to give easily insight in the data do determine office vacancy.

System Dynamics
System Dynamics is a research method which is useful to simulate different scenarios in complex systems, it is the simplification of a complex world (Sterman, J.D., 2000).

Game Theory
Game Theory has the aim to find the best solutions of all parties involved. This can only be achieved by an interactive analysis between two or more parties. Game Theory is a way to analyze interaction among a group or rational agents who behave strategically. Game Theory games mostly be played in a normal (simple) form or an extensive form.

DATA COLLECTION
Just collecting data and doing an analysis will not give the right insight. To achieve the aim of the research out of the research proposal the steps out of Figure 61 are taken.

Figure 61: Data modeling approach

Different parties have contribute to this research, in short their share:
Kadaster, (Dutch land registry) has provided the most extensive datasheet. These serves as basis for the research (GIS-analysis). This because they add the geographic coordinates to the remaining information (e.g. size of the office). Because the datasheet also contains the address including postal code, the other datasheets could be combined by the address.
Jones Lang LaSalle, (international brokers agency) has provided a total survey of the total office vacancy in the B5 region on postal code and address level.
Province Noord-Brabant, The Province Noord-Brabant has provide a total survey of the employment development of the past 15 years.
Plan capacity of the municipality 's Hertogenbosch, To determine the future plan capacity of the municipality 's Hertogenbosch the policy document 'kantoren en bedrijventerreinen beleid (2010)' is reviewed. This gives insight in the future supply of newly built offices.

At the end the combination of the datasheets of the Kadaster and Jones Lang LaSalle determined the vacancy and the deviation of the office stock. The datasheet of the Province Noord-Brabant and the Kadaster determined the past employment development in relation to built office stock. These input helped by the valuation of the real-estate office model.
In the next paragraph the construction of the System Dynamics office model will briefly be explained, for this the previous described data gave input, which the data is based on the municipality of 's Hertogenbosch.

RESEARCH MODEL
The main part of this study is the built of a System Dynamics model to predict the future. Out of literature research the different relationships within the office real-estate market are filtered out. Within the research the effect of all the exogenous and endogenous variables is fully explained. In this article just the most important variables and input will briefly explained. After this the different scenarios which are simulated will be brief explained.

Real-estate office model
Figure 62 gives a simple figurative representation of the stock and flow model, the most important relationships and flows are shown. Which the most important exogenous and endogenous variables will be explained below.

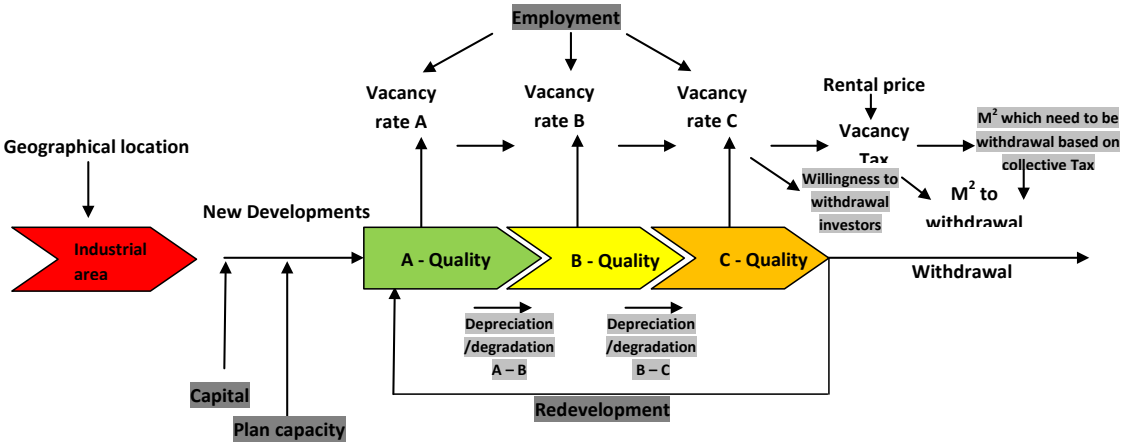


Figure 62: Simple representation of the System Dynamics model

Exogenous variables:
Employment: The employment development influence the demand for office space. An increase in employment means an increase in demand for office space and the other way around. The basic input for this variable are the WLO-scenarios (welvaart en leefomgeving), the next developments are modeled depending on the scenario, *Strong Europe* +1,01%, *Transatlantic Market* +1,01%, *Regional communities* -3,18%, *Global Economy* +5,9%.
Plan capacity: The inflow of newly built office depends of the available plan capacity. For this the hard plan capacity (the least), the soft plan capacity (the most), and no plan capacity can be modeled in the System Dynamics model.
Redevelopment: An office could be at the end of the economical and/or technical life cycle. This not direct mean a withdrawal out of the market, a renovation/ redevelopment could take place. Out of the numbers of the NEPROM (2012) the city of 's Hertogenbosch has a redevelopment of 1% each year.

