‘Corporate Real Estate Portfolios 2040 according to ICT trends’

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Preface

This report contains the interim research results for my graduation thesis at the faculty of Architecture of Delft University of Technology within the Real Estate & Housing department and the laboratory Corporate Real Estate Management. Within the faculty this report is also stated as the P3 report, it is the third progress checking moment of the five (P1, P2, P3, P4 and P5) in total.

The interim research results as described in this report will focus on the developments in information and communication technology in relation with (future)real estate portfolios of corporations in the Netherlands. This research aims at better understanding the future demand for office space and location by looking at the demand influenced by ICT its extreme. With this future demand real estate developers and real estate owners can align current and future real estate portfolios to the future demand for the next three decennia. This all in order to obtain and retain user satisfaction, efficiency, sustainability and cost reduction, or let us say: a better future.

I would like to thank my coordinator Dr. ir. D.J.M. (Theo) van der Voordt and my mentors ir. M.H. (Monique) Arkesteijn, dr. ir. A.(Alexander) Koutamanis, at Heren2 ir. P.U. (Patrick) Virginia and dr. ir. i. (Ivan) Nevzgodin for guiding me and my research to this proposal and further.

Robert Rosa
Delft, October 3, 2013.

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Management Summary

The last decade has seen the most formidable technological advances in information and communication technology ranging from fibre optics to micro electronics, computers, and of course the Internet - the fastest growing consumer service the world has experienced so far. Global information super-highways have been developed and because of them decisions are now being made quicker than ever before. As we enter the new millennium, the prospect of a global village supported by a wide information infrastructure will provide new chances but also risks.

To benefit from the chances and to cope with the risks the market needs to prepare for and react on changes. Therefore, this paper presents the future demand for office use based on current trends concerning Bits (ICT), Bricks (Real Estate) and brains (People). Possible scenarios illustrate some exemplary applications in the business and private life, leading to a discussion of the impacts on economy and society in the large scale.

This research has been motivated by observations made for the office vacancy 14.1% according to DTZ Zadelhoff (2012). Apart from the economic crisis, the accelerated pace of flexible ways of working in combination with fast developing information and communication technologies creates a "mismatch between the relatively static office supply and the fast changing demand for innovative workplaces is increasing." This mismatch stimulates the development of new offices for qualitative improvement causing a quantitative problem.

According to the Economic Institute of Construction (EIB), this amount of vacancy will be doubled (27%) if no measures are taken. While several market-actors are hoping to continue a supply-driven strategy, some practitioners are seemingly moving towards the transition to 'demand-driven' (re)development approaches. Preliminary research has however shown that there seems to be a knowledge gap in both practice and theory as to real estate and ICT trends. ICT is seen as a side issue of real estate. The potential of ICT innovation will really be exploited when bringing people, communication and information are brought together efficiently and effectively at all levels. The keyword for smart workers in smart networks is: **"Connectivity".** ICT is becoming more and more important factor in the way office-workers demand to work. The demand for real estate relates to three scale levels: society, organisation and individual. Supply also relates to various scale levels, namely area, stock, building and space.

The aim of this research is to rather prevent office vacancy in the future than solving it. Knowing the characteristics of the future offices and locations, real estate investors know what buildings are the most valuable and which buildings should be repelled or demolished. Therefor the future demand for office use needs be understood.

Research question

On the basis of the insight in the future match, this thesis set-out to answer the following research question:

What is the future demand of office workers for real estate portfolios in the Netherlands in the year 2040 as a result of ICT developments over the next two decades and how can the supply be matched with this demand?

Research Method

Because no specific theory or model could be found in the conducted literature study, these factors combined have facilitated the choice for an inductive rather than deductive research. This research thus made use of a mixed methods approach of observation and triangulation, literature study and empirical research done through in-depth interviews.

Why is the scope of this research until 2040? Simply because change takes time. As will be explained later, Rogers (1995) divided five different classifications of members of a social system on

the basis of innovation adaption. Because it takes five, ten or more years, depending on the innovation, before the majority (more than 50%) of these members adapt to or make use of the innovation. Based on Gartner's Hype Cycle for Emerging Technologies (Fenn, 2010) relevant ICT trends are filtered out and compared with the interviewee's understanding of technologies' evolution against Gartner's analysis of the technologies' maturity. Overall the research can be divided into five main research phases. In most of the 5 phases, theory and empirical research had been used simultaneously to triangulate and verify identified patterns.

Notwithstanding, demand changes over time and, moreover, the time frame for organisations (1-year budgets and 2 to 3-year planning horizon, maximum of 5 years) is completely different from the time frame for real estate (an economic life span of 10 to 50 years for building parts and the building).

Introducing the world of office work

An organisation is a social entity that has collective goals and is linked to an external environment.

The first office originated around 1450 where due to the invention of the printing press, which was performed at home. The following centuries a transition of the office took place influenced by managerial aspects and ICT. Four major groups based on primary skills reflect the overall nature of office work. These are:

- Word processing
- Data processing
- Information management and transmission
- General managing and communicating

These activities are currently performed by knowledge workers who do their work at the first place and sometimes in the second place (see Figure 36).

Figure 1 Office places

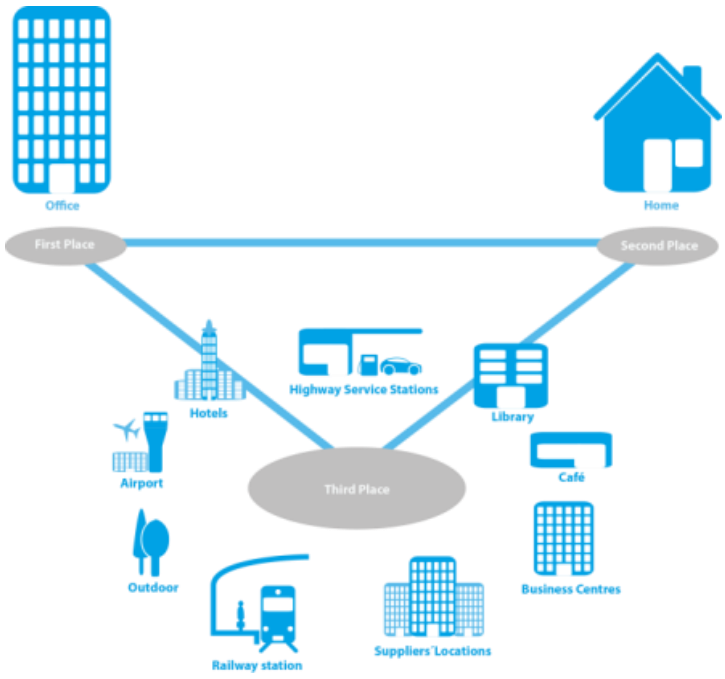


Table 2 Office use over the years

Period	Office use	ICT
1450	First office	Printing press, at home
1560	Uffizi	
1900's	Commercial offices	Telegraph and telephone
	Taylorism	Telephone and type writers
1950's -1980s	Egalitarian management approach	Telephone and computers
2000's	New ways of working	Mobile devices

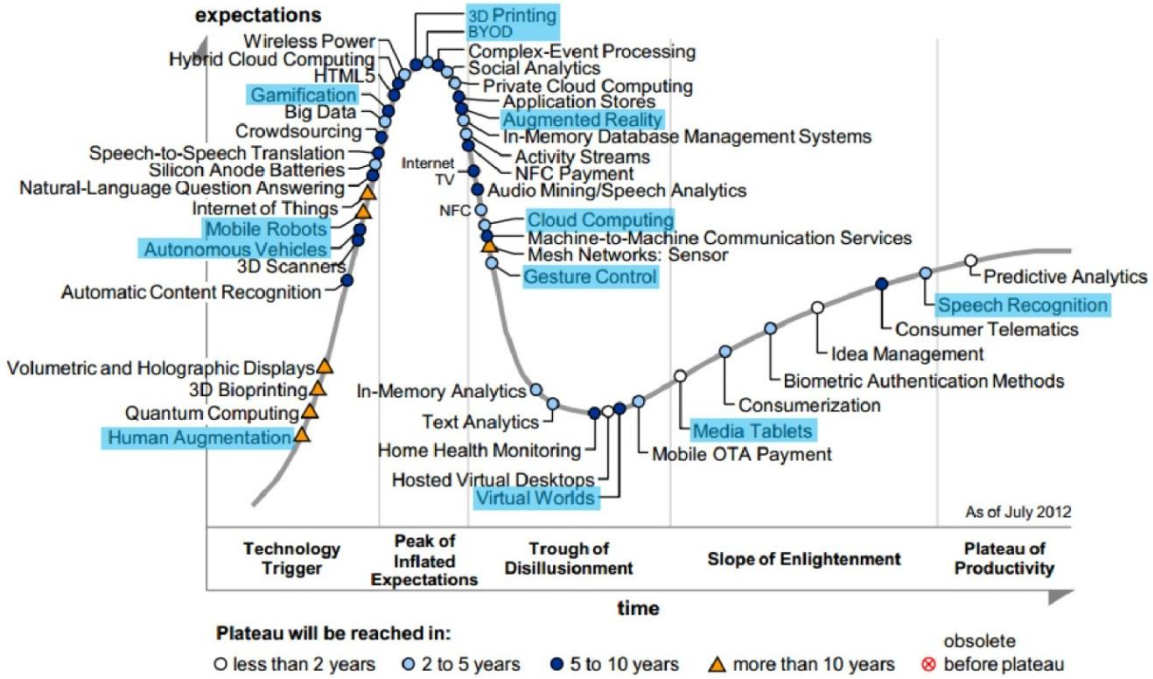
Theoretical research

The current ICT trends that influence the future demand for corporate real estate portfolios in the Netherlands are stated in Table 13. Form the Hype Cycle, the following trends have been filtered according to their influence on the activities performed by knowledge workers (see Appendix 4 Relevant ICT Trends). After selecting the trends relevant to ways of working and/or the office workplace the trends are divided into two subjects, namely 'control and input' and 'mobilisation'. Dividing the trends allows to focus on ways and means workers perform their primary activities in workplaces separately form the time and place where the activities take place.

Table 1 Current ICT trends that influence office work

Trends	Control and input:	Mobilisation:
1. Speech Recognition		
2. Media Tablets		
3. Virtual Worlds		
4. Gesture Control		
5. Cloud Computing		
6. Augmented Reality		
7. BYOD (Bring Your Own Device)		
8. 3D Printing		
9. Gamification		
10. Mobile Robots		
11. Autonomous Vehicles		
12. Volumetric and Holographic Displays		
13. Screens		
14. Software for routine work		
15. Crowdsourcing		

Figure 3 Emerging Technologies Hype Cycle 2012 (Source: Gartner, 2012)



The accepted premise is that every new technology goes through the following phases:

1. **Hype:** Search for next big thing leads to Hype around any new technology.
2. **Struggle**: Adoption of these Bleeding Edge technologies depended on the Visionaries who had the vision, energy and money to make it work.
3. **Success**: Mainstream adoption required convincing the Pragmatists who needed success stories and support system around the technology.

Empirical research

According to the interviewees, the most important trends are Media tablets (mobile devises), Cloud computing, BYOD. In combination, mobile devices with access to the 'Cloud' and having the opportunity to Bring Your Own Device and Choose Your Own Device gives workers the choice of working anywhere and at any time. The other selected trends must not be underestimated. They contribute to a more seamless control of ICT and mobilisation of workers. These trends are likely to be adopted by the majority in the next five to ten years. Next to these trends, robots and holograms, will influence the decision travellers need to make. The decision whether they should go personally or whether they should present themselves as a hologram or robot. These trends are likely to be adopted in a slower pace over the next ten years. While organisation will become smaller, dynamic and flexible adoption rate of ICT innovations could increase. This will create a more attractive environment for future office workers. Virtual communication and collaboration can be replaced completely, but it is more likely that more than one out of three meetings is going to be virtually in the future.

In the future there will be ways of working where teams are being guided, teams who are working together, partly virtually and partly where they physically come together in the same place. It will be capricious and unpredictable. Routine work will diminish and done by software. We will focus more on creative processes, design processes and developing tools to remove administrative, hazardous and routine work. The core of the organisation will shrink and the rest will be replaced by short term and project based workers using fun and cosy third workplaces. These office workers will demand facilities to support their desired way of working, if not, they will find a job elsewhere where

they can work at different hours during the day at the most convenient location while using the most convenient device for a certain job at a certain time. Leaders and Managers will find their roles changing, they will be the 'senior citizens' of the organisation and will no longer exert influence through power and hierarchies. Here for transparent environments is a necessity. Buildings that are left behind empty should be either transformed or demolished. Therefore zoning plans need to be abolished.

If Bullinga's predictions about the future are true can only be verified in the future, but that does not really matter in this research. What really matters is for real estate managers to understand this possible future to be able to anticipate on changes when workplaces are going to be (re)developed). This anticipation will lead to a better fit to the demand of the users over the next twenty years or more.

According to observation, literature and interviews all the discussed hypes are likely to be adopted by the majority within the next ten to 15 year, which brings us to 2030's. In 2030 it is almost impossible to tell the difference between virtual and physical. In 2040 even the late majority will have adopted these innovations. However, the adoption rate and amount could be deviated by the behaviour of the latest generation. Looking at the environment in which they grow up, it is likely that they will easily adapt to new innovations unless a counter trend of digitalisation occurs where this generation desires to go back to the core where more handwriting is done and physical meetings and interaction takes place. But then again, global competition kicks in where those using advanced ICT can get the job done faster, cheaper and with better quality. Self-management, freedom in ICT and choice in workplaces are the key elements in the future.

Trends

In theory the new way of working makes it possible for employees to work where ever they want, whenever and how ever. But management and technical support is crucial for its success. Changes in society, such as a more mobile workforce and workers' demands for flexibility, have fuelled the development of portable office equipment. Laptop computers, cellular phones and facsimile machines now equip a growing telecommuting workforce and, in some cases, have eliminated the need for central offices altogether. The option of telecommuting has become a valuable tool for companies competing for skilled employees who are tired of commuting long distances from the suburbs. Deciding the future is not possible but some see opportunities:

"The future depends on what we do in the present."
~ Mahatma Gandhi & ***"The best way to predict the future is to invent it."*** ~ Steve Jobs.

Table 2 Theoretical and Empirical ICT trends

Time to plateau (years)	Trends	Control and input:	Mobilisation:
2-5	**1** Speech Recognition	■	
<2	**2** Media Tablets	■	■
5-10	**3** Virtual Worlds		■
2-5	**4** Gesture Control	■	
2-5	**5** Cloud Computing		■
5-10	**6** Augmented Reality		■
2-5	**7** BYOD (Bring Your Own Device)		■
5-10	**8** 3D Printing		■
5-10	**9** Gamification		■
>10	**10** Mobile Robots		■
5-10	**11** Autonomous Vehicles		■
>10	**12** Volumetric and Holographic Displays		■

■ Has influence

Future demand 2040: *Choice in place & Freedom in Technology*

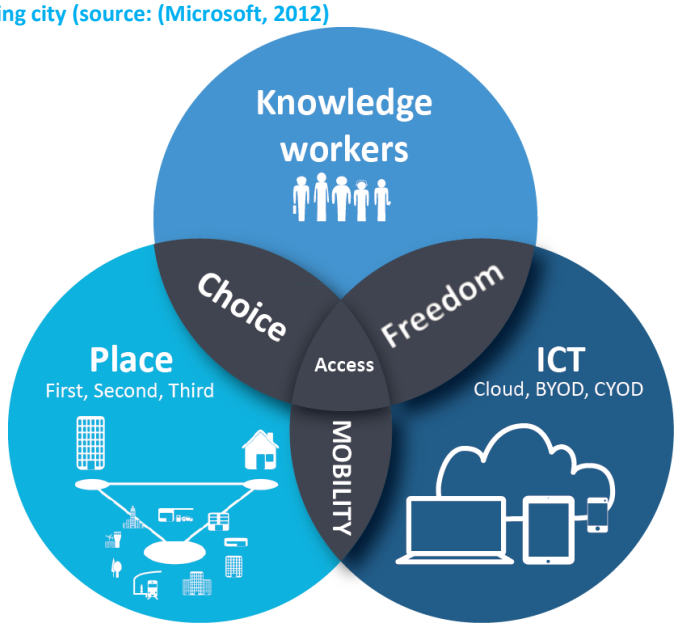
The future demand will be formed by the generations that will be on the work floor in 2040. Therefore it is important to better understand these generations, who currently are 27 years younger and at school. The next paragraph elaborates more on the workforce of 2040.

Generations X and Y and the millennials do not look to be following in the baby boomers' footsteps. Working long hours to move up and get a corner office is no longer the definitive path to success. Millennials value having more time and flexibility, as well as the opportunity for personal growth, quality relationships, and finding a cause for the work they do. The job of the future will have very little to do with processing words or numbers (the Internet can do that now). Nor will we need many people to act as placeholders, errand runners or receptionists. Instead, there is going to be a huge focus on finding the essential people and outsourcing the rest.

Employees will have access to a larger and more skilled workforce. Because the future of work is the employee.

The decreasing growth of the working force, which results in scarcity of talented knowledge workers, will end in a 'War for Talent'. In the competitive knowledge economy organisations must do what it takes to attract and retain talent to survive. For organisations this means satisfying the diversifying workforce by offering 'Choice' in places they desire to perform their activities while giving them 'Freedom' in using ICT the device(s) they find best to do the job (see Figure 4).

Figure 5 The anywhere working city (source: (Microsoft, 2012)



Different users

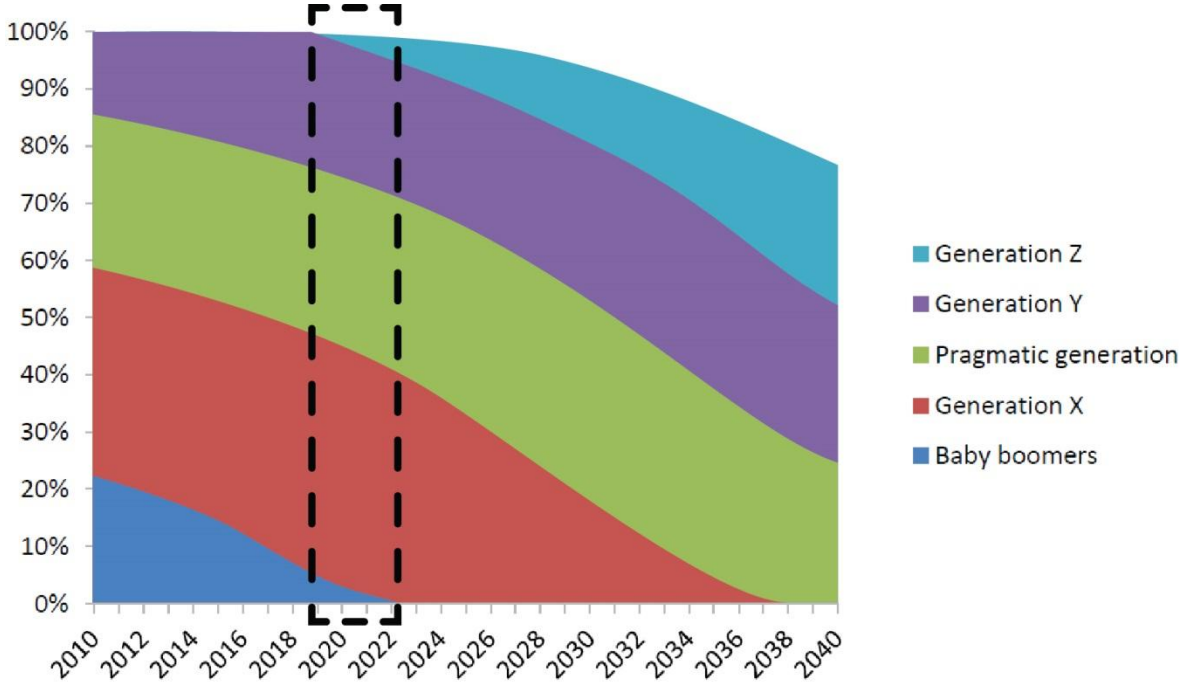
In today's workplace there are two types of workers: the employee and the professional. Apart from 'the professional' and 'the employee', according to (Belbin, 1981) office workers can be divvied over eight team roles. The Baby Boomers, X, Y Young generation X and generation Y are grown up and educated with social media, mobile devices, internet etc. They demand this way of working after education. This generation will work during flexible working hours and make use of third office places, which sometimes are their first place office and having home as their second workplace. As Drucker (2009) described, "The modern organisation should be the destabilizer, the building design, the team, the project would all become more dynamic, real-time, to balance change and continuity.

Overall literature study suggested that what is changing is the change of place, space and use (Vos et al., 1999). Nowadays up to 2040, the workplaces themselves might not change drastically. What is going to change is the access to activity based workplaces spread over different office buildings in different locations (Groat and Wang, 2002).

Table 3 Generations joining workforce

Generation	Birth period	Join workforce	Retire
Protest generation	1940-1955	1961-1980	2005-2022
Generation X	1955-1970	1976-1995	2022-2037
Pragmatic generation	1970-1985	1991-2010	2037-2052
Generation Y	1985-2000	2006-2025	2052-2067
Generation Z	2000-present	2021-2040	2067-2082

Graph 1 Generation division on work floor 2010-2040



Despite all of the predictions of a futuristic workplace we all seem to inhabit vastly different offices and factories. Different future scenarios have a lot of influence on the outcome which we cannot control. So will there ever be a workplace where everything is ideal? The answer is probably not because of the compromises that must exist, but it is likely to offer flexibility and empowerment to the people that work within it.

In the future there is no specific and constant demand. An attempt to define a demand in the future is doomed to fail. There will be different alternating demands for different workplaces, locations and ICT. The future demand for corporate real estate portfolios will be a continues alternating demand happening from task to task during a working day. Instead of a predetermined office portfolio that allows to be adapted at the end of a 5, 10 or more years lease contract or even longer term ownership, an alternative needs to be found to match the supply with the demand.

The demographic future can be summed up in the words “fewer, older and more diverse”. An aging population will lead to a declining labor force. It is expected that for several years the population of the Netherlands will continue to slightly grow to 17.8 million people in 2040, a million more than at the start of 2012 (CBS, 2012). Thereafter, a decline in population size is foreseen and thus a shortage of employees.

Matching: future demand with corporate real estate portfolios 2013-2040.

The demand for corporate real estate portfolios can be summarised as freedom and choice. When comparing this future demand with the current corporate real estate portfolio it can be concluded that there is a mismatch. This mismatch resulted in a current vacancy rate of 27% in the Dutch office market of which 13% is still hidden. This mismatch needs to be turned into a match in order to lower the vacant and unused office space that is costing the owners and the government money while pauperising the spatial quality in the surrounding area. Innovated and further developed ICT that will used by generation X, Y & Z during the next two decades cause another demand for office use. More flexible. The current corporate real estate portfolios need to be restructured in order to be able meet this demand. Considering the four possible scenarios for the Netherlands towards 2040, four alternative solutions have been discussed. They have been weighed and tested against the four different scenarios.

Table 16 states the (mis)matches between the current supply and future demand on three different levels, namely on location, object and ICT level.

Figure 6 Current supply versus Future demand

Current supply	Matching	Future demand
Location		
First place offices and Second place offices with focus on First place offices. Assigned locations to work.	Mismatch: Assigned locations	Way of working: time, place, device and organisation independent working. (Choice in places to work)
Object		
Long contracts because of investors security in cash flows versus.	Mismatch: Long contracts	Short contracts to end, switch or pause
Workplace		
Different per organisation (Assigned, per seat, or assigned flexible workspaces)	Mismatch: assigned workplaces with some flexibility in some cases	Choice in places to work and freedom in ICT to use
ICT		
Computer (BYOD)	Partly match	CYOD, BYOD, Cloud, Video conference

Preparing for the future: *Retain by Releasing*

The current supply is focused on assigned places where employees of one organisation work during assigned hours. The solution for this is offering a wide variety of different workplaces at different locations where the knowledge worker can choose from.

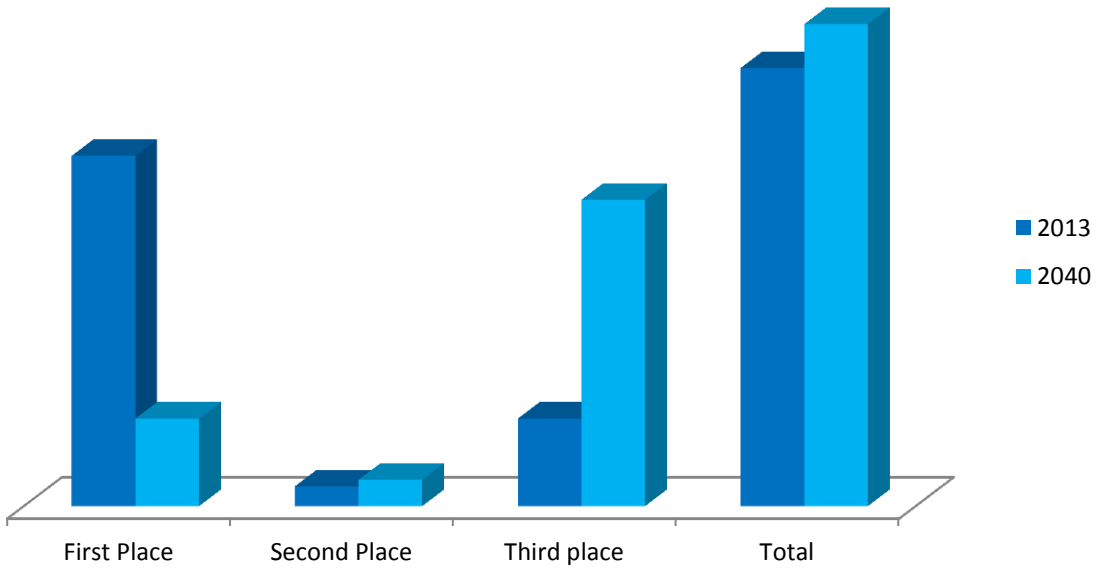
Figure 7 Future demand and supply match

Future demand	(Mis)match	Future supply
ICT		
Freedom in ICT (BYOD/CYOD) Access to information Mobility	Match	Secure and compatible internet network. Cloud computing Mobile devices Virtual communication
Workplaces		
On-demand workplaces	Match	Shared workplaces

activity supporting workplaces Choice in ICT (BYOD/CYOD)		Activity based workplaces Collaboration tools: (Telepresence facility)
Object		
On-demand Short-term contracts	Match	Shared business centers Instant offices Home office Monthly or by usage
Location		
Choice in location to work		Different office locations

In 2040, ICT will be facilitating office workers to work remotely from anyplace with a connection to the internet. Comfort in workplaces is obtained activity based workplaces. In Figure 72 the impact of the selected trends is stated resulting in a strong declination of the first office use where those office users are moved to third place workplaces leaving the second workplace almost unchanged (see Figure 72).

Figure 8 1st, 2nd and 3rd Place workplaces 2013-2040



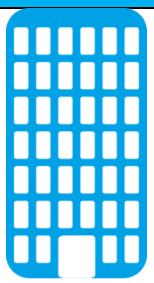
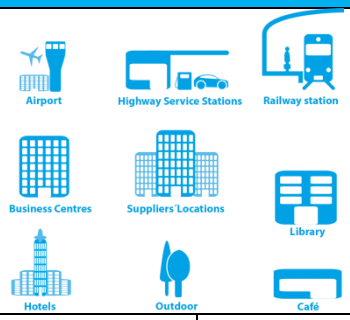
Weighing and selecting alternative solutions for a future match

Four different strategies have been designed and tested against four scenarios of the Netherlands 2040.

- **Alternative 1: Owning the first place office**
- **Alternative 2: Owning the first and third place office**
- **Alternative 3: Owning the first place office + access to third place office**
- **Alternative 4: Access to third place office**

- **Talent Towns**
- **Cosmopolitan Centres**
- **Egalitarian Ecologies**
- **Metropolitan Markets**

Table 4 Four alternative strategies

	First Place Office		Thid Place Office		Second Place Office
					
	Contract type	**Responsibility**	**Contract type**	**Responsibility**	**Responsibility**
A1	Own, lease or rent	Organisation	-	-	Worker
A2	Own, lease or rent	Organisation	Own, lease or rent	Organisation	Worker
A3	**Own, lease or rent**	**Organisation**	**Membership**	**Third party**	**Worker**
A4	-	-	Membership	Third party	Worker

Alternative 3 fits the different scenario's best. While the workplaces at the first place office will be more based on the individual office worker, Workplaces at the third place office need to be activity based workplaces to provide a best fit for the task.

Figure 80 illustrates the matching of each alternative solution in each of the four scenarios of the Netherlands 2040. Considering the most matches in with the four scenarios, alternative 3 performs best compared to Alternative 1, 2 and 4. Concerning this alternative, the organisation owns, lease or rents their own central office as the first place while providing the workforce a budget to acquire access to third place offices that are shared with other organisations. The second workplace is up to the workforce.

While the best solution is selected, the implementation of will be discussed in the next chapter.

Figure 9 Alternative solutions against scenarios

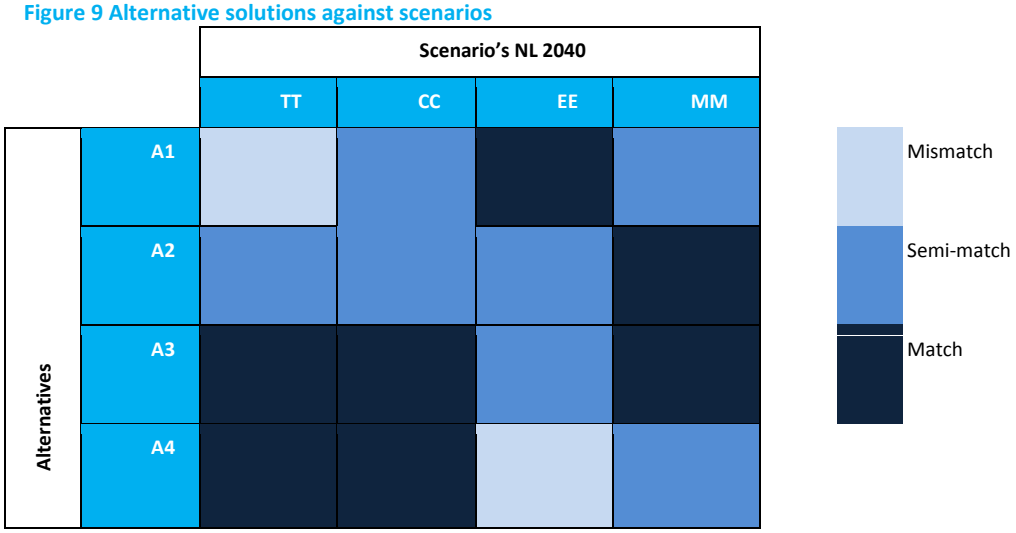
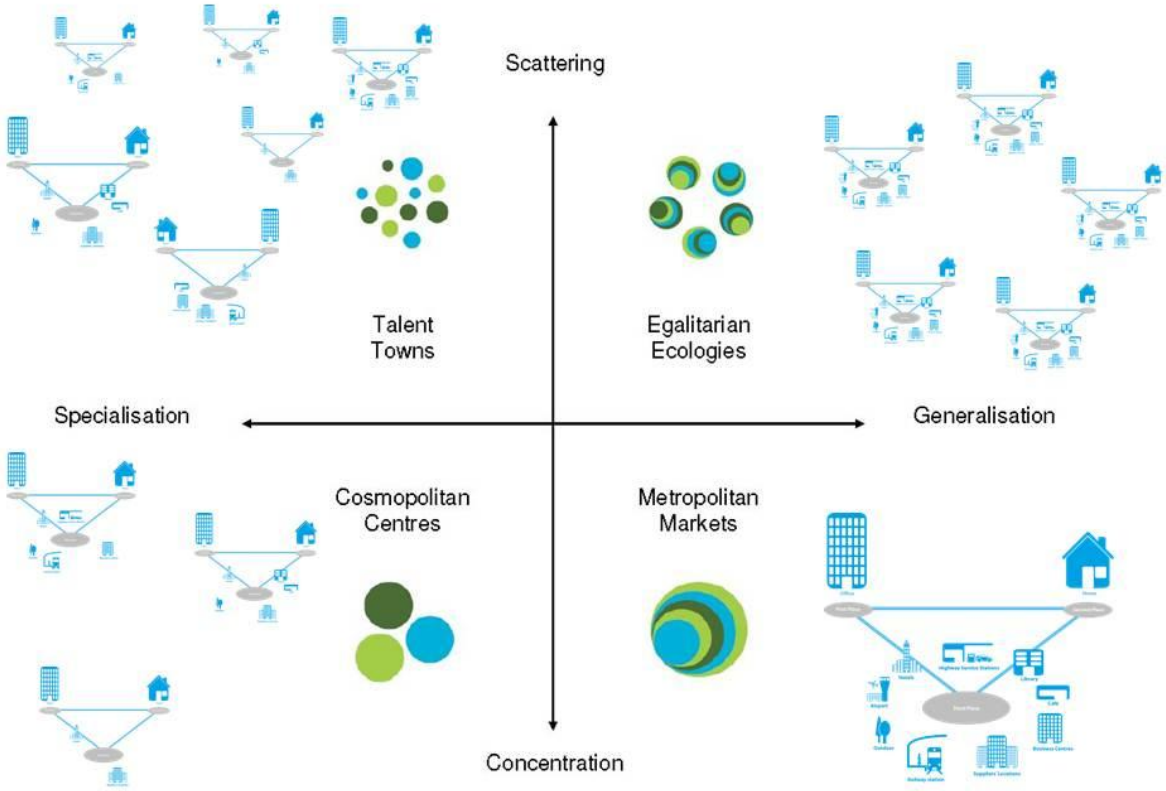


Figure 10 Workplaces in four scenarios



Step by step plan: *First, second welcome third*

Alternative 3 can be implemented via a step by step plan in four phases, namely the preparation phase, the pilot phase, the implementation phase and the continuous phase where the implementation is evaluated and adjusted to obtain a constant match between the workers' demands and the facilities they have access to. Creating third place offices can be done by co-creation with users, experts and owners. According to the target group, activity based workplaces can be selected from three types of spaces, namely works spaces, meeting spaces and support spaces.