Endogenous variables:
Withdrawal: To model the effect of different kind of interventions by taken office out of the market different possibilities to 'withdrawal offices' are modeled. An office withdrawal not directly mean a demolishing or the transformation to another function, it could be one of them. In this research only the effect of: 'what happen when an office is out of the market will be investigated'. In the model there are three possible withdrawal methods. Namely:
1) The government buys the structural vacant overstock;
2) A collective Tax will gain financial resources to take office out of the market;
3) A system of development credits restricts the new plan capacity to office which will be taken out of the market (exchange system).

Depreciation: The numbers of depreciation determined by the EIB are modeled in the System Dynamics model. Each time period a percentage of the office stock will shift from A-quality towards B-quality, and from B-quality towards C-quality (the office users/ tenants, will shift simultaneously). Beside this depreciation percentage there could occur an depreciation acceleration effect if there is a high percentage of vacancy at a certain location. For this some numbers are estimated, in the future this could be investigated more detailed.

The above standing adjustable variables can be modeled on a certain way. For this there is tried to simulate the most realistic scenario by the use of a power-versus-interest grid analysis. Which the government and the office owners both has got advantages and disadvantages. The first 3 scenarios determining the possible present situation, the last 3 scenarios tried to give insight in different intervention possibilities. The model starting points are added by the results of the System Dynamics analysis. After the System Dynamics analysis the preference to execute one of the scenarios is measured by the different responsible policy makers with the use of Game Theory.

RESULTS
Because all the methods are used successive, the results will be presented separate. Within the conclusion all the results will be combined.

Geographic Information Systems results

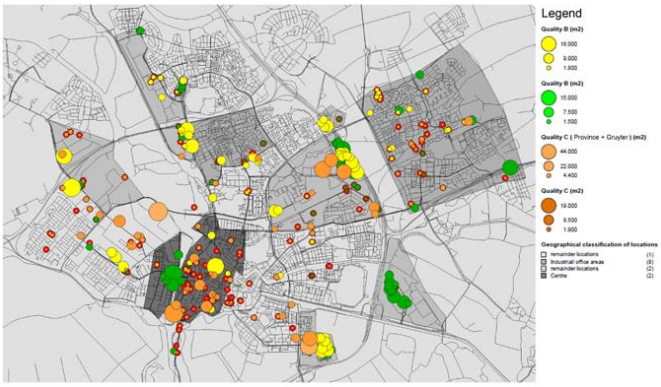


Figure 63: Representation of the different quality groups in 's Hertogenbosch

Location	Vacancy A-Quality	Vacancy B-Quality	Vacancy C-Quality	Overall
City Centre	14,15%	12,35%	12,34%	12,74%
Remaining locations	7,81%	4,95%	1,21%	3,43%
Formal locations	17,11%	18,05%	7,12%	15,04%

Overall at the whole municipality of 's Hertogenbosch deals with 12,42% vacancy. In short there occur direct problems at centre locations and at formal locations. By reviewing the quantitative distribution of the stock lots of threats occur in the formal B-quality and C-quality. Both has got a big share in the total market, and will shift in the future towards a less attractive one. These problem areas can also be found at the visualization of the GIS-analysis Figure 63. The more the location occur yellow and orange dots, the less the qualitative good buildings. The size of the dot indicated the size of the building.

System Dynamics results

The results will be discussed by first indicate the present situation, after this the possible feature scenarios will be discussed.

The present situation

Scenario	Employment development		Willingness to invest	Plan Capacity	Tax-ation	With-drawal	Governmental influence
	Year 1-5	Year 5->					
1	5,9%	5,9%	Depends off vacancy %	Soft	As Usual	None	Present Method
2	1,01%	1,01%	Independent off vacancy %	Soft	As Usual	None	Present Method
3	-3,18%	-3,18%	Independent off vacancy %	Hard	As Usual	None	Present Method

Scenario 1: Global Economy, years of growth (before the crisis)
This scenario should prove the model of spatial planning works well by economical growth. Out of the System Dynamics graphs there can be conclude a fast decline of vacancy, this result in a negative amount of vacancy (after approximately 4 (2015) years), Figure 38. This means the planned capacity works well if there is economical growth.

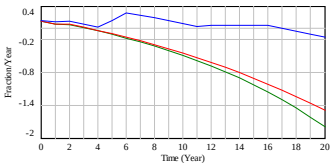


Figure 64: Vacancy development in the city, scenario 1, (A, B, C – Quality stock)

Scenario 2: Transatlantic market/ Strong Europe (present situation)
This scenario expose the impact of stabilized growth and release of all plan capacity. The model assume a moderated growth (+1,01%). This should reduce the vacancy at all the locations. In general this decline will be achieved in the first 2/3 year (2013/ 2014) at the centre and remaining locations. Because the proposed big amount of soft planning capacity at the centre and the remaining locations the vacancy will increase once again. This means too much plan capacity by a economical stabilization.

Scenario 3: Economical contraction, combined with hard planning capacity
In this scenario the effect of scraping the soft planning capacity is not visible. The ecomical shrinkage overrules the releasing of just the hard plan capacity. A huge increase in vacancy is visible Figure 65.

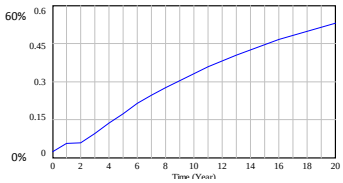


Figure 65: Overall vacancy development scenario 3

The reaction on different governmental policies

Scenario	Employment development		Willingness to invest	Plan Capacity	Tax-ation	Withdrawal	Governmental influence
	Year 1-5	Year 5->					
4	-3,18%	1,01%	Depends off vacancy %	None	Obliged	Governmental payment	Hierarchy
5	-3,18%	1,01%	Depends off vacancy %	Soft	As Usual	Collective Tax	Present Method
6	-3,18%	1,01%	Independent off vacancy %	Hard*	Obliged	Development credits	Present Method

*Plan capacity will be exchanged, 60% of an office withdrawal can be rebuilt!

Scenario 4, Governmental coordination
This scenario directly provides insight in the stop of plan capacity and a direct withdrawal by the government. First the vacancy will increase (this because the negative employment development in the first 5 years). After this the vacancy quick return back into an equilibrium. There will even occur a scarcity for offices around year 10.
The disadvantages of this scenario is the capital distruction by buying office out of the market, which there is no certain future value for the offices.

Scenario 5, Model collective Tax
This scenario gives interesting insights in proposed solution concepts (vacancy Tax). Advantages of this scenario is the gradually market adoption. In the model the overall vacancy (Figure 66) is going towards an equilibrium and it will not fluctuate or go into a huge unbalance. Beside this the costs for this solution will be jointly supported by the office owners in total, there is made no difference if an offices is occupied or not. The disadvantage of this scenario is the negative spiral which the extra Tax could cause.

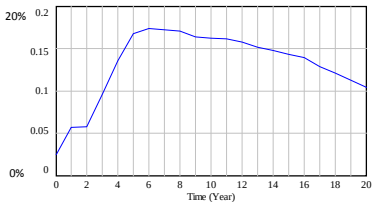


Figure 66: Overall vacancy development scenario 5

Scenario 6, Model development credits/ construction claim
The effect of this scenario has the aim to create 'scarcity', this because there first need to be taken more offices out of the market, whereupon there only can be redeveloped 60% at another (better *suitable) location. The withdrawal stops by a vacancy percentage of 5%,*

Figure 67 shows a negative vacancy percentage at year 20 (2031), this is because of the pipeline effect which often occurs in System Dynamics models.
In this scenario there can be remarked a double effect, which can be created by development credits (construction claims). Namely by the coupling of the withdrawal of offices with the release of plan capacity, this scenario locks the model (office real-estate market) with two valves.

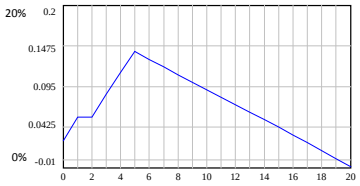


Figure 67: Overall vacancy development scenario 6

Game Theory results
In this part of the research the BrabantStad policy makers are approached by a Game Theory survey. Because the outcome out of scenarios 4/5/6 are the most relevant only these are represent in this article.

Consistency note: The statistic consistency cannot be fully proven. This because of the time period of this research. Nevertheless the approach of this research give interesting results in the mode of operation of the office real-estate market. Because the current respondents are policy makers out of B5 region an extreme value test could be passed. Beside this a bigger sample size, should give more detailed information.