Considering the technological trends (mobile devices (<2014) in combination with Bring/Choose Your Own Device (2014-2017) and Cloud computing (2014-2017) and generational changes (2021) a step by step plan has been created for 2013 till 2040. This step by step plan is divided over two phases:

- **Phase 1 2013-2020:** Preparation phase
- **Phase 2 2020-2025:** Execution phase

In perpetration phase each organisation can make a tailored business plan where the organisation's goals, objectives are clarified and the needed workforce is analysed to achieve these goals and objectives. In this phase three steps (doing an inventory, evaluate findings and develop a strategic plan) need to be taken to obtain a complete preparation.

- **Phase 1 2013-2020:** Preparation phase

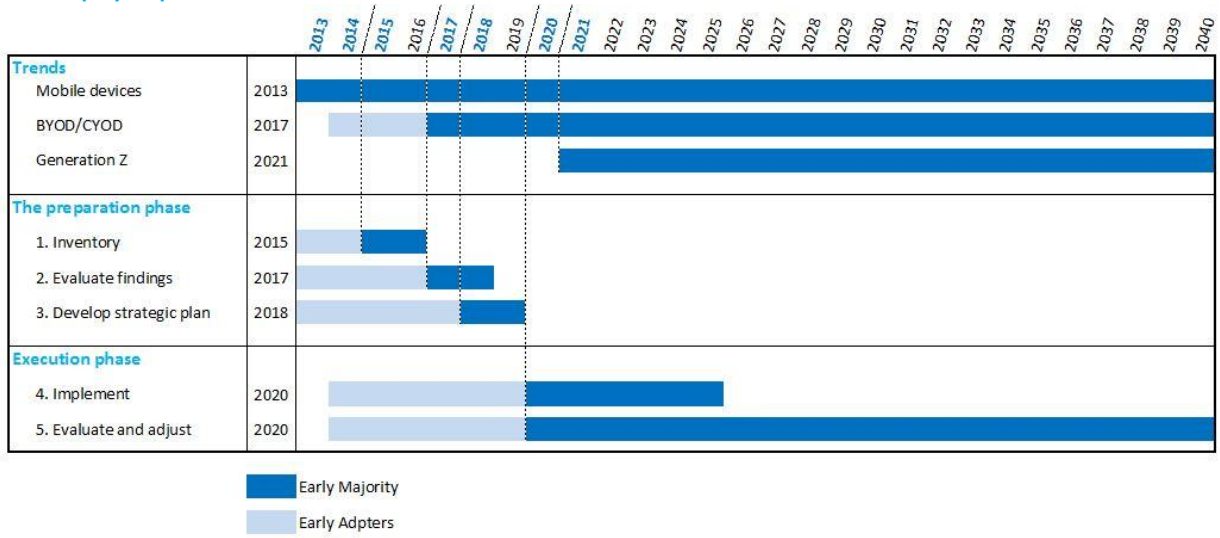
1. ***Inventory:*** *Establish goals and analyze the portfolio*
2. ***Evaluate findings***
3. ***Develop a strategic plan***

Once these three steps have been taken the execution phase can begin. In this phase the workforce needs to be prepared for change. Once the organization is 'ready' for the transition the last two steps can be made.

- **Phase 2 2020-2025:** Execution phase

4. ***Implement: run a pilot project around 2020-2025***
5. ***Evaluate and adjust 2020-2040***

Figure 11 Step by step time-line 2013-2040



Future supply: *Bits, Bricks & Brains*

The supply must be on-demand, in other words, knowledge workers must have access to different activity based workplaces at different locations and time.

The future demand of office workers for corporate real estate portfolios in the Netherlands between 2020 and 2040 will be to have the ability to have a choice in the place to work and the freedom in technology to get the job done (see Figure 89). To match this demand, the supply must be on-demand, in other words, knowledge workers must have access to different activity based workplaces at different locations and time. In combination with a comforting and inspiring environment, continues productivity and innovation will be at its max.

Figure 12 Office of the future

Conclusion

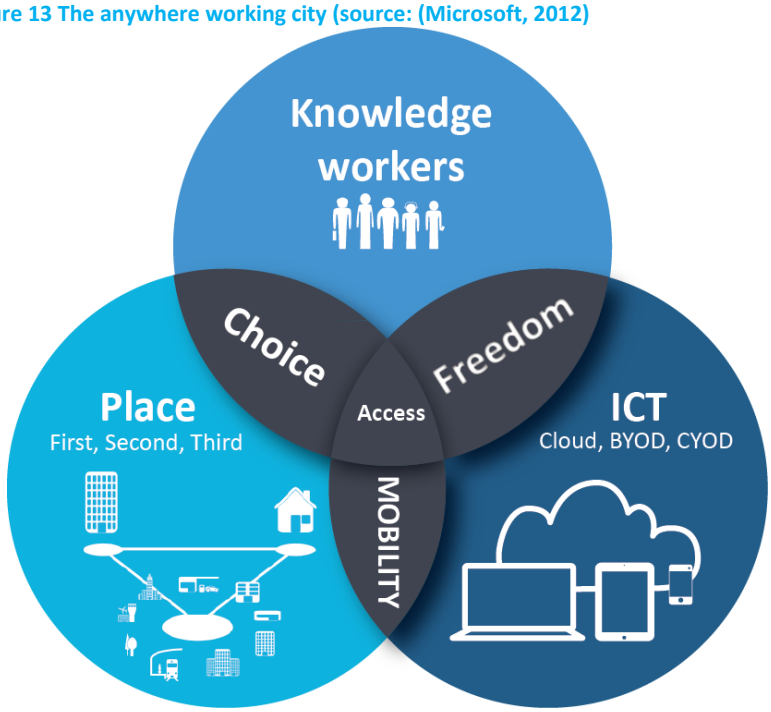
What is the demand of office workers for corporate real estate portfolios in the Netherlands in the year 2040 as a result of current ICT trends and how can the supply be matched with this demand?

In the future there is no specific and constant demand. An attempt to define a demand in the future is doomed to fail. There will be different alternating demands for different workplaces, locations and ICT. The future demand for corporate real estate portfolios will be a continues alternating demand happening from task to task during a working day. Instead of a predetermined office portfolio that allows to be adapted at the end of a 5, 10 or more years lease contract or even longer term ownership, an alternative needs to be found to match the supply with the demand.

In this research, by using Gartners Hype Cycle and in-depth interviews, the current ICT trends have been studied that have influence on the activities knowledge workers perform. Therefore the first sub question will be answered.

The future demand of office workers for corporate real estate portfolios in the Netherlands between 2020 and 2040 will be to have the ability to have a choice in the place to work and the freedom in technology to get the job done (see Figure 89). To match this demand, the supply must be on-demand, in other words, knowledge workers must have access to different activity based workplaces at different locations and time. In combination with a comforting and inspiring environment, continues productivity and innovation will be at its max.

Figure 13 The anywhere working city (source: (Microsoft, 2012)

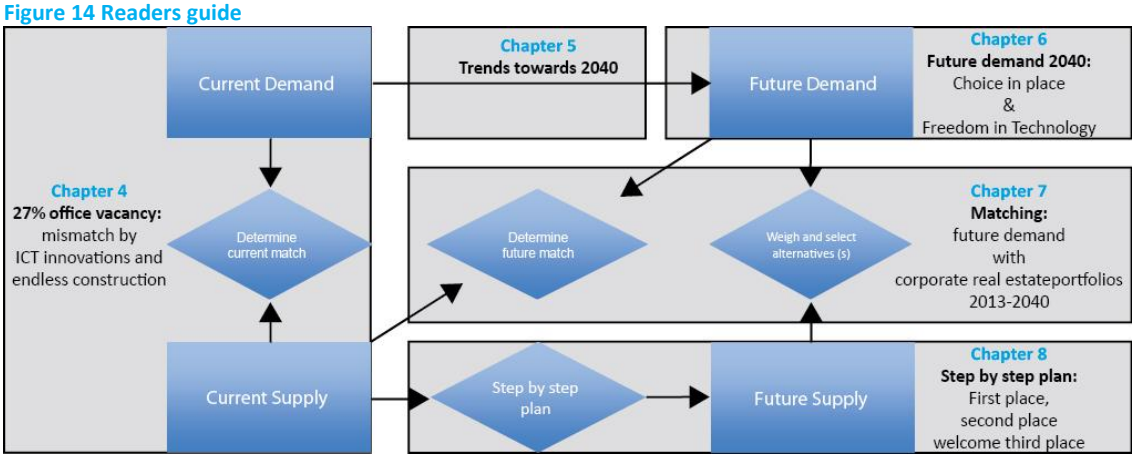


Readers guide

This report has been divided into four parts (I, II, III, IV) which consist of ten sub chapters in total. Part I, II, and III are describing different phenomenon while part IV describes how to handle the previous described changing world. Part I is the introduction to the research and consists of two chapters describing the research setup. The first chapter introduces the research topic with the problem description, the main and sub research questions will be discussed as well. The second chapter presents the research methodology and will elaborate on the way the research will be conducted, the research model, data collection as well as respondents' selection. In part II, is setting the basis of the research topic and provides background information from the beginning of the office till the current situation in chapter 3. Part III states the trends towards 2040 divided over chapter 4 and five. Chapter 4 states the theoretical research and elaborates more on the findings of the studied literature about trends. Chapter 5 presents the interim empirical research results that are obtained from the interviews about trends. In part IV, the possible situation in 2040 is described according to the research results in chapter 6. The last part is the conclusion of the research. The research will focus on four themes:

Organisation (i.e. the new way of working)
User (i.e. office worker)
Technology (i.e. ICT)
Accommodation (i.e. real estate portfolio)

Figure 14 Readers guide



I. Research setup

1. Introducing topic

This research is not about real estate, it is not about workplaces and it not about location. This research is about people. It is about what people want, what people do, it is about how people live. After finalising their education, people may actually spend most of their time working (8 hours a day, 5 days a week) during 40 years of their life time. Job satisfaction is an important element of individual wellbeing. In corporate real estate, this satisfaction is or must be the underlying factor. In order to obtain this satisfaction trough real estate, people's demands, which might change over time, need to be understood, and dealt with. Unfortunately, the static character of real estate forces us to think 40 to 50 years in advance to best fit the supply with the demand and obtain satisfaction. This thesis sketches a vision on corporate real estate portfolios in 2040 by analysing trends in ICT that influence the demand for office. Understanding the potential future demand provides real estate developers and managers more insight how to matching real estate supply with this demand. In particular, three major trends will shape the future of work in this century:

- the pace of technological change
- shifting demographic patterns
- the path of economic globalisation

These mayor trends will evolve over the next 10 to 15 years. The implications of these trends for key aspects of the future workforce and workplace will be considered, including the size, composition, and skills of the workforce; the nature of work and workplace arrangements and worker compensation. The coming decades are going to be remarkable in terms of the technological advancement that will happen and its subsequent impact on information. The greatest ICT will not be found on a shop shelf or in a catalogue. It will be the way information is processed. A revolution is waiting to happen. Changing the way we deal with information, where to find information, who to trust to give provide information, what to do with that information, how to store it, how to access, process and share it is going to change everything.

1.1 Changes in demand and increasing office vacancy

The increasing vacancy in the Dutch office market is a serious problem. At the moment (reference date: January 2012) 6.795.000m² of the in total 48.195.000m² of office space in the Netherlands is vacant (Zadelhoff, 2012). Of this 14.1% vacancy, 51% (almost 4.000.000m²) is structurally vacant[1]. In a healthy market the vacancy would be approximately 5 per cent in order to absorb relocation of businesses. According to a recent forecast by the Economic Institute of Construction (EIB) (2010), by 2020 the structural vacancy rate will be doubled from 4 to 8 million square meters if no drastic measures are taken. Regularly, debates and symposia are organised trying to find possible solutions to solve this rising problem.

Despite the large amount of vacancy in the office market, new offices are built. According to consultants and developers, new offices are built to meet the needs of current office users. Tenders are currently being issued for the development of new offices. This demonstrates a mismatch between the existing office supply and the current demand of office users, which stimulates the development of new offices for qualitative improvement causing a quantitative problem. Is short term thinking the cause of an unexpected reduction of the functional life span of offices? Or is the demand for office use changing faster than we thought? More research needs to be done on both sides of the market to restore the situation and to retain more balance between supply and demand. Despite desperately waiting for new tenants or transforming offices into other functions like housing or art galleries, it is not clear what real estate owners really do to solve office vacancy. The aim of this research is to rather prevent office vacancy in the future than solving it.

[1] Vacant for more than three years in a row.

This report contains the research results for my graduation thesis done within the laboratory called 'Corporate Real Estate Management'. This laboratory forms part of the department of Real Estate & Housing from the faculty of Architecture at Delft University of Technology. Real Estate Management is concerned with the best possible alignment between supply and demand for real estate. The demand for real estate relates to three scale levels: society, organisation and individual. Supply also relates to various scale levels, namely area, stock, building and space. A key issue is how to match demand and supply, both quantitatively and qualitatively, on the short term and in the long run. Furthermore it is essential to have a sound balance between costs and benefits and to take into account issues such as sustainability and constraints such as legislation, time and budget.

Thanks to ICT innovations we become more and more a knowledge and service economy: smart workers supported by smart networks. However, organisations have not yet assumed the form that best utilises the innovative possibilities. In particular, the large companies are still controlled by the mechanisms that match the economy 40 years ago, where scalability, speed, increase and the margins are great assets. Therefore the differences between business and internet initiatives currently only seem to be growing. But are we there, if we succeed in interactive knowledge and communication tools to work successfully in the workplace? Organisation sociologists expect that the real changes in office use take place when the end of the economic crisis is in sight. Every major crisis or depression that our history has known, gave a very clear common good, namely a major impact on our inventiveness. After the 'shake out' the real innovators stand up. With effect, because they set a new era: the stage in which economic and social potential of innovation really gets harvested.

We really exploit the potential of ICT innovation when we are capable of efficiently and effectively bringing people, communication and information together at all levels. The keyword for smart workers in smart networks is:

"Connectivity".

The report will focus on developments in ICT that have significant influence on real estate portfolios in 2040 of the office workers in the Netherlands. This research aims at aligning these real estate portfolios with the future demand of office users in order to obtain and retain user satisfaction, efficiency and cost reduction. The main problem is the current and future mismatch between the relatively static office supply and the fast changing demand for innovative workplaces on a global scale level.

Why until 2040? As will be explained later, Rogers (1995) divided five different classifications of members of a social system on the basis of innovations. Because it takes a while, depending on the innovation, before the majority of these members adapt to or make use of the innovation. Based on the Hype Cycle for Emerging Technologies (Fenn, 2010), it is assumed that innovations in the next five to ten years will take approximately another ten to fifteen years before it is used by the majority of office workers. Also it has to do with the long technical life cycles of real estate (approximately 40 years for offices) that forms a relatively static supply of real estate.

"In the past the office was characterised as administrative and information-processing unit. Through evolution of our work processes and the introduction of new ways of working and work organisations an office is created in which creation, knowledge sharing, collaboration and meeting becomes increasingly important. Due to the increasing fusion of private and business activities the new office environment is not only office object, but it has also become a 'home and on the way' environment. The scale of existing offices, at failure to transform, that will lose their function is of unprecedented magnitude. Offices with a layout and spatial structure aligned to rooms, status and personification is a thing of the past. How will the Office of the Future look like?" (EIB et al., 2010).

To better understand how to solve the main problem this research has been set up as a first step. From earlier research on the problem and influential factors, several answers are formulated. To answer the main research question several sub questions are set up. These questions will be answered by different methods in theory and practice, which will be elaborated in this report.

1.2 Problem description

As already stated, the Netherlands has 14.1% vacant office buildings. Economically and structurally a depreciation period of 40 years is often held for offices. Nearly 80% of the vacant offices are younger than 30 years. With 51%, more than half of the empty offices are built after 1990 and thus younger than 20 years. The large number of vacancy of relatively new buildings is partly due to the different dynamics within locations (EIB et al., 2010).