Dominant strategy government	Frequency	Percentage	Cumulative
Active	11	53,8%	52,4%
Passive	5	23,8%	76,2%
None	5	23,8%	100%
Total	21	100%	

Table 31: Governmental strategy (within the solution scenarios 4/5/6)

The government is purposed to participate active in 53,8% of the game matrixes, passive in 23,8% of the matrixes and with no stratey in 23,8% of the matrixes (Table 24). In comparison with the governmental strategy in all the scenarios the government seems to act more towards an active role by the solution scenarios.
Within the first judgment of the governmental strategy (passive/ active) in Table 24 there is remarket a more active strategy (53,8%) instead of the passive strategy (23,8%) by the government. These discrepancy can be explained by the next phenomena:
The dominant AP strategy (active participating investor and passive participating government) never occurs by the 3 scenarios with solutions. This means the government prefers to do both nothing (PP) or to have a dominant role (A,A), (P,A).

CONCLUSION
'Which governmental policies are the most beneficial to take offices out of the market or improve it sustainable?'
The office market is stuck, it is like a difficult domino game, the market depends off different chains which all influence each other, a missing link could let collapse the total market.
The present problems can be the best described as a wrong system. The inflow is too high (plan capacity), the present stock has a wrong quality distribution, and there is a low outflow. This could be simple adjust by change the inflow of new quality offices and the outflow of less quality offices. Hereby there are 3 important stumbling blocks, namely, the political issue, financial depreciation, and renewal of quality.

To answer the research question of this research, I conclude on the basis of the System Dynamics analysis, Game Theory analysis and expert interviews the use of the scenario of the development credits as the most beneficial. Not only because of the quick result, but also because of the most fair trading system. The construction claim will shortly be explained.

Best solution: Construction claim model to trigger both office owners and government

The basics of the construction claim is simple. If office owners will take their office out of the market they could take their present tenant along to a new office development at a better suitable location. At this location 60% of the left offices can be rebuilt, in this solution the office owner is fully responsible for the withdrawal of the left office. Here it is not important whether the old office will be demolished or transformed to another function.

By comparing the Game Theory results with the System Dynamics results together, an extra advice need to be formulated. Out of the municipalities behavior there also occurs a passive participating role by passive acting of office owners in this construction claim scenario. Out of this viewpoint there should be add an extra dimension within this scenario to make the municipalities more eager. The municipalities are probably not eager to shrink down their plan capacity and couple it to the existing stock. To solve this passive acting there should be add extra triggers within this concept. Which there could be an interesting role by the province. If the construction claim model will be restricted by the province, the municipalities could be more eager to active participation in this scenario, in order to stimulate the withdrawal of offices, hereby can the municipality release more plan capacity.

The last problem what you cannot to afford to miss is the qualitative renewal off office stock. In this respect if the equilibrium is reached after approximately 10 years there only will take place redevelopment (1% of the stock will improve in quality). The total cycle in case of the technical (quality) life cycle would be 100 years. With this fact in mind there is a major challenge for the redevelopment of offices (quality improvement). The government should construct resources to urge office owners. For this an obliged energy in combination with an obliged renovation after a certain cycle (for example 25 years), could bring the market in an equilibrium of a qualitative good stock.

DISCUSSION AND RECOMMANDATIONS

You can stop to create an end, but investigating something could be never ending. This almost philosophical sentence give researchers an open end, this to always have improvement possibilities. I think an investigation ends if the purposed aims can be satisfied. In this research I think I created an interesting System Dynamics model which is helpful to predict the future behavior of the office real-estate market, and even more interesting the mode of operation of the model. The investigated case, ‘s Hertogenbosch was helpful, because it first is representative for the B5, beside this the growth of the municipality was just perfect to model it in the timeline of this research.

The last part of the research, Game Theory, was interesting to review but could be investigated more deeper. Nevertheless it is giving interesting insights in the behavior of policy makers concerning the office real-estate market policies.

At the end there are two important things to achieve in the future. First the labeling of all the offices, this to create a tool for the quality measurement of an office, this to stimulate the qualitative renewal of office stock. Second the System Dynamics model could be used to calculate the (financial) break-even point of let an office be vacant for several years, or demolish it directly.

REFERENCE

1. Anink, D., et al., (2010), Kiezen voor nieuwbouw of het verbeteren van het huidige kantoor. W/E adviseurs, Agentschap NL.
2. Hobma, F.A.M., Schutte-Postma, E.T., (2011), Planning and development law in the Netherlands, Delft University of Technology.
3. Sterman, J.D., (2000), Business Dynamics, System thinking and modeling for a complex world, Mc Graw Hill, Boston.
4. Kummerow, M., (1999), A System Dynamics Model of Cyclical office oversupply. The journal of Real-estate Research vol 18, no.1, 233 – 255.
5. Millington, A.F., (1994), An introduction to property valuation, The estate gazette limited, London.
6. Neprom, (2012), Nieuw commericeel vastgoed in 2012, Voorburg.
7. Van Elp, M., de Kok, I., Saitua Nistal, R., Zuidema, M.V., (2011), Kantorenmonitor, Analyse van vraag en aanbod, Economisch instituut voor de bouw (EIB).
8. Zadelhoff, DTZ, (2011). Van veel te veel, de markt van Nederlands commercieel onroerend goed.
9. Schultz van Heagen, M. et al., (2012) Convenant aanpak leegstand kantoren. Ministerie van Infrastructuur en Milieu, IPO, VNG, IVBN, Vastgoed Belang, Neprom, CoreNet, FMN, NVB.
10. Gemeente ‘s Hertogenbosch, (Januari 2011), Kantoren en bedreiventerreinen beleid, Meer aandacht voor herstructurering en transformatie, ‘s Hertogenbosch.

Ing. G.L.J.J. Lamers

During this research I started a bit naïve by a very wide approach. The interviews with experts helped me too constructed a good research boundary, despite they all had a small different opinion about the office real-estate market and the solutions.
Beside this I want to thank my graduation committee to bring this research to the next level. Last but not least I want to thank the Brabantste Ontwikkelings Maatschappij to give me the opportunity to use their knowledge, knowhow, and network.

Contact: lamers_geert@hotmail.com
+31 6 11 340 430
www.linkedin.com/in/geertlamers

2005 – 2006 Foundation course Building engineering, Avans Hogeschool
2006 – 2010 Bachelor in Building Technology, Avans Hogeschool
2010 – 2011 Pre-Master Construction Management and Engineering, TU/e
2011 – 2013 Master Construction Management and Engineering, TU/e
2012 – 2013 Graduation internship, Brabantse Ontwikkelings Maatschappij

HET BEHOUDEN VAN EEN DYNAMISCHE KANTORENMARKT IN DE PROVINCIE BRABANT.

INTRODUCTIE

'Complexiteit in de kantorenmarkt', de voorgaande zin is alles omvattend voor de huidige kantorenmarkt (crisis). In het algemeen is de vastgoed kantorenmarkt een opeenvolging van cyclussen met stadia van groei en recessies, meestal ontstaan door een directe reactie op het huidige fiscaal beleid, economische ontwikkeling en trends.

Bij bovenstaand constatering is het spel van vraag en aanbod interactief, waarbij er altijd een spanning ontstaat is het geen schaarste dan is het overschot. Om de markt te kunnen laten werken dient er letterlijk en figuurlijk speelruimte te zijn, vanwaar er door de markt een leegstand van 5% tot 7% als gezond bevonden wordt.

Uiteindelijk is er geen onderzoek nodig naar de huidige stand van zaken en wat de oorzaak is. Het is interessanter om te beschouwen wanneer en hoe de huidige kantorenmarkt in evenwicht te krijgen is. Om aan te geven hoe groot het probleem is, wat feiten en cijfers. De huidige voorraad aan kantoren bestaat uit 41 miljoen m^2 welke in gebruik is en 7,6 miljoen m^2 welke aangeboden wordt. Dit resulteert in een leegstandspercentage van +/- 15,6%. Hierbij dient dus een verdeling gemaakt te worden in frictieleegstand en structurele leegstand (over voorraad, mismatch tussen vraag en aanbod).

PROBLEEM DEFINITIE

In de afgelopen decennia zijn er vele kantoorgebouwen ontwikkeld op speciale uitleg locaties buiten de stad (kantorenparken/ industrieterreinen). De race voor het meest aantrekkelijke kantoor werd gevoed door: het beschikbare kapitaal, het verlangen van gemeentes om grond te ontwikkelen, en de ontwikkel drang van private partijen. Hierbij zijn veelal de effecten van economisch (negatieve) ontwikkelingen niet meegenomen, de vooraf genoemde race heeft dan ook een structurele over voorraad gecreëerd, met een scheve verdeling in de kwaliteit van gebouwen i.r.t. de voorraad.

Onderzoeksvraag

Wat zijn de effecten van verschillende beleidsmaatregelen om de vastgoed kantorenmarkt weer terug in evenwicht te brengen en de structurele over voorraad te laten verdwijnen?

Onderzoeksdoel

Het doel is om te onderzoeken of een mogelijk evenwicht in de kantorenmarkt te verkrijgen is met verschillende maatregelen (afgeleid uit het kantorenconvenant, (Schultz van Heagen, M. et al., 2012), maar ook geruchten uit de markt). Om dit doel te bereiken wordt de kantorenmarkt gemodelleerd met behulp van System Dynamics. De kantorenmarkt van Noord-Brabant wordt beschouwd (in het bijzonder 's Hertogenbosch) om grip te krijgen op de verschillende markt cycli en toekomstig gedrag (in het bijzonder het gedrag van beleidsmakers).