Besides the economic recession, new technologies regarding communication and information processing change the demand for ways of working. These ways of working are affecting office use in terms of how, when and where people work and therefore demand other types of workplaces, facilities and locations. These workplaces allow colleagues to work during flexible hours and at different locations. Flexible workplaces that can be shared with others are more often used and have other office space requirements. Flexible workplaces reduce the amount of square meters per workplace needed per colleague (fte). User's wishes are more decisive than ever. Various studies have shown that not the demand for smaller office spaces increases, but other types of concepts. The office itself is not the central point, but the range of (extended) facilities and the mix of people and companies is. Today's employee is looking for a valuable place where he or she can meet other people and share knowledge. Flexible workspaces with a reception, fast internet and good coffee are on the rise in the big cities, think Spaces, Seats2Meet, Regus, iGluu, The Coworking and much more. Especially freelancers are taking full advantage of this phenomenon lately.

The freelancer is the new nomad. The number of freelancers is still growing, which causes the demand for flexible workplaces to continuously to increase. In the 90s, one in seventeen employees was freelancer. Now it has increased to one in ten. The self-employed workers are called the new nomads. They have no office space and have their entire infrastructure placed in the cloud. A clear shift from 'a workplace' to 'a place to work' can be observed. More and more, people are increasingly working in areas outside the existing office walls and at times outside normal working hours. This happens not only on a national scale but also on a global scale. Globalisation demands more efficient and effective communication facilities. Virtual communication is becoming more and more popular, which makes the location of central workplaces less important. Cross-border collaboration with a heterogeneous group of employees, partners, suppliers, consultants and even customers from around the world is becoming less the exception and more the rule in a global economy.

The workplaces, or at least the offices, need to facilitate virtual communication means to make use of the global economy. Virtual communication and –teams can have a big influence on a corporate real estate portfolio. A demand for a certain way of working does not always evolve into an actual change within an organisation, but more and more employees require certain standards for them to accept a job. The findings of the 2011 Cisco Connected World Technology Report concluded that from the survey of nearly 3,000 college students and young professionals, two of the five respondents said they would accept a lower-paying job that had more flexibility with regard to device choice, social media access, and mobility than a higher-paying job with less flexibility (www.cisco.com). In order to attract young talent and retain older people with experience, organisations need to listen carefully to this changing demand.

As can be concluded by Meer and Feijt (2010), the impact of the economic crisis on the office will be strengthened by efficiency effects of the new way of working. This will be a long-term declining user area. New demand has a different character: small, flexible and high quality. The current and future supply should also.

Beside the fact that offices that are not leased do not generate revenue, they simply impoverish by being vacant dragging surroundings with it. Minimal maintenance is committed and there is no liveliness. In many areas, a large number of offices are built together. Due to this monoculture, the attractiveness of such an area is even worse. If there even is someone who would lease office space at this time, it will certainly not be in an area with poor appearance.

Problem statement

"The effects of the new way of working in addition to office downsizing due to the economic crisis form a real problem. There seems to be a double dip. The high office vacancy rate is an economic and social problem" (Meer, 2010). The main problem is the current and future mismatch between the relatively static office supply and the fast changing demand for innovative workplaces on a national and global scale level. This mismatch causes inefficiency, in terms of spatial and financial factors, for real estate investors and users. In order to retain or obtain user satisfaction, efficiency and cost reduction, the mismatch between the demand and supply needs to be solved and prevented. The accelerated pace of flexible ways of working in combination with fast developing information and communication technologies creates a

"mismatch between the relatively static office supply and the fast changing demand for innovative workplaces is increasing."

This problem can be seen on different scale levels, namely on workplaces, office space and the real estate portfolio of a company or a corporation (see Figure 17). Accommodation strategies of corporations need to be aligned to the developments of ICT and the ways of working. It is time for a dared look in to future of work and its environment.

Vision & Expectations

My personal vision on this research is the synergy between:

'bits and bricks'

This can be seen as a harmony between ICT and corporate real estate, or at least, the alignment of corporate real estate strategies with ICT developments. Bits & bricks facilitate office workers with all the comfort, efficiency and pleasure they need to do their job even better. This vision enables companies and corporations of all sizes to be able to adjust and optimise their real estate strategy and management. The workplace of the future has to stimulate and increase worker attraction, attract older people to work longer, worker retention, loyalty, distributed work and energy saving. ICT can withhold personality and physical connection, but this is changing:

"The future is all about emotion." (Canton, 2011)

Based on the analysis of trend watchers[2], like futurists Dr. James Canton Ph.D. and Dr. Patrick Dixon, and observed developments in ICT and office use, the expected result of this research was formulated beforehand: In 2040, office workers will work between 50% and 80% in virtual teams using third workplaces (see Figure 15). These virtual teams use audio-visual technology for communication and collaboration like 'TelePresence' (see Figure 16). Current products will be further developed to enhance digital communication quality. The consequences of virtual teamwork are reduction in the needed core office space and increase in usage of third workplaces. These offices will only be paid for according to the used time, facilities and consumption of goods by membership. Among others, the company 'Regus' has already implemented this kind of office, but in the future there will be much more variety in quality, price and location. A shift will be made from:

"An office with colleagues" to "A colleague with offices"

and a shift from

"location, location, location" to: "Communication, communication, communication".

[2] Professionals who study trends and predict future outcomes based on these trends.

Instead of an office worker going to the same office every day, at the same location, at the same desk, during the same working hours, amongst the same colleagues and working for the same employer, the office worker will vary in most, if not, each of these aspects per day or even per hour. The term “location, location, location” is the number one rule in real estate. Because the immobility of real estate, it is important for offices to be located at places with easy access to suppliers, customers and to the workforce. For the office worker to make use of above mentioned flexibility, the communication between employers, colleagues and clients becomes an important factor, especially when virtual communication is becoming almost indistinguishable from natural communication. To clarify the problem and give more insight into solution(s) to this problem theoretical and empirical research will be done to obtain answers.

Figure 15 Third working locations (source: www.regus.com)

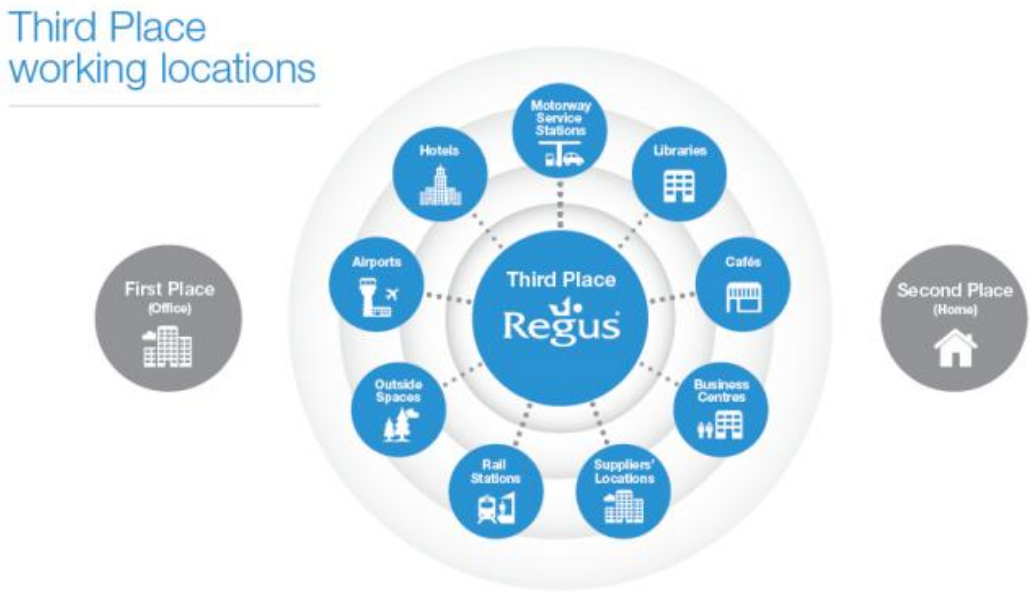


Figure 16 TelePresence by Cisco

1.3 Research questions

Main research question

What is the future demand of office workers for real estate portfolios in the Netherlands in the year 2040 as a result of ICT developments over the next two decades and how can the supply be matched with this demand?

Sub questions

In order to answer the main question, several sub questions need to be answered. Also the method that will be used to answer the question is stated per question:

(Trends)

Chapter 5: Trends towards 2040

1. **What are the current trends in ICT that influence the future demand for corporate real estate portfolios in the Netherlands?**
   (Literature study + interviews with ICT developers and trend watchers)

(Future Demand)

Chapter 6: Future demand 2040: *Choice in Place & Freedom in Technology*

2. ***To what future demand do current ICT trends lead?***
   (Capita Selecta, literature study, interviews with ICT developers, trend watchers and real estate developers/consultants.)

(Future Demand - Current Supply & Future Supply)

Chapter 7: Matching future demand with Corporate real estate portfolios 2013-2040

3. ***What is the best possible solution for corporations to obtain a real estate portfolio stays aligned with the future demand?***
   (Trend watchers and real estate developers/consultants, DAS-Frame: Weighing and selecting alternatives.)

(Current Supply - Future Supply)

Chapter 8: Step by step plan: First place, second place welcome third place

4. ***How can the best possible solution be implemented?***
   (DAS-Frame: Step by step plan)

These sub-questions are answered due to literature studies and interviews. These interviews will be held with team-leaders, of (international) companies established in the Netherlands belonging to the frontrunners in ways of working and ICT. To better understand the current ICT developments, some products will be tested like teleconferencing and augmented reality. For office use, teleworking and third place offices will be used. All tests will be documented and subjective as objective assessments will be recorded.

1.1 Research Aim

The objective of this research is to complement the current knowledge about the trends in ICT to better understand the influence of these trends on the use of corporate real estate. Due to the combined effects of the economic recession and the change in office use, it is possible that an entirely new market demand arises. When this changing context is recognised in an earlier (re)development stage of real estate or functional life cycle of real estate, more input can be given to steer on the supply. The earlier the trends are recognised, the more the supply can be aligned to the demand. Therefore it is important to obtain the:

"office demand for the coming three decennia."

Measures by real estate owners need to be taken to attract and retain tenants. With this research recommendations will be given and further needed research will be assigned. The final result will deliver an ICT trend based future demand for workplaces, offices and office locations within the Netherlands. To better understand the implementation of the research result, the development from the current supply to the future supply of Heren2 will be simulated based on the obtained future demand. The result can be used to give more insight in which office buildings and locations are ready for the future or are adaptable to match the future demand. Knowing the characteristics of the future offices and locations, real estate investors know what buildings are the most valuable and which buildings should be repelled or demolished. A couple of slogans come to mind when understanding the future: "The future is now" and "Knowledge plus action is power" resulting in a reformulated slogan related to this paper:

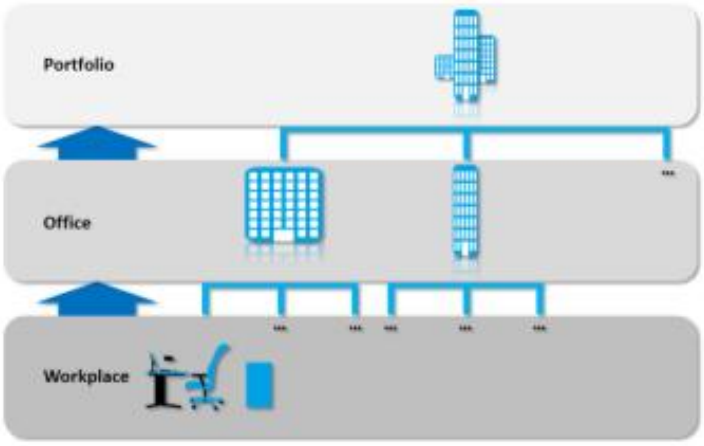
"**Knowledge** about the future **plus action** in the present **is** sustainable **power**".

This report provides the penultimate research results of the final research report. The findings of the final research will be presented in a research report that will be made accessible in the TU Delft Repository and my graduation company Heren2 also will receive a copy. My hope for this research paper is that it will jumpstart the preparation for the future by sharing knowledge and ideas that spur strategic action with successful achievements.

1.2 Research focus

Overall this research focuses on three different scale levels, namely on workplace level, office level and finally on Portfolio level Figure 17. The changes in workplace might have influence on the qualitative and quantitative requirements of the office buildings. The way workplaces are used influence the demand for office buildings forming particular real estate portfolios. Important aspects are types of workplaces, supporting facilities, office building characteristics and the composition of the real estate portfolios determining the accessibility, variety, flexibility and contract types and duration.

Figure 17 Different levels



1.3 Research Delineation

The research boundaries are delineated tot office workers and corporate real estate within the Netherlands.

This research will focus on:
- Quality of space
- Location of space
- Technology of space
- Quantity of space

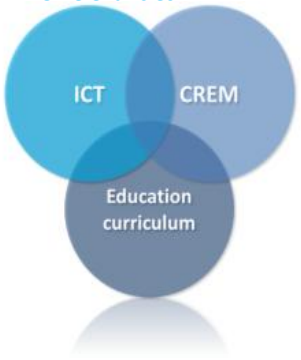
This research will not focus on:
- Cost of space
- Environmental sustainability

1.4 Research relevance

Because this is a final master thesis to complete my Masters in Real Estate & Housing, the research needs to be relevant to at least one of the master tracks.

Scientific Relevance

Figure 18 Relevancies



This research is done within the department of Corporate Real Estate Management (CREM) laboratory. Corporate Real Estate Management stands for developing and managing real estate for professional private real estate users such as higher education organisations, office users and health care organisations. CREM analyses user needs and desires while taking the internal and external changes into account that are relevant to a certain case. The research topic is relevant to the domain and the theme 'Optimising office accommodation', which aims at improving our understanding of the impact of different office lay-outs and facilities on experience and use of the working environment. This theme focuses more on object (office building) level, but my research will go up one level to the real estate portfolio level (office buildings/space). Furthermore, from the education curriculum a connection to actual business problems will be made.

Much research is done about ICT developments, new ways of working and real estate management, because most primary processes of companies as well as governments are supported by these aspects. However these researches are mostly done separately. This research combines the body of knowledge of all three themes as a whole. Methods for accommodation strategies and scenario planning will be used. Qualitative research methods will be used in order to answer the sub questions. Also does this research form a basis for further research about the integration of ICT developments, ways of working and real estate management.

Practical Relevance

Office vacancy increases the risk of impoverishment of an area, especially when the concentration of unoccupied real estate is high in a certain area. The impoverishment is caused by the cut down on maintenance costs by the real estate owners during vacancy. The deterioration of property gives the area a negative image and threatens the area to come into a downward spiral. Not only for the remaining users of the area is it an undesirable situation, but also for the municipality.

This research is practically relevant as a part of this research will be about the communication between different colleagues even across borders and the relation between work and private life. Work and personal life might intermingle and the workplaces of the future might be closer to the user. This research will be done expecting that by steering on retention and satisfaction of users, vacancy can be reduced and that a comfortable and sustainable work environment will be provided.

Target group & utilisation potential:

This research is intended to help all stakeholders, workers, employers, educators, and policymakers to make informed decisions. The end-users and suppliers of real estate are the primary target group as they form the demand and supply side of the real estate market. Secondary target groups are ICT developers, real estate developers and owners who provide facilities (i.e. hardware, software and buildings and workplaces) for office users. The target groups can be divided into users and suppliers (see Table 5).

Users are those who make use of real estate as a mean to perform their primary work processes. In this research the users are office workers and clients of a 'knowledge-based enterprise'. The term 'knowledge-based enterprise' is described by Gupta and Moitra (2004) as companies that rely heavily on knowledge assets, information exchange, employee-employee interaction and real-time decision making for successful functioning. Employees usually work in temporary workgroups in order to

accomplish intellectual and project-based work. These mostly non-routine and complex tasks show a high interdependence among team members, and therefore require an effective coordination and integration of individual activities. In order to cater the needs of such teams, knowledge-based companies need dynamic work environments, which provide effective networking capabilities, support the real-time flow of information and offer the ability to spontaneously scale and re-configure itself, based on changing business requirements.

Table 5 Target group

Users	Suppliers
Office users: Organisations: - - Employers - Employees - Clients	**Workplace:** - Catering industry - Office owners - Private RE/Vehicle owners - Public transportation companies - Real estate developers
	ICT: - ICT (device & software) developers
	Consultants: - Real estate consultants - Innovators

Suppliers are those who provide facilities for the users and are office owners, ICT developers, real estate developers and managers. After this research is done, the target group can immediately start making their processes more efficient and improve their work and work environment.

To better understand the future demand of the office users, the focus lies on the innovators. Relevant innovators for this research are futurists, ICT (devices and software) developers and in some cases even the user themselves. Not only in the Netherlands, but also on an international level, among others, Microsoft and Cisco provide innovative ICT for the users. Microsoft develops, manufactures, licenses, and supports a wide range of products and services predominantly related to computing through its various product divisions. Microsoft Corporation develops consumer electronics like personal computers and laptops, servers, smartphones, and video game consoles[3]. Also does Microsoft develop operating systems for these devices and other software for data processing. Cisco used to focus more on the back-end of ICT like networks and infrastructure. Nowadays Cisco also develops devices for virtual communication like Telepresence and other collaboration products.[4] Both, Microsoft and Cisco integrate their ICT into buildings to illustrate their vision on office use. Microsoft does this with their office at Schiphol and Cisco does this in their Smart buildings and work spaces.