THEORETISCH KADER

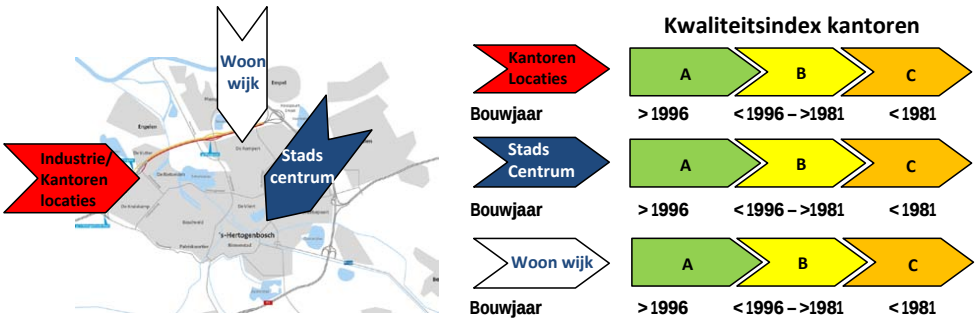
De financiële structuur van vastgoed fondsen, investeringsgedrag van kantooreigenaren

Allereerst is het belangrijk het doel van de fondsen te beschouwen, namelijk het veiligstellen van geld ten aanzien van inflatie. In de afgelopen decennia hebben twee markteigenschappen de vastgoed kantorenmarkt interessant gemaakt om te speculeren, namelijk: Een stabiele groei (inflatie verzekering), en ten tweede de (toen nog) schaarste aan ontwikkel locaties (Kummerow, M., 1999).

Door bovengenoemde eigenschappen zijn er vele spelers ontstaan in de markt waarbij ieder een ander doel had. Partijen welke nu in de problemen zitten hebben vaak op verkeerde locaties posities en hun voorraad gefinancierd middels het hefboom effect (veel schuld), indien de opbrengsten van de verhuur hoger is dan de rente van de financiering is er niets aan de hand. (Millington, A.F., 1994). De problemen ontstaan bij een krimpende markt waarbij huurders kritischer gaan kijken en prijzen dalen. Enerzijds dalende inkomsten, anderzijds dalende waarde van het te duur gekochte vastgoed, dit fenomeen wordt ook wel 'het onder water staan van vastgoed portfolio's genoemd'. Recente voorbeelden zijn Eurocommerce en TCN, beide zijn failliet gegaan.

De Invloedsfactoren van leegstand

Zoals gezegd is leegstand een groot gevaar voor kantooreigenaren (met hefboom portfolio's). Om de markt te sturen en de over voorraad terug te dringen is het interessant om te beschouwen wat de belangrijkste invloedsfactoren van leegstand zijn. De laatste jaren is dit veelvuldig onderzocht, in dit de meest representatieve invloedsfactoren zijn weergegeven in Figuur 1, (EIB, 2011, DTZ, 2011), namelijk geografische locatie en (gebouw)kwaliteit.
Natuurlijk zijn er meer factoren van invloed, bijv. prijs, kwaliteit, gebruikskosten, enz., maar deze zijn vaak gerelateerd aan geografische locatie en (gebouw)kwaliteit.



Figuur 1: Leegstand invloedsfactoren + Kwaliteitsindex

De levenscyclus van een kantoor, de veroudering

Uit onderzoek blijkt er vaak een mismatch te zijn tussen technische levenscyclus en de economische levenscyclus. Dit komt veelal door een verkeerde waarderingsmethodiek (statisch i.p.v. dynamisch). Om dit te ondervangen heeft het EIB (economisch instituut voor de bouw) de (economische) afschrijving van gebouwen beschouwd. Hierbij is het percentage van de voorraad wat van A naar B-kwaliteit en van B naar C-kwaliteit verschuift bepaald. Afhankelijk van de locatie. Deze zijn gepresenteerd in Tabel 1.

Centrale locaties	Overige locaties	Industrie/ kantorenlocaties
0,5%	0,6%	0,9%
% voorraad verschuiving per jaar		

Tabel 1: Voorraad verschuiving per jaar

Overheidsbeleid

Een groot deel van het onderzoek in stedelijke (her)ontwikkeling (in Nederland) bevind zich op het gebied van overheidsbeleid, aan de hand van de publicatie van Hobma en Schutte Postma, 2011) kan het volgende geconcludeerd worden.