Motivation on subject

As a kid I always was wondering why some buildings and areas were designed and used in such way. I immediately started figuring how it could have been done better to create more quality. More quality experience not only for the users, but also for those looking at or passing by the building or area. From those first moments I decided that I wanted to:

"Create extra value for humanity with real estate."

Beside real estate, I always was very interested in the newest technology and tried to get the most pleasure, comfort and efficiency out of technology. I always wondered what is going to be next, how technology could support our daily processes and imagine how the future would look like. Despite my interest in the next best thing in technology, I had more affinity with real estate and found my way in this sector. During my internship as a project leader of an accommodation research at a real estate company, I found out that I like corporate real estate management most. Creating real estate strategies is a challenging and complex task. Testing the robustness of a strategy based upon future possible scenarios makes it very interesting. For my graduation project I wanted to combine something that really interests me with corporate real estate management.

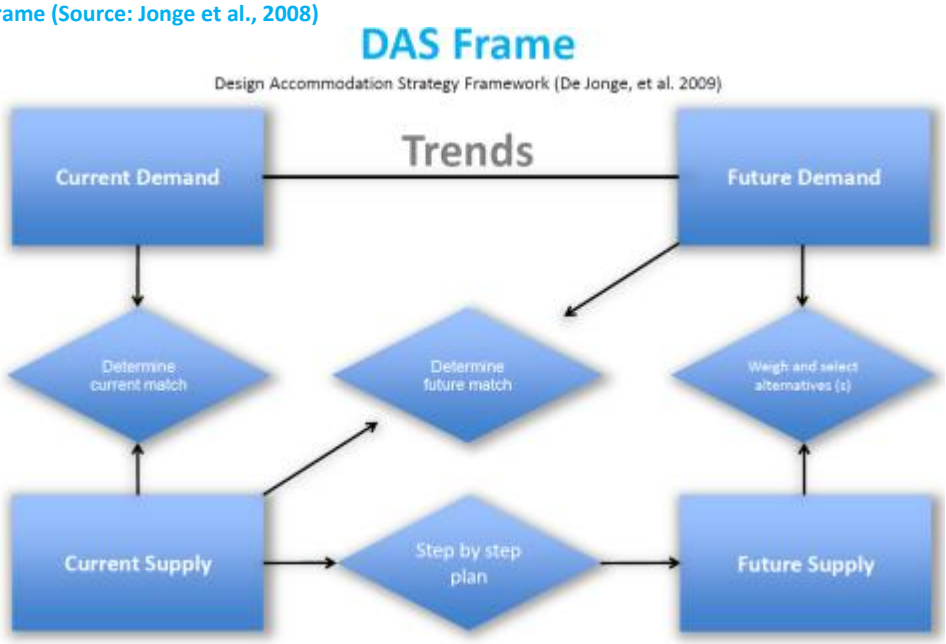
What in my opinion is lacking or not paid enough attention to while designing an accommodation strategy is the development of ICT and possible changes in the way of working in the

[3] http://www.microsoft.com/en/us/sitemap.aspx

[4] http://www.cisco.com/en/US/products/index.html

future. However, the DAS-Frame (see Figure 19 DAS-frame (Source: Jonge et al., 2008)Figure 19) does take trends into account somewhat, but I have a feeling that accommodation strategies are more designed to be able to adapt to changing ICT rather than creating the future workplace and office portfolio. This can change! Because of globalisation it is interesting to look at companies situated in different countries with different cultures and time zones. Luckily I came in contact with Heren2, who operates on an international level within the Netherlands, Germany and the Caribbean. Al together, my decision to research developments in ICT in relation to the future demand for real estate is based on my personal interests.

Figure 19 DAS-frame (Source: Jonge et al., 2008)



Learning Objectives

My goal is to create a vision of the future way of working according to technological developments in order to see how office portfolios of the future will look like. I want to:

- Gain knowledge and experience in conducting scientific research.
- Gain knowledge and understanding of data collection and data processing.
- Gain knowledge and understanding of the development in ICT and the influence of ICT on office use over the next three decennia.

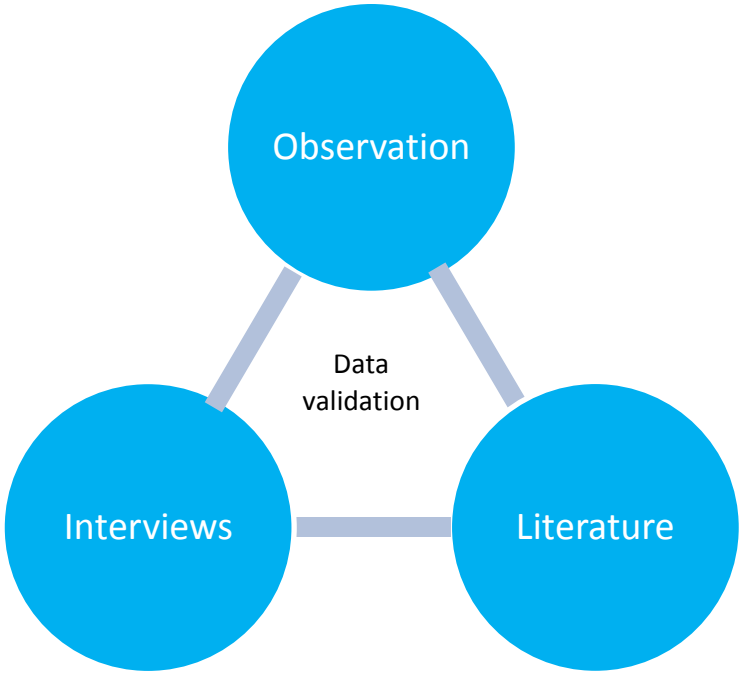
After successfully finalising this research, I want to be capable of researching future demands and develop a model to constantly align future supply with future demand.

2. Research Methodology

2.1 Introduction

The problem that is being analysed in this thesis is a problem that is concerned with changing demand for office use in combination with the static office supply. Inductive reasoning is a bottom-up approach that moves from specific to the general. In this case, specific refers to the observed change that will be described in section III and that eventually leads to broad generalisation and theory. To be able to understand how to anticipate on this change, the future demand for office use needs to be clarified. Some developments and changes can already be observed in early stages. Only possibilities of future demand for office use can be sketched by the observed phenomenon's by assuming that certain developments will (continue to) take place. These factors combined have facilitated the choice for an inductive rather than deductive research method. Instead of starting off with a defined theory, from which a hypothesis is made, that is then confirmed by observation; this research followed more of a 'bottom-up' approach. Having observed growing interest ICT solutions to ways of working and office use, this thesis is set out to identify specific patterns in this phenomenon. In this research these patterns are the trends. The further analysis of these trends will lead to the developments of a theory about the demand for office use in the Netherlands in the year 2040. This inductive method allows for the identification of "*mutual simultaneous shaping of factors*" (Groat and Wang, 2002) by making use of a variety of fields of knowledge and research techniques for triangulation. In this qualitative research methodological triangulation is conducted by interviews, observations and literature.

Figure 20 Model of triangulation



2.2 Qualitative Research

This inductive research is a qualitative research, in the form of words rather than numbers, in which the term 'testing' in a broad sense will be used. The researcher will search for both information that supports (authenticate) the allegation(s) as for information that may disprove (falsify) the allegation(s) (Baarda et al., 1996). In this research futures studies where implemented, which seeks a systematic and pattern-based understanding of past and present, and to determine the likelihood of future events and trends.

2.3 Research Phases & Techniques

The research process is cyclical in nature, which enhances additives that could be made at earlier stages of the research. At a certain point, when sufficient data clusters or patterns have emerged, a decision will be made that the data collection can slow, stop, or change direction. However, this research is divided over five phases:

1. The first phase (P1) of the study was an exploration of the subject, The first phase (P1) of the study was an exploration of the subject, which is a joint interest of the CREM lab and myself. The subject has not been randomly chosen since it requires reading a vast amount of literature on the topic to determine the gap in the knowledge which is intended to be narrowed. A keen interest in the subject has been chosen. This led to the main and sub-questions. Accordingly, these questions were defined within the study area, the scale and scope of the research. A hypothesis had not been provided because due to the no testable prediction can be given that designates the relationship between two or more variables.

2. In the second phase (P2), a literature study is done, 23 conversations and two interviews took place. The literature study focused more on the development of ICT over the years and real estate management. One interview is done with a manager at Regus (mr. Sander Ruben, Centre manager at Regus) about Regus and the third place office. Two offices in The Hague (The Hague Equinox and The Hague Central Station) were demonstrated and documentation is received. In July a second interview is planned with a member of the management team of Regus about the future of Regus, offices and ways of working. Another interview took place via phone with a consultant at KPN (Martin de Boer MSc, ICT Business Consultant at KPN Consulting Nederland) about the new way of working and developments in ICT. Documentation and presentations were sent. A more in-depth and personnel interview took place on the 27th of June 2012 with de Boer. Also several orientation interviews and conversations are done with office users (European Patent Office, Reinier de Graaf Gasthuis, Ordina, Bluerise) real estate developer (OVG) and real estate advisors (ABC Management Groep, CBRE and Royal Haskoning). Primarily, in the literature study the change in office use will has been researched. Since literature about the office owners, specifically about their role and actions in order to avoid vacancy is very scarce except for giving incentives. This phase led to partially answering the research questions and formulating the questionnaire for the interviews.

3. In the third phase (P3) the empirical research will be discussed, involving several (15-20) in-depth interviews in total, consisting of interviews with office users (>10) and interviews with office space providers (>5). The obtained literature will be tested on the interviews with the office users and developers/owners. In an exploratory way knowledge will be generated about the office owners. This will allow the research questions to be answered. From the two basic forms of qualitative analysis (intra-case analysis and cross-case analysis), which essentially are the same in their underlying logic, this research undergoes a cross-case analysis. The cases, in form of one-on-one interviews are systematically compared and contrasted. The conducted interviews are based on predetermined open questions. All interviews have been recorded, while notes have been taken to emphasise important information. Relevant to the research subject (ICT), notes are typed directly on an iPad, which at the same time records the conversation. In this way, all information is digitally stored in a central location in a ‘Cloud’ environment (Dropbox in particular). Taking notes during an interview can be distracting for both the interviewee as the interviewer, because interviewees often have the tendency to wait for the interviewer to finish his notes before continuing. This however provides time to think about what to say. In my case, I have tried to take notes on an iPhone, iPad and Laptop. Taking notes on an iPhone gives the impression of

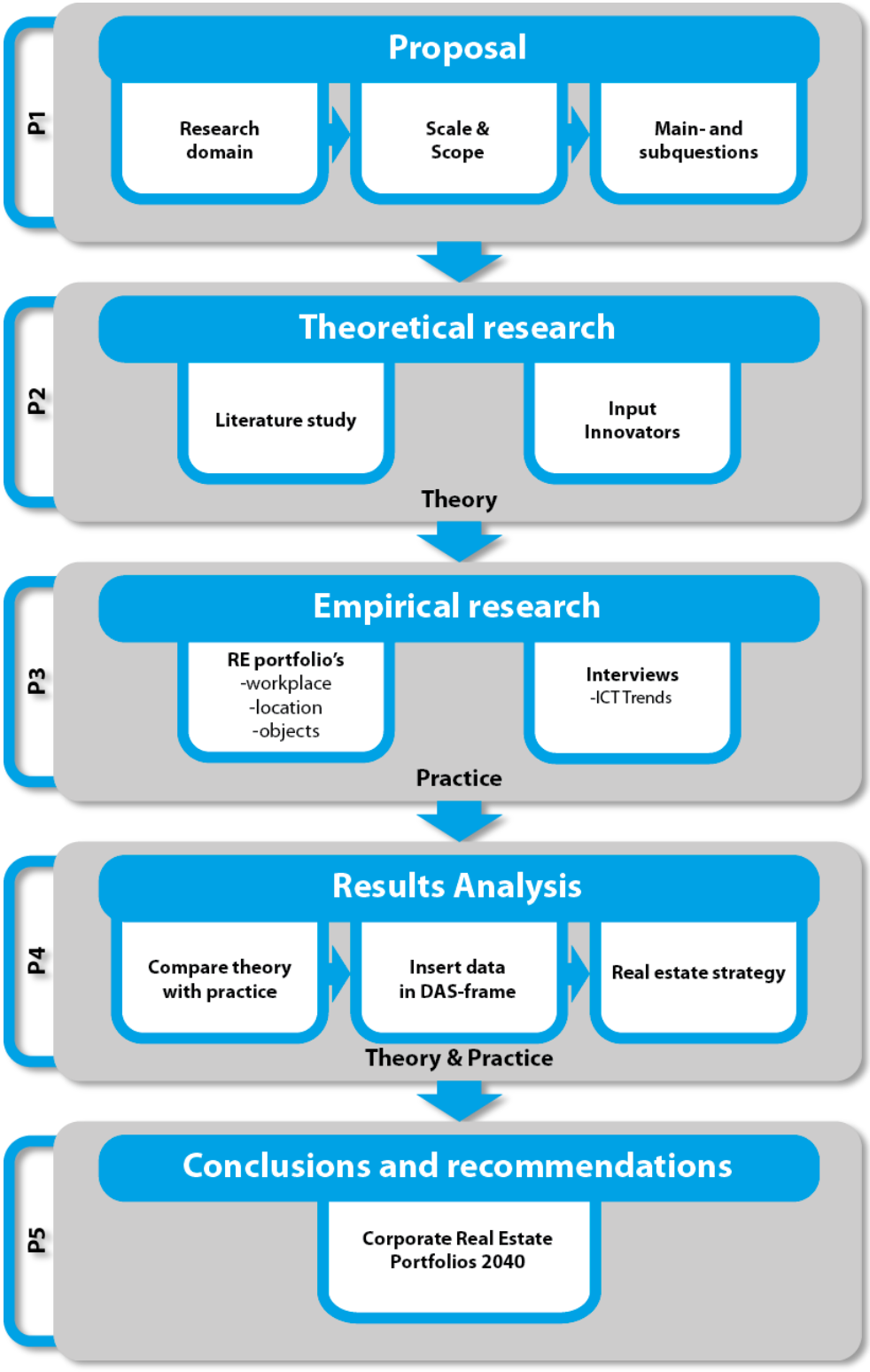
doing other things during the conversation, like chatting with friends. Taking via a laptop notes arouses a separating feeling due to the barrier the physical shape of the laptop makes between the interviewee and interviewer. Even a small iPad or laptop creates a physical barrier between the interviewee and the interviewer. All these devices require the interviewer to look down, losing eye contact with the interviewee. However, the iPad aroused the less distraction, probably because the interviewee can follow all actions done on the device minimising and increasing the feeling of transparency.

4. In the fourth phase (P4) an analysis of the results from the empirical research will be done. The focus will be on themes 'current trends in ICT' and 'corporate real estate portfolios 2040'. Also the DAS-Frame will be used to obtain a real estate strategy while using designing methods and scenarios of 'The Netherland of 2040' (Weel et al., 2010).

5. The last phase (P5) is the final phase of the research. The final conclusion will be formulated in the final phase (P5) as well as the recommendations. These recommendations are tightened by means of brainstorming sessions on an individual basis with relevant consultants, owners and users.

There is a distinction between the interviews with office users and office space providers mainly because literature about office providers is scarce. The interviews with (representatives of) office users and ICT providers/developers are therefore mainly to test the literature, while the interviews with office space providers are rather exploratory. The research model (see Figure 21) consists out of basically two types of research methods, namely theoretical research done by a literature study and practical research done in the form of interviews. The theory about changes in the demand for office space and corporate accommodation strategies will be compared with the situation in practice in order to determine the matches or mismatches between demand and supply. The corporate real estate strategy will be adjusted to align with the demand for office space. The new strategy will be tested in future scenario's to determine the robustness of the strategy and adjusted if necessary. After this iterative process it becomes clear how the future real estate portfolio of corporations is going to be like as a result of the workplace of the future. A step by step plan will be made to illustrate how to go from the current supply to the future supply. In the end a conclusion will be made and the final graduation report and presentation will be finalised.

Figure 21 Research model



2.4 Respondents selection

To cover the point of views of professionals relevant to the scope of this research, respondents are selected. The respondents need to at least cover the input of users of workplaces and providers of ICT. Office owners can give more input about the preconditions related to real estate. The selected respondent profiles are state as followed:

Office users: The office users who will be interviewed need to meet the following criteria;

- Member of a company, corporation or another type of organisation,
- Office worker (as described in paragraph 3.1)
- Front runners in ways of working and ICT use.

It is also possible to interview representatives of office users who meet the criteria as described above.

Real estate owners:

Real estate owners need to be in the possession of real estate for office use or catering industry with (simple) workplaces[5].

Public transportation companies:

Public transportation company's need to own or exploit vehicles that provide or in the near future can provide with (simple) workplaces[6] and facilities for travellers to (partly) perform their work activities as determined in paragraph 3.1 .

ICT developers:

ICT developers need to be developers of devices/hardware or software. It is assumed that up-to-date knowledge about current and future developments is available.

Innovators:

The innovators, also called futurists or visionaries, need to be relevant to ICT, and/or real estate for office use.

Other than frontrunners in ways of working and ICT use, there is no distinction in company size or sectors, as the relationship between real estate and users is central rather than the sector and the amount of the users. The office/workplace providers are divided into five groups (see Figure 22). The office user respondents are those who make use of facilities of the suppliers. Because this research is inductive and therefor an iterative process, the proposed respondents might change during the research.

Figure 22 Respondents suppliers

Innovators	Early adaptors	Early majority	Late majority	Laggards
Futurists - Marcel Bullinga - Marjet Rutten - Dr. James Canton ICT device & software developers - Microsoft - Cisco - Getronics -Capgemeni - OGD	Workplace providers: - Regus - Microsoft (Schiphol)	Workplace providers: - Seats to meet - Google - Starbucks - NS - GVB - KLM - Igluu - Spaces - …	Workplace providers: - European Patent Office (EPO) The Hague - Other companies	-

[5] Workplace where a laptop can be used for processing and entering information.

2.5 Answering research questions

The research questions will be answered according to theoretical and empirical input as illustrated in Table 6.

Table 6 Answering research questions

Research question		
Introduction		
Literature study: -Results	Qualitative input: -Results	Comparison: -Differences -Similarities
Conclusion		

Qualitative Analysis

The framework developed by Miles and Huberman (1994) describes the major phases of data analysis: data reduction, data display, and conclusion drawing and verification.

Data Reduction

Conducting a qualitative research can result in a large data collection. The mass of data has to be organised and somehow meaningfully reduced or reconfigured. Miles and Huberman (1994) describe this first of their three elements of qualitative data analysis as data reduction. "Data reduction refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written up field notes or transcriptions." Not only do the data need to be condensed for the sake of manageability, they also have to be transformed so they can be made intelligible in terms of the issues being addressed. The most salient portions of the data will be used to answer the research question. Apart from exploring the specific content of the respondents' views, it is also a good idea to take note of the relative frequency with which different issues are raised, as well as the intensity with which they are expressed.

Data Display

Data displays, whether in word or diagrammatic form, allow the analyst to extrapolate from the data enough to begin to discern systematic patterns and interrelationships. At the display stage, additional, higher order categories or themes may emerge from the data that go beyond those first discovered during the initial process of data reduction.

Trend watching

Trend watching (understanding and following trends) in this research is done first by literature studies, of which Grartner's Hype Cycle followed by in-depth interviews with professionals. The data from the interviews has been compared with the obtained literature, which in some cases led to new literature and conclusions.

2.6 Research instruments:

The research methods are: conversations with office workers, literature study, conversations with experts, in-depth-interviews with the respondents and brainstorm sessions.

In order to ensure high quality of the research, the four criteria given by (Groat and Wang, 2002)for qualitative research are taken as premise:

- *Credibility* – addresses the truth-value of a research (Groat and Wang, 2002), in other words how far results represent reality. In order to ensure this, triangulation from multiple sources was conducted. Additionally member checks will be done, where data interpretation after analysis is checked with respondents from whom the data was obtained.
- *Transferability* – 'has to do with the extent to which conclusions of one study can be applied to another setting or circumstances' (Groat and Wang, 2002). A description of the analysed case will be

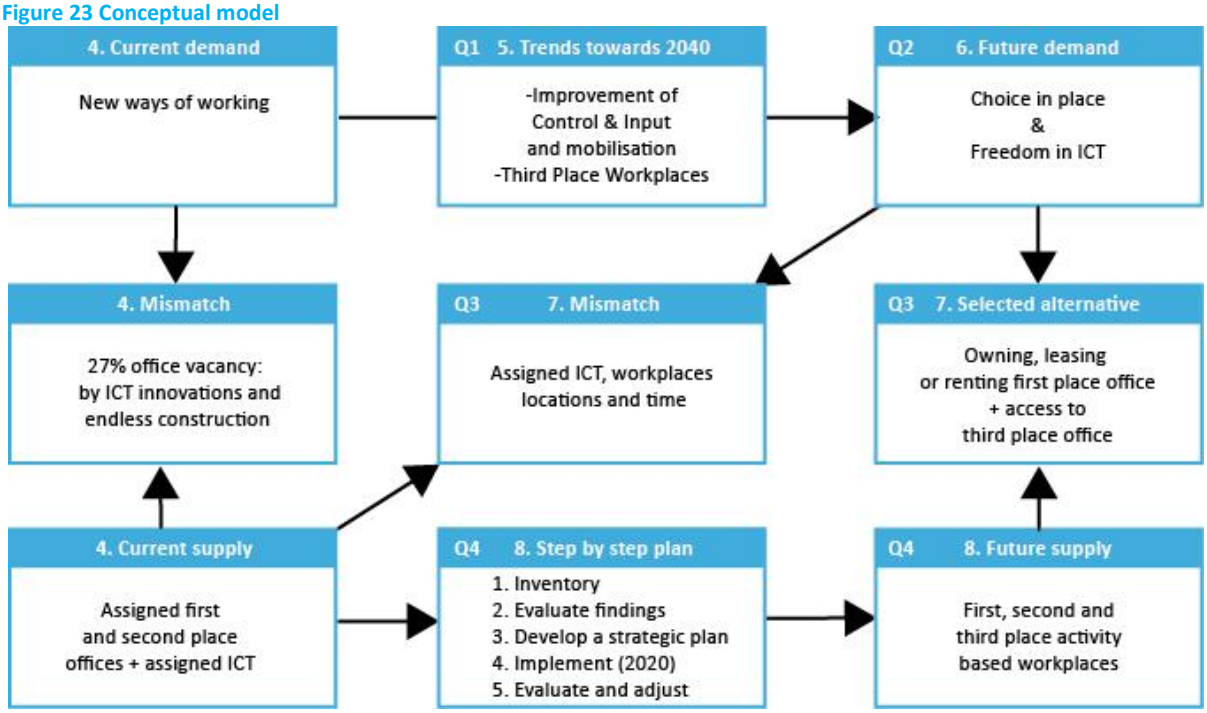
made to fully comprehend the case specifics, this allowed for a better understanding of the differences and similarities to other cases. Other researchers will thus have a better ability to judge the transferability of findings to their own research.

- *Dependability* – is a measure for the consistency within data. This was secured by making an 'audit trail' which documents all the processes by which data was collected, analysed and interpreted. In other words providing a complete database and showing how the data was obtained. This allows other researchers to track down possible instability of data.
- *Confirmability* – rather than demanding objectivity of data, investigators data and interpretations should be confirmable. This is ensured by triangulation and reflection on my epistemological assumptions and possible changes in perspective that may emerge during the course of the study. While this research doesn't have the ambition of generalizability, paying close attention to each of these four premises allows this research to be reviewable by others researchers. This makes it easier for others to verify findings and possibly build upon them.

2.7 Conceptual Framework

This chapter further identifies the research field, including the results of the source study. As already mentioned in chapter one, the DAS-Frame is used for this research. The trends in ICT that changes the current demand into the future demand form the base of this research. The theoretical framework for this research can be divided into four themes, namely the users, organisation, ICT and CREM and consider the demand as well as the supply of real estate (see Figure 23).

Figure 23 Conceptual model



2.8 Research organisation

TU Delft

- Coordinator of the CREM laboratory: Dr. ir. D.J.M. (Theo) van der Voordt.
- First mentor: ir. M.H. (Monique) Arkesteijn MBA. Arkesteijn will mostly give guidance to the CREM part of my report.
- Second mentor: Dr. ir. A. (Alexander) Koutamanis. Koutamanis will mostly give guidance to the ICT part of my research.

Heren2

- Graduation company: Heren2 B.V.: Heren2 will facilitate this research with internal knowledge, a network of relevant professionals and a workplace. The director and shareholder, ir. P.U. (Patrick) Virginia MRE will give guidance on the implementation and knowledge and experience from practice.

Heren2 is a multi-disciplinary real estate company existing of a team of experienced real estate specialists, mainly active in the field of (re)developing and renovating real estate. Heren2 is also active in the field of property management. The wide range of specialism allows Heren2 to add value to almost every aspect of feasibility studies, construction and/or housing projects as well as managing real estate and portfolios. Not only architectural and construction wise, but also legal or commercial expertise.

In addition, Heren2 has a broad knowledge and experience when it comes to complex redevelopment tasks, area development tasks and renovating monuments. Heren2 is located in Amsterdam and in Curaçao and thus operational on an international level. Next to the support heren2 provides to this research, with this research Heren2 obtains more knowledge about the (future) demand of their (potential) tenants. This enforces the match between the supply and the demand, which prevents vacancy, attracts and retains tenants evolving in a successful real estate development for the coming two or more decades.

De Houthavens

One of the projects of Heren2 is the Houthavens. This area undergoes a transformation development from industrial area into a creative industry business area with future aim at creating a mixed function area destined for living, working and recreation. This research will give input to develop a durable and matching supply.

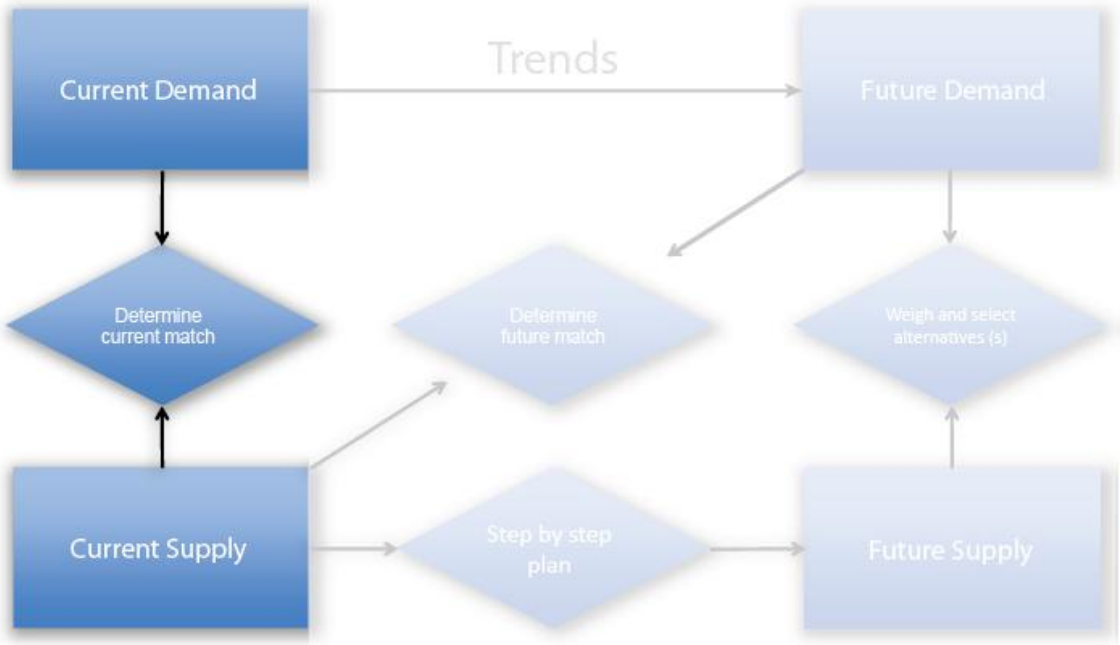
Student

- Master student: R.P.C. (Robert) Rosa BSc: I will conduct the research independently with guidance from my mentors. I am responsible for the planning, quality and final product.

All mentors have a network in the business to obtain a wide variety of valuable respondents and other contacts for the research.

II. Setting the basis

3. Introducing the world of office work



3.1 Introduction

This chapter sets the basis of the research topic, which is “Corporate Real Estate Portfolios 2040 according to ICT trends”. The term ‘Corporate Real Estate Portfolios’ will be broken down to have an unambiguous understanding about throughout this report. To have a broader perspective, a corporation will be referred to as an organisation. Real Estate Portfolios will be broken down in workplaces, offices and locations. Finally, the meaning of ‘ICT’ will be explained.

Before starting the journey through the emergence and further development of the office, this chapter will introduce the meaning of the organisation, the office worker and the office is clarified.

3.2 Defining the organisation, the office worker and the office

Office work activities done by knowledge workers

For this research the office users are divided into employers, employees and their customers. The employers and employees are office workers, also called ‘white-collar’ worker. The terms ‘office employee’ and ‘office worker’ will be used interchangeably to render the French term *employé de bureau.* While the former is a more literal translation, the latter is at least in America the more commonly accepted term (Crozier, 1971).

Office workers perform their primary processes in an office building or at a workplace. The primary process of office workers started with writing and administrating economical activities. Nowadays the primary processes of office users are performing professional, managerial, or administrative work. More specific in this research, the office worker is called “knowledge worker” (also called ‘Solution Workers’). The term ‘knowledge worker’ is increasingly used to describe workers who do not just provide information, but are also responsible for generating and conveying essential knowledge needed for making decisions. Often these skills requirements are manifested in increased demand for workers with higher education levels. These individuals are valued by companies because their specialised knowledge of a specific subject area, along with their ability to offer analysis and development within that area, helps to advance the company’s overall understanding of that area and the strategies they can then base around it.

Jobs will favour strong cognitive and entrepreneurial abilities. In demand are the high-level skills needed for managing, interpreting, validating, transforming, communicating and acting on information. Valued attributes include no routine analytic skills such as abstract reasoning, problem solving, communication and collaboration. Workers with these skills can perform tasks requiring a level of action that cannot be done easily by computer software.

An overview of office work competencies

Oliverio et al. (2006) describe a wide range of proceedings that make up office competencies. However, four major groups based on primary skills reflect the overall nature of office work. These are:

- Word processing
- Data processing
- Information management and transmission
- General managing and communicating

Word processing

Word processing is the producing of written documents such as letters or reports by using software programs and computers. Usually these documents are shared in printed form, but more and more in digital form. Desktop publishing is closely related to word processing and requires many of the same skills. Desktop publishing is the producing of documents that include both text and graphics. Examples of these documents include newsletters, brochures, and forms. Executives and managers, both general and technical, spend much time composing written communications. Technical personnel, such as engineers, advertising designers, architects, and public relations specialists, are employees likely to use word processing and basic desktop publishing skills in their work.

Data Processing

Data processing is the collecting, organising, analysing, and summarising of data, generally in numeric form. Many positions require competency in such skills. This type of activity is usually done at a computer, using spread sheet and statistical software programs. Data processing and word processing are often collectively referred to as information processing. Many workers do this type of office activity. Data processing is done by accountants, budget analysts, brokers, insurance salespersons, and many other types of personnel found in all kinds of organisations deal with data and prepare reports.

Information Management and Transmission

Information management refers to the organising, maintaining, and accessing of data. Transmission refers to the communicating of information both within and outside the organisation. A wide range of workers is likely to need the skills for information management and transmission. Personnel such as buyers, real estate brokers, and property managers must have well-organised information systems. The details they need to make decisions often require them to design their own systems. Often their information must be available to others, too. Following a well-designed system is the key to easy use of information.

General Managing and Communicating

General managing and communicating are broad areas that involve handling work time and tasks efficiently and interacting with other employees and customers. Setting up schedules, meeting deadlines, and tracking the progress of tasks are aspects of general managing. Communicating with customers and co-workers is a common activity for many types of workers in a company. Reporting

on the progress of tasks, projects, or budgets are also aspects of general managing. Often, these reports are given orally and delivered with the use of a multimedia presentation.

General management and communication skills are critical for a wide range of employees, from executives to salespeople to office support staff. Office employees must be good managers of their own time. In addition, they must be skilful in guiding the work of any employees who report to them. They must be able to establish priorities and follow schedules for the completion of tasks. They must communicate clearly and effectively to co-workers and customers.

Altogether, for knowledge workers to perform these four proceedings, the following basic activities are done:

- Reading
- Listening
- Watching
- Writing drawing
- Operate computer applications
- Computer mediated Communication (CMC)
- Natural communication
- Commuting

Examples of outputs from knowledge work are analyses, evaluations, instructions, programs, plans, assurances, reasoning or arguments, decisions, and action plans. In other words, knowledge work is human mental work performed to generate useful information and knowledge. In doing the work, knowledge workers access data, use knowledge, employ mental models, and apply significant concentration and attention. Examples are systems analysts, programmers, accountants, managers, analysts, and lawyers. Work may be done individually, in groups, or in teams. How do knowledge workers differ from clerical workers? Just as knowledge workers may engage in some clerical activities in performing knowledge work, clerical workers may perform some knowledge work activities. The difference is the mix of work activities; for the knowledge worker, the dominant, most important activities are knowledge work activities. Nowadays, most of these activities are done with the use of ICT.