Passieve en actieve gemeente, het verschil tussen beleid en wetgeving

Het verschil tussen beleid en wetgeving is in eerste instantie belangrijk. *Wetgeving* bepaald de verschillende grenzen waarin entiteiten kunnen handelen (zowel publiek, privaat als individueel), van deze wetgeving kan alleen van bepaalde procedures afgeweken worden volgens een bepaalde procedure. Beleid daarentegen is opgesteld om een consistent en systematisch kader te creëren waarbinnen gehandeld kan worden. De wetgeving en het beleid van de afgelopen decennia heeft een situatie gecreëerd waarbij de overheid als private entiteit risicodragend kon deelnemen aan grondontwikkelingen waarbij zij tegelijkertijd publiekrechtelijk de bestemming van de gronden konden wijzigen. Deze werkwijze heeft een actieve grondpolitiek, waarbij de overheid vele financiële middelen kon creëren. Deze gemakkelijk bron van inkomsten heeft er voor gezorgd dat vele gemeenten te veel risico hebben genomen, waarbij zij nu onder verscherpt toezicht staan (artikel 12 procedure). Indien de overheid passief handelt faciliteren zij als publiek orgaan andere ontwikkelende entiteiten.

Plan schade

De eerder genoemde ontwikkeldrang en handelswijze heeft geleid tot grond speculatie van zowel publieke als private partijen. Binnen de huidige (te grootte) voorraad aan harde en zachte plan capaciteit zal er afgeboekt dienen te worden. Indien de grond in bezit is bij een private partij en er rust al een bestemmingsplan op deze plan capaciteit (hard) dan kan deze partij plan schade verhalen op de beleidvoerende publieke partij, dit kan voor de gemeente in de papieren gaan lopen.

GEGEVENSVERZAMELING

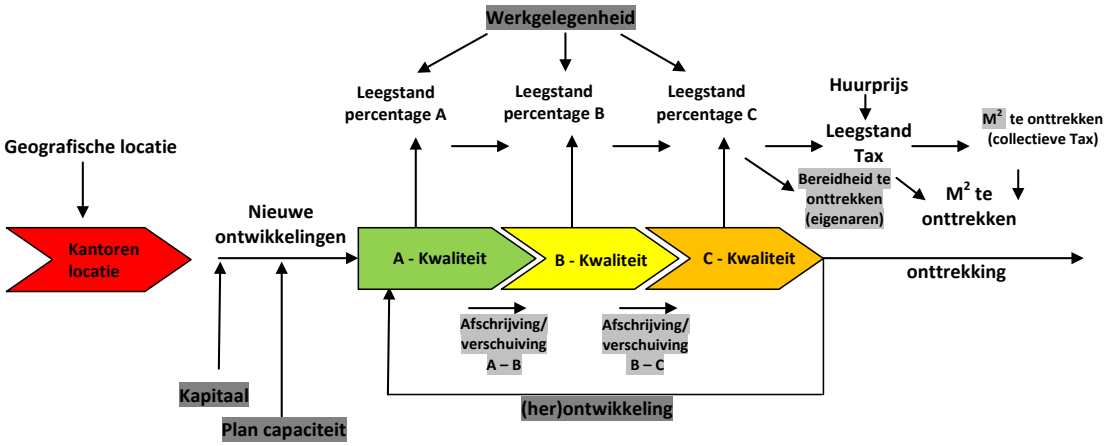
Het verzamelen van data alleen en het doen van een wetenschappelijke analyse is niet voldoende. Om het gestelde doel te bepalen worden de volgende stappen genomen.

Figuur 2: Aanpak data verzameling

Verschillende partijen hebben bijgedragen aan de data, namelijk: *Het kadaster, Jones Lang LaSalle, de Provincie Brabant, en de Gemeente 's Hertogenbosch.* Belangrijk was waar welk kantoor staat, de grootte (m^2) en of het leegstaat. Daarnaast is de werkgelegenheid beschouwd in relatie met de hard en zachte plan capaciteit. Al deze gegevens hebben als input gediend voor het System Dynamics model welke de kantorenmarkt in 's Hertogenbosch simuleert.

ONDERZOEKSMODEL

In dit deel van het onderzoek is een System Dynamics model gebouwd wat de kantorenmarkt van 's Hertogenbosch simuleert. In Figuur 3 is het model schematisch weergegeven. Waarbij de exogenous variabelen invloeden van buiten af zijn, en de endogenous variabelen invloeden in het model.



Figuur 3: Schematische weergave System Dynamics Kantoren model

RESULTATEN

Gezien alle methoden achtereenvolgens worden gebruikt worden de resultaten apart gepresenteerd, in de conclusie wordt het wel als een geheel beschouwd.