Office activities done via ICT

Since its origins, Information & Communication Technology (ICT) has continuously extended into new areas, making its way from mathematical computation and data processing via office automation to electronic commerce. During its expansion and transformation, existing technologies like telecommunication and manufacturing have been reshaped, and new ones like mechatronics and virtual reality were created. In today's society, information has become one of the essential goods, and information technology is rapidly becoming an integral part of modern society and everyday life.

Many times ICT is linked to networks or network cables servers and other devices related to networking. To make prevent misunderstanding or unilateral understanding of ICT, the definition and scope is stated. ICT stands for Information & Communication Technology. In 'the history of computing', Boogaard describes (2012) that in the eighties the term 'Information Technology' (I.T.) was the overall theme for information technology and automation. Especially in the 1980s when the first steps were taken to historiography. In the same decade ICT was the usual indication. It is moreover a special feature of the Dutch for the "C" of communications to be added. In the English literature one finds it superfluous.

In general, ICT is known as a term that stresses the role of unified communications[7] and the integration of telecommunications (telephone lines and wireless signals), computers as well as

[7] (UC) is the integration of real-time communication services such as instant messaging (chat), presence information, telephony (including IP telephony), video conferencing, data sharing (including web connected electronic whiteboards aka IWB's or Interactive White Boards), call control and speech recognition with non-real-time communication services such as unified messaging (integrated voicemail, e-mail, SMS and fax) (Wikipedia).

necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to create, access, store, transmit, and manipulate information. In other words, ICT consists of IT as well as telecommunication, broadcast media, all types of audio and video processing and transmission and network based control and monitoring functions.

Information and communication technologies (ICTs) have revolutionised work practices: the acquisition, processing and storage of data thanks to hardware, software, and networks have changed the face of work in offices and factories. Their impact has been felt beyond the walls of traditional companies' spaces, resulting in the modification of time and space constraints at work and in the constant blurring of the frontier between private and work life.

On the work floor, knowledge workers use a computer to perorm most of their activities. A computer is a device which can be programmed to carry out a finite set of arithmetic or logical operations. According to Campbell-Kelly and Aspray (1996) the first computer dates back from the year 1890. This was a piece of equipment constituting a new punched-card tabulating system for processing the U.S. census. Others claim that computers go way back, even BC. The most striking innovation in the field of ICT is the personal computer (Dijk et al., 2000). In the Netherlands the device entered the market in the early eighties, less than 20 per cent of all workers operated some sort of computerised equipment at work, It was not until the nineties before a significant proportion of the population was about to purchase a personal computer for private use. by 2005, this had risen to over 80 per cent (see (Borghans and Ter Weel, 2005) and (Soete and Ter Weel, 2005) for an overview). These developments have also hugely impacted the way we work

One of the most important features of computer technology is that it complements our work. It has reduced the costs of many kinds of interactions by making a great many processes operate more efficiently, and it has made it possible to engage in new interactions that have become cost effective.

Nowadays it is almost impossible to imagine a world without computers. Most data and information is processed by a computer. Office workers use computers to process documents, make calculations, listen and look to audio-visual data or communication. Weiser (1991) sets out the major trends in computing, which is summarised in Table 7.

Table 7 The coming age of calm technology (source: (Weiser, 1991))

The Major Trends in Computing	
Mainframe	many people share a computer
Personal Computer	one computer, one person
Internet - Widespread Distributed Computing	*…transition to…*
Ubiquitous Computing	many computers share each of us

Different workforce characteristics

When researching the demand of office workers it is important to understand the different users and their backgrounds. On an abstract level office workers can be divided into two types of workers, namely the Employee and the Professional. When office workers team up, different personalities can be observed. Also different generations are joining and leaving the work floor. This paragraph elaborates more on the two different workers and different generations who have influence on the demand this research is investigating.

Two Types of Workers: the Employee and the Professional

In today's workplace there are two types of workers: the employee and the professional. The employee is the individual who recognises himself as someone hired to do a particular job for a particular salary. The professional sees himself as the person within the company who reliably performs to make a difference. The professional seeks challenge and is not afraid of failure. The employee focuses on completing the task at hand and receiving compensation. The employee, however, is focused on his job as it has been defined: meeting expectations, following the rules, and

other forms of job preservation and advancement. The employee seeks comfort and safety while avoiding risks through routine. Innovation is limited to small optimisations of the status quo. The professional concentrates on how to tackle the job. Both types of workers experience very different results at the end of the day, mainly with regards to passion, motivation, perception and attitude. The individual who claims, "I am only an employee," is passionate about arriving at work and completing the assigned task. He may feel increasingly motivated as it approaches payday because perceives his role as doing a job for a salary. His attitude is to get the job done within the given time. On the other hand, the professional is driven by a passion to perform at a superior level by taking pride in his work, delivering the best service to both internal and external clients, always seeking ways to improve, helping colleagues excel at what they do and being a great team player.

The professional is motivated by daily challenges, workplace changes and the desire to make a difference; motivating others along the way. He perceives himself as an important staff member who receives an opportunity each day to deliver nothing less than quality service adhered to high standards. His attitude is always positive, focused on meeting the client's needs and not on being first to walk out the door at the end of the day.

Most organisations would like their employees to stop working as employees and start working as professionals. Ironically, many organisations do not encourage this shift to take place. Organisations that truly value their employees will embrace and implement strategies that motivate and support their employees, which allow them to feel, respected and most importantly, valued. These organisations will produce more professionals than employees. Other than the dichotomy of professionals than employees, office workers have different personalities.

Different personalities

Apart from 'the professional' and 'the employee', office workers have different personalities. Very often, office workers work in teams consisting of members with different characters. A good team exists of few personalities in team roles described by (Belbin, 1981) who posited the necessity for eight team roles to be deployed within a team for it to operate optimally. Belbin coined special names for the team roles, giving their characteristics as:

- *Completer-finisher:*

  Painstaking, conscientious, anxious; searches out errors and omissions; delivers on time; perfectionism; obsessional behaviour.
- *Chairman (named* Co-ordinator (Belbin, 1993)*:*

  Mature, confident, a good chairperson; clarifies goals, promotes decision making; delegates well; inclined to be lazy; takes credit for effort of a team.
- *Company worker*:

  Disciplined, reliable, conservative, and efficient; turns ideas into practical action; adherence to the orthodox and proven; obstructing change.
- *Monitor-evaluator:*

  Sober, strategic, discerning; sees all options; judges accurately; scepticism with logic, cynicism without logic.
- *Plant:*

  Creative, imaginative, unorthodox; solves difficult problems; preoccupied with ideas and neglects practical matters; strong ownership of ideas.
- Resource investigator:

  Extrovert, enthusiastic, communicative; explores opportunities; develops contacts; loses enthusiasm once initial excitement has passed.
- Shaper:

  Challenging, dynamic, thrives on pressure; has the drive and courage to overcome obstacles; a proneness to frustration and irritation; inability to recover situation with good humour or apology.

- Team worker:
  Co-operative, mild, perceptive, and diplomatic; listens, builds, averts friction, calms the waters; indecision on crucial issues; avoiding situations that may entail pressure.

Of course, team roles can be divided and named other than Belbin does, but the point is that there are different types of workers to form a team with. The composition of a team is considered to have a strong influence on team processes and outcomes (Bell, 2007). Besides the traditional groups of employers and employees a third powerful group arises: the 'freelancers'.

"Small is the new big, only when the person running the small thinks big.
Do not wait. Get small. Think big".
-Seth Godin[8]-

The Independent Professional

In the book 'Society 3.0' Hoff (2011) explains that business has been in motion quite a bit in recent years. More and more people experience an employment contract with an organisation that is not as certainty as earlier times, they have decided to work for themselves. The economic recession has reinforced that process. This huge stream of people are self-employed and are called 'Free lancers', 'FreeAgent' or 'Self Employed Professional' (SEP). It is a movement that can be seen throughout the Western world. At the moment, the SEP's constitute almost 10% of the workforce. Observing the current movements, in the coming years this share may reach 30% or even up to 40% of working people. The SEP's are being supported in their actions by the Internet (2.0). It just allows them to finally be able to easily network and find like-minded people. That is exactly how the SEP acquires knowledge, contacts, and tasks. The SEP is a wanderer through virtual networks.

"A Knowmad is a nomadic knowledge worker - that is, a creative, imaginative, and innovative person who can work with almost anybody, anytime, and anywhere. Technologies allow for new thesis paradigm workers to work either at a specific place, Virtually, or any blended combination. Knowmads can instantly reconfigure and recontextualise Their work environments, and greater mobility is creating new opportunities".
-John Moravec-

Organisation

An organisation is a social entity that has a collective goal and is linked to an external environment. An organisation is a tool, a vehicle that creates a product or service with people and resources within a given period of time that is of value to the recipient thereof. Because of this, the service or product is sold at least as much a higher price than the purchase plus add the cost of the value. In the value chain that is called making profit. There are a variety of legal types of organisations, including corporations, governments, non-governmental organisations, international organisations, armed forces, charities, not-for-profit corporations, partnerships, cooperatives, and universities. A hybrid organisation is a body that operates in both the public sector and the private sector simultaneously, fulfilling public duties and developing commercial market activities. Most of the time an organisation consists mainly of a management team, staff, employees and clients. According to management science, most human organisations can be divided into four types:

- Pyramids or hierarchies
- Committees or juries
- Matrix organisations
- Ecologies

[8] Seth Godin (born July 10, 1960) is an American entrepreneur, author and public speaker.

A hierarchy exemplifies an arrangement with a leader who leads other individual members of the organisation. This arrangement is often associated with bureaucracy. These structures are formed on the basis that there are enough people under the leader to give him support. Just as one would imagine a real pyramid, if there are not enough stone blocks to hold up the higher ones, gravity would irrevocably bring down the monumental structure. One can imagine that if the leader does not have the support of his subordinates, the entire structure will collapse. Management of organisations is in this case the decision maker and peruse a certain return on investments. To maximise this return on investment the organisation needs to attain and retain the best people for the job, who can deliver products or services within time, budget and quality.

In this research the focus lays on corporations as legal type of organisation with a pyramid, hierarchy matrix or an ecology type of structure. Having these different types of structures and goals, one corporation is not the other. Therefore it is important to match their accommodation with the type of organisation (e.g. the primary process and corporate culture). Organisations themselves are changing rapidly as well. They grow or shrink, try to tap into new markets and adapt their working processes to new technological infrastructures, particularly focussing on Information and Communication Technology (ICT). Highly specialised employees no longer work individually, but co-operate in multidisciplinary teams. In order to attain and retain the best people, an employer needs to be interesting. Therefore organisational structures become increasingly flexible and ‘flat'.

From a business point of view the office workers activities are done to serve the customers of the organisation knowledge workers work for. Mainly these activities take place at offices owned by the organisation. This main workplace is also referred to the ‘First Place’ workspace. There also is a ‘Second Place’ and ‘Third Place’ workspace, which will be discussed.

Three types of work places and locations

Oldenburg (1989) calls one's "first place" the home and those that one lives with. The "second place" is the workplace where people may actually spend most of their time (8 hours a day, 5 days a week). Third places, then, are "anchors" of community life and facilitate and foster broader, more creative interaction. All societies already have informal meeting places; what is new in modern times is the intentionality of seeking them out as vital to current societal needs. Oldenburg suggests the following hallmarks of a true "third place":

- Free or inexpensive
- Food and drink, while not essential, are important
- Highly accessible: proximate for many (walking distance)
- Involve regulars – those who habitually congregate there
- Welcoming and comfortable
- Both new friends and old should be found there.

Both the first and third place will be infiltrated by activities that happen in the second place and the first and third place characteristics are integrating in the second place. However, in this research, the focus lies on work, which makes the office the first place and home the second workplace. Overall, the following three types of first place locations can be described:

1. **Central locations**
   Central office locations are close to or are part of a city center. Features are multi-functionality, liveliness and often good access by public transport. The accessibility by car is often less good, especially in the larger urban centers, there may be congestion and parking solutions are scarce and costly. The characteristics of buildings in central locations vary greatly. Near or around a central train station, there is a concentration of large office buildings, with some large users. Towards the real city center buildings are diverse and

smaller. Space for new construction is scarce and office buildings often have a monumental character or have been renovated.

The type of user in central locations could include headquarters, superregional oriented, large public services (especially around central stations). Towards the city center more small-scale users who appreciate the dynamic environment of a town. As a background to these companies may include high-quality and creative consultancy.

2. **Formal locations**
   Mono functional office locations and large office on business parks are known as formal office locations. From the users perspective these locations are seen as real business work locations. Characteristics are relatively uniform buildings and good accessibility by car, including good parking. The accessibility by public transport does not necessarily have to be good. There can be a small train station or express bus or tram connections. Thought, buildings at these locations are relatively young. Many of the formal locations have been developed over the past 20-30 years. The types of users vary with price ranges. Large business and financial services and ICT companies are placed in a more expensive segment. Companies in the wholesale trade industry and offices of construction and transport are in the lower segment.

3. **Other locations**
   Other locations are scattered office concentrations. They can be offices located in residential areas or at the countryside. The type of buildings is diverse, office villas, canal houses, and contracted dwellings in residential areas or separate office pavilions at the countryside. The offices are not necessarily easily accessible by car or public transport. Amenities are very dependent on the location in the residential area. The type of user are small-scale consumer-oriented services (broker, mortgage consultant), high quality service providers (architects, legal, accounting) and smaller public services or a local bank.

The office

In this research the term accommodation refers to real estate, but what is real estate actually? Van der Voordt et al. (2004) extensively describe real estate and the management of real estate in the book ‘Inleiding Vastgoedmanagement’ (Introduction Real Estate Management), which will be summarised in the next paragraph. Other than our homes, they are the places in which we spend most of our time. They are home to our talents, energies, and efforts--our work.

Offices reflect our society's values. They show that we care about efficiency and order but also power and authority. They reflect our beliefs about progress and high technology, but also competition and cooperation.

In this research, an office is a place where people do their work. In modern terms an office usually refers to the location where white-collar workers are employed. However,

Figure 24 Basic office features

an office performs its primary duties by protecting the workers from wheatear. In order for the office workers perform these activities with comfort some basic features (see Figure 24) must be present. These features are:

- Protection against the outdoor climate.
- A chair to sit in.
- A desk to work on.
- ICT (i.e. internet, computer printer / scanner / copier).
- Storage for files and other products.

The main purpose of an office environment is to support its occupants in performing their job, preferably at minimum cost and to maximum satisfaction. With different people performing different tasks and activities, however, it is not always easy to select the right office spaces. To aid decision-making in workplace and office design, one can distinguish three different types of office spaces: work spaces, meeting spaces and support spaces. For new or developing businesses, remote satellite offices and project rooms, Serviced Offices can provide a simple solution and provide all of the former types of space. The structure and shape of the office is impacted by both management thought as well as construction materials and may or may not have walls or barriers.

Offices reflect societal values. They show that we care about efficiency and order but also power and authority. They reflect our beliefs about progress and high technology, but also competition and cooperation. Office buildings are partly or completely leased or owned by organisations. Throughout this thesis, the office and relevant matters will be further discussed. But, it is important to understand the emergence of the office.

3.3 The emergence of the office

It is obvious that administration has been conducted for many centuries, but previously it did not take place in such extent that separate buildings were founded for. Administration was a side issue which took place in the houses of the merchants, in production buildings, warehouses or monumental and representative town halls, palaces, churches, monasteries or barracks. Letters, contracts and accounts were written, and it also kept handwritten copies. Most of the time writing was done standing behind high tables, which also took up little space and demanded rather no other provisions.

The first office

The first office originated with the invention of the printing press by Johannes Gutenberg, around 1450. This office work took place mainly at home. The first office buildings rose around the Middle Ages starting in 1560 with the palace by Giorgio Vasari for Cosimo I de' Medici as the offices for the Florentine magistrates hence the name "uffizi" ("offices") (see Figure 25). Also the Bank of England (The Four Per cent office, Bank of England, 19th Century, John Soane) is a notable example (see Figure 27).

Figure 25 Uffizi in Florence

It was ordered in 1560 by **Cosimo I de' Medici**, first Grand Duke of Tuscany, to house the administrative and judiciary offices of Florence, the “uffizi” (Italian for “offices”) service skills, job, function, duty. This word was used in the 15th century by the theoreticians of the Renaissance, in

particular by Francesco di Giorgio in idealised urban and architectural studies, a collective building where the clerks should do their job.

The first office users were often governments, banks, stock exchanges and notaries. The users were, amongst others, bankers, merchants and notaries. An example of an office building from 1560 is the Uffizi in Florence, which served as the office for the magistrates and later served as a model for the offices of the industrial revolution.

Figure 26 Uffizi layout

The first commercial offices appeared in the northern industrial cities of the United States in the late nineteenth Century. With the invention of the telegraph and telephone, offices could be situated away from the home or factory and control could be retained over production and distribution to distant markets. New technologies such as electric lighting, the typewriter and the use of calculating machines allowed large amounts of information to be accumulated and processed faster and more efficiently than before. The concentration of wealth in the new corporations required an ever-greater proportion of an increasingly literate population to work in the 'white collar factories'.

Europe follows the Uffizi's example and respectable let the history of the office begin in the 19th century, which in this context is characterised by the word "growth". This growth was based on a multitude of factors, which are strongly reinforced: better farming methods, strong population growth, colonisation, industrial revolution, developments in transportation, scale in administrative units, financial and banking developments, the introduction of obligatory education, sanitation improvements and so on. The enormous up scaling as a result also included growing need for administration and archiving. As the first examples of the type "office buildings" that arose, Pevsner[9] considers three insurance offices in London and Liverpool which were designed between 1830 and 1860 by the renowned architect when C.R. Cockerell.

Figure 27 The Four Percent office, Bank of England

Immediately there was a distinction made, which is still very important when constructing offices: the specific office for one owner-user and the office building for lease.

A second aspect that quickly led to specific spatial and functional needs was the technical development of devices that had to make office work more efficiently. A good example is the typewriter. Also, it was not long before they found out that much of the office work could be performed probably cheaper and more carefully by women. Another important factor that played a role in the emergence of the office is the industrial revolution.

[9] Sir Nikolaus (Bernhard Leon) Pevsner, CBE, FBA (30 January 1902 – 18 August 1983): architectural historian in Britain.

The industrial revolution

Figure 28 Industrialisation

The Industrial Revolution began in the 18th century in Great Britain. It was only the first stepping-stone to the modern economic growth that is still growing to this day.

In the book 'The new office', Francs Duffy and Powell (1997) explain de changes in offices, starting in the 19e century. The locally oriented American economy of the early 1800s did not need offices as we know them today. Business was run then much as it had been run for half a millennium. Goods were made, transported, and sold. With the help of a few clerks, merchants ran their small companies as family businesses. Few differences distinguished the merchants in early-nineteenth-century Boston from those in thirteenth-century Florence.

With the arrival of the railroad, however, the general merchant's business and the entire nature of American commerce changed forever. The railroad not only united the states, changed how and where we lived, and dramatically altered the country's image, it also transported goods almost anywhere. Suddenly, coal and the steam engine made it possible for business fortunes to increase as rapidly as they could be expanded westward. Using the railroad, local businessmen could do business nationally. And they could no longer do their business in their heads. Once the stakes for business increased, so did the logistics.

Not since the end of the nineteenth century, when large office buildings were first invited, has there been such innovative thinking about office design. Finally, the technical development played an important role in the design of the building type. The first offices were based on masonry structures, but soon the new material iron was used in construction. Their success and the design and use of office space were critical. Hard and efficient work was of great importance for the business. Back then during office work it was a shame to do something with pleasure, feeling good was bad. Managing change must involve simultaneously rethinking the use of human resources, reinventing the ways in which information technology should be used, and redesigning the working environment. Scientific Management has entered the office.

Taylorism: Scientific Management

Figure 29 Frederick Taylor

Frederick Taylor began what was known as scientific management. In the 1880s, when most workers still laboured in agriculture or factories rather than in offices, Taylor developed techniques in the steel industry that taught factory managers how to save money and increase productivity by making their employees more efficient. How the job was to be done was thought out by management; workers were mere instruments to execute the tasks.

Frederick Taylor 1856-1915 was for a large part responsible for the dominant office structure in the twentieth century. His theories made Henry Ford's mass production possible. Taylor contributed to management thinking 'scientific management', this can be translated into treating people as units of production. Taylorism, which was dehumanisation of work, first began in the factory and later in the office. Efficiency was optimised bye time and motion studies. This phenomenon took place during the first decade of the 90's in North America and later in Europe. In Europe it was implemented slightly different, but similar was that intelligence and inventiveness was not expected from workers.

IT at that time was telephone and type writers and workers needed to be at the same place at the same time to perform their job. The conventional office is an exercise in simultaneity with everyone at their place. It was the nine-to-five working day with a sharp separation between home and work, which can still be seen in some organisations today. Taylors influence on the physical office hindered new ways of working. Value, order, hierarchy, supervision and depersonalisation were integrated in architecture. However, in the 1990's, managerial innovation momentum stimulated by developments in IT had little effect on designers of the physical office environment.

Figure 30 The conventional office

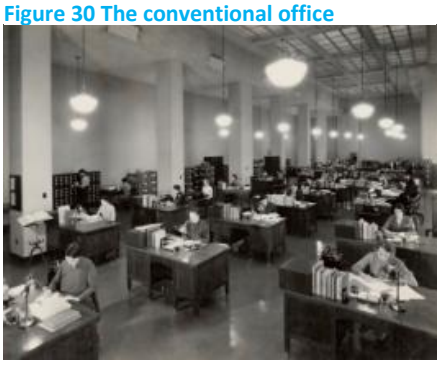


Figure 31 Wainwright Building: plan

The industrial revolution was dominated by the development of mass production techniques and created clustered activities. In North America, exploitation of steel and the elevator made it possible to build tall. Also electric lightning and air-conditioning made buildings comfortable and attractive to work in. There was less concern what people in those buildings actually did all day and how they perform their tasks.

Gentleman clubs were determined only for the elite group consisting of ambitious, successful, intellectual people with common interests in a rich and divers environment with level of comfort and service each member could not afford solely. Some businesses tried to emulate this for more interaction among staff, access to richer resources to accommodate more types of activity and save money. There was a desire for club-like offices for different time tables, for networkers who do not have to be told what to do or where to be at a certain time but need a place to meet, exchange ideas, and share resources. The real revolution is happing now. Organisations, habits and the relation between home and the office are being renegotiated.

Typical designs used contemporary but conventional furniture which was available at the time. Standard desks and chairs were used, with lateral file cabinets, curved screens, and large potted plants used as visual barriers and space definers. Floor plans frequently used irregular geometry and organic circulation patterns to enhance the egalitarian nature of the plan. Many designs used slightly lower than normal occupancy density to mitigate the acoustical problems inherent in open designs.

Office furniture companies quickly developed 'panel-hung systems' and other types of 'systems furniture' which sought to provide some of the advantages of office landscape, but with slightly greater privacy, density, and storage capacity. Initially, the layouts typical of these systems imitated the irregular, organic forms of office landscape. However, they quickly degenerated into the regimented 'sea of cubicles' common in modern offices and reminiscent of earlier 'Taylorism'. The 'sea of cubicles' effectively replaced office landscape by the mid-1960s.

3.4 Conclusion

The organisation and knowledge workers

An organisation is a social entity that has collective goals and is linked to an external environment. To maximise this return on investment the organisation needs to attain and retain the best people for the job, who can deliver products or services within time, budget and quality. In this research the focus lays on corporations as legal type of organisation with a pyramid, hierarchy matrix or an ecology type of structure. Having these different types of structures and goals, one corporation is not the other. Therefore it is important to match their accommodation with the type of

organisation (e.g. the primary process and corporate culture). Organisations themselves are changing rapidly as well. They grow or shrink, try to tap into new markets and adapt their working processes to new technological infrastructures, particularly focussing on Information and Communication Technology (ICT). Highly specialised employees no longer work individually, but co-operate in multidisciplinary teams. In order to attain and retain the best people, an employer needs to be interesting. Therefore organisational structures become increasingly flexible and 'flat'.

For this research the office users are divided into employers, employees and clients. Clients mostly visit the office for meetings. The employers and employees are office workers, also called white-collar worker. The primary processes of office users, also called 'knowledge worker' are performing professional, managerial, or administrative work. There are three types of knowledge work tasks: job-specific, knowledge-building and maintenance, and work management (Davis and Naumann, 1997).

Four major groups based on primary skills reflect the overall nature of office work. These are:

- Word processing
- Data processing
- Information management and transmission
- General managing and communicating

The high-level skills needed for managing, interpreting, validating, transforming, communicating and acting on information. From a business point of view the office workers activities mainly take place at an office. This main workplace is also referred to the 'First Place' workspace. There also is a 'Second Place' and 'Third Place' workspace.

Three places

Oldenburg (1989) calls one's "first place" the home and those that one lives with. The "second place" is the workplace where people may actually spend most of their time (8 hours a day, 5 days a week). Third places, then, are "anchors" of community life and facilitate and foster broader, more creative interaction. All societies already have informal meeting places; what is new in modern times is the intentionality of seeking them out as vital to current societal needs. Both the first and third place will be infiltrated by activities that happen in the second place and the first and third place characteristics are integrating in the second place. However, in this research, the focus lies on work, which makes the workplace the first place and home the second workplace.

The office

In this research, an office is a place where people do their work. In modern terms an office usually refers to the location where white-collar workers are employed. However, an office performs its primary duties by protecting the workers from wheatear. In order for the office workers perform these activities with comfort some basic features (see Figure 24) must be present. These features are: protection against the outdoor climate, a chair to sit in, a desk to work on, ict (i.e. internet, computer printer / scanner / copier) and storage for files and other products. The main purpose of an office environment is to support its occupants in performing their job, preferably at minimum cost and to maximum satisfaction. To aid decision-making in workplace and office design, one can distinguish three different types of office spaces: work spaces, meeting spaces and support spaces. For new or developing businesses, remote satellite offices and project rooms, Serviced Offices can provide a simple solution and provide all of the former types of space. Offices reflect societal values. They show that we care about efficiency and order but also power and authority. They reflect our beliefs about progress and high technology, but also competition and cooperation. Office buildings are partly or completely leased or owned by organisations.

The emergence of the office

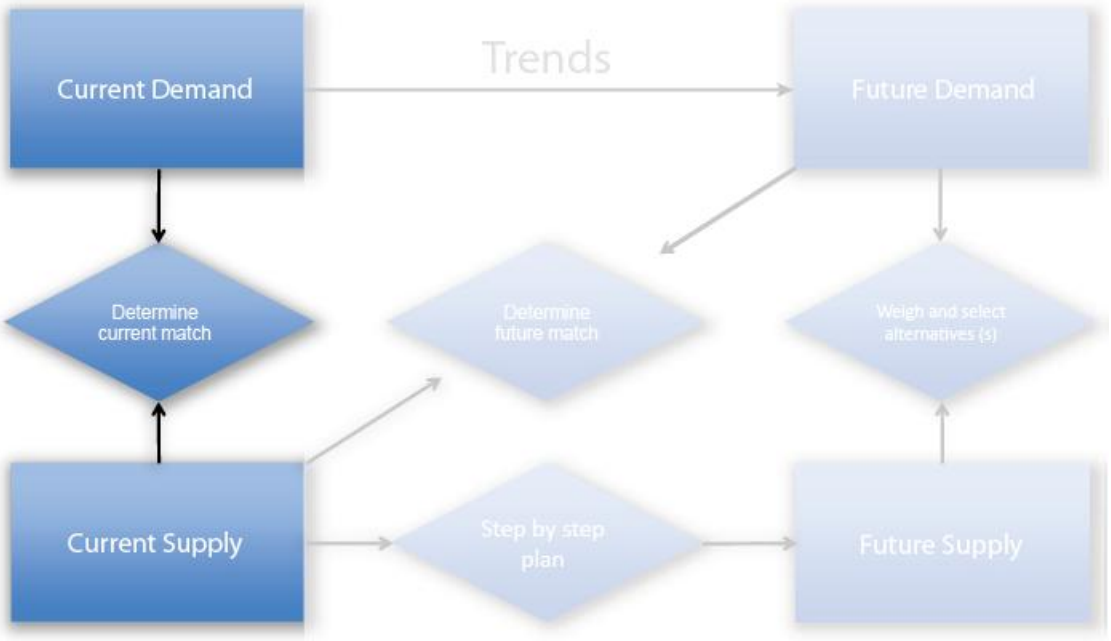
The first office originated with the (IT) invention of the printing press by Johannes Gutenberg, around 1450 and took place mainly at home. Influenced by Ford's mass production, efficiency of routine work on the workplace and the office layout was introduced by Taylorism in the 1880s. In Chicago, the mid-western hub of the American rail network, technologies such as the steel frame and elevator enabled office buildings to be constructed higher than previously possible to generate maximum income from the site. These were the first speculative office buildings and generally followed the traditional layout of separate rooms opening into corridors. The floor plan would then be stacked to generate the greatest income from the site — this profit-driven logic came to define the skylines of Chicago and New York by the early twentieth century. Also electric lightning and air-conditioning made buildings comfortable and attractive to work in. Gentleman clubs existed for the elite group to meet, exchange ideas, and share resources, which was not done in the office. The clubs were equipped in a way one could not afford solely. These changes influenced by technology and organisational culture can be seen in later periods as well but in other forms.

Efficiency was the guiding principle and 'time and motion' were the measures of success. Offices were a celebration of the class divide, manifestations of the roles and relationships between managers and 'workers' that defined the corporation. Indeed the very definition of 'white collar' represented a move off the shop floor into an environment in which one's clothes and collar remained clean.

Early office buildings such as Johnson Wax in Racine, Wisconsin, reflected the management mantra of the era, where people were supervised and work was measured by inputs: clocking in and out was the demarcation of the working day. Buildings celebrated the post-industrialised economy and shaped towns and cities as transport and communications technologies allowed the separation of administration functions from the locations of factories and extraction industries.

Conceived in an era of command and control, constrained by paper and fixed technology, reflective of hierarchy and order with a culture of presenteeism and paternalism, the traditional fixed and stratified office is evolving to embrace more fluid and intuitive ways of working. The typology of the modern office owes its origins to the white collar factory and the efficiencies of production through division of labour that theorists such as Frederick Taylor and practitioners such as Ford celebrated. Consumer education is critical to ensure that demand meets expectations once third place offices are ready for broad deployment. Users need to be able to manage their working hours and schedule their activities in combination with the desired workplaces.

4. 27% office vacancy: mismatch by ICT innovations and endless construction



4.1 Introduction

The current mismatch between the supply and demand of the Dutch office market is mainly caused by four different factors. The changing processes (the new ways of working), technological innovations (continuing automation) determined the qualitative change in demand for certain types offices and locations. The decrease of the labour force by the recession from 2008 determined the quantitative decrease in demand office space. This financial crisis caused a lower net absorption of office space while the development of new office building was not only continued by construction lag, but also by investors who provided financial means for construction. An example of the extreme difference between absorption and supply in 2008 and 2009 is illustrated in Figure 32.

Figure 32 Demand and supply at Amsterdam office market (source: www.dtz.nl (2013))

4.2 Current office situation: 14% vacancy towards to 27%

As shown in Figure 33, over the past 15 years the office supply increased from 33.3 million square meters to 47.4 million square meters. In addition, the use of offices has increased from 31.2 million to 41.1 million square meters. The difference between quantitative demand and supply causes an increase in vacancy of 2.2 million square meters to 6.3 million square meters of office. This is more than 13% of the total stock. The percentage would be much lower in a 'healthy' office market, namely around 4% or 5%. This small percentage, also called 'frictional vacancy', makes a good flow of office movers as possible. A 'healthy' situation would therefore be approximately 2.1 million square meter of vacancy (see Figure 34).

Figure 33 Total office supply the Netherlands (Source: EIB et al., 2010)

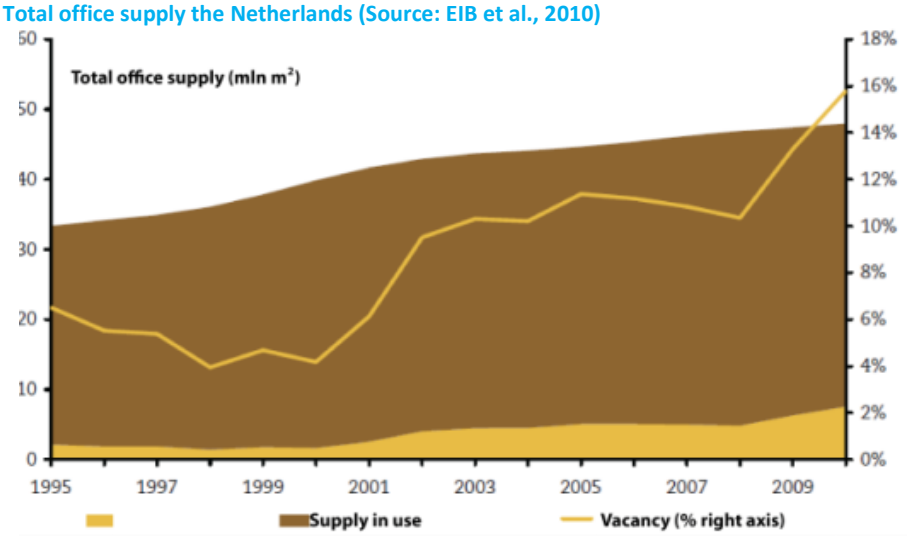