GIS resultaten

Locatie	Leegstand A-kwaliteit	Leegstand A-kwaliteit	Leegstand A-kwaliteit	Overall
Centrum	14,15%	12,35%	12,34%	12,74%
Overige locaties	7,81%	4,95%	1,21%	3,43%
Formele locaties	17,11%	18,05%	7,12%	15,04%

Er kan geconcludeerd worden dat ’s Hertogenbosch ook een structurele over voorraad heeft. Waarbij kwantitatief voldoende voorraad is, alleen de kwalitatieve verhouding (A-B-C) scheef gegroeid is. Hetzelfde beeld is te verwachten in de andere B5 gemeente.

System Dynamics resultaten

Scenario 1(groei)/ 2(stabilisatie)/ 3(neergang):

Binnen deze scenario’s is er beschouwd of de huidige plan capaciteit (zacht/ hard) afdoende zou zijn met het economisch meest optimistische scenario (WLO-scenario Global economy +5,9%). Hierbij is een negatieve leegstand op te merken, het zou dus te weinig zijn. Buiten dat is beschouwd wat er zou gebeuren bij een stabiliserende (+1,01%) en neergaande economie (-3,18%). Hierbij valt te concluderen dat de zachte plan capaciteit te groot is voor een stabiliserende economie. Zoals te verwachten is er bij een neergaande economie een stijging in leegstand, ondanks de harde plan capaciteit.

Scenario 4(Onttrekking financiering overheid)/ 5(Collectieve Tax)/ 6(uitruil ontwikkel claims):

Binnen deze scenario’s zijn de effecten van de verschillende maatregelen gemeten. In scenario 4 is er beschouwd wat de kosten zouden zijn als de totale onttrekking op het conto van de overheid zou vallen, dit betekent kapitaal vernietiging. Binnen de ruimtelijke ontwikkelingen geeft dit wel snel een gewenst effect. Binnen scenario 5 is er beschouwd wat het effect is van een collectieve belasting boven op de OZB voor alle kantoorgebruikers, hierbij ontstaat er een groot fonds, welke de markt in evenwicht kan brengen. Nadeel is wel de kans dat de markt in een negatieve spiraal komt.

Scenario 6 beschouwd het uitruilen van ontwikkel claims, indien een kantooreigenaar zijn kantoor uit de markt weet te halen (transformatie of sloop) dan mag hij op een betere locatie 60% terug ontwikkelen. Dit scenario koppelt de in- en uitvoer aan elkaar. Dit geeft relatief snel een gewenst resultaat, nadeel is het lage ontwikkel- en bouwvolume.

Game Theorie resultaten

Uit de Game Theorie enquêtes afgenomen bij de publieke beleidsmedewerkers van de B5 blijkt alleen een actieve houding indien de overheid de macht in handen heeft. Daarnaast blijkt dat er veelal een afwachtende houding is. Dit is ook gebleken uit 1 op 1 interviews. Uiteindelijk blijkt hieruit dat er een cultuuromslag nodig is om de markt in beweging te krijgen.

CONCLUSIES

Uit het System Dynamics en Game Theorie onderzoek kan het volgende geconcludeerd worden. Er is een te hoge plan capaciteit gebaseerd op groei. Indien deze groei niet doorzet geeft het model met het uitruilen van de ontwikkel claims het meest effectief resultaat, met weinig kapitaal vernietiging. Nadeel hiervan is het begrenzen van het systeem waarbij de gemeentes waarschijnlijk een passieve houding in zullen nemen omdat de uitruil van ontwikkel claims hun grond exploitatie begrensd. Om dit probleem te ondervangen zou deze wetgeving regionaal gecoördineerd dienen te worden (door de provincie). Hierbij worden de gemeentes verleid om actief mee te participeren in de uitruil van ontwikkel claims, hoe meer kantoren er uit de markt genomen worden hoe meer gronden hun uit de voorraad uit kunnen geven. Het laatste probleem wat ondervangen moet worden is de kwalitatieve vernieuwing, aangezien aan de voorzijde de plan capaciteit terug wordt geschroefd zal de huidige voorraad kwalitatief geüpgrade dienen te worden. Het verplichten van het energielabel van kantoren en de actieve stimulatie van de verbetering hiervan zou uitkomst kunnen bieden.

Binnen de toekomst valt er door de vele trends, demografisch ontwikkelingen, effecten van het nieuwe werken, enz. een krimp naar de kantoren vraag verwacht. Een totale ontwikkel stop is niet de oplossing, dit omdat dit innovatie tegen zou gaan, daarentegen zijn er nog volop kansen voor binnen stedelijke ontwikkelingen op oude stationslocaties. Het advies daarbij, geef alleen plan capaciteit uit op geschikte locaties en stop met de uitleg locaties.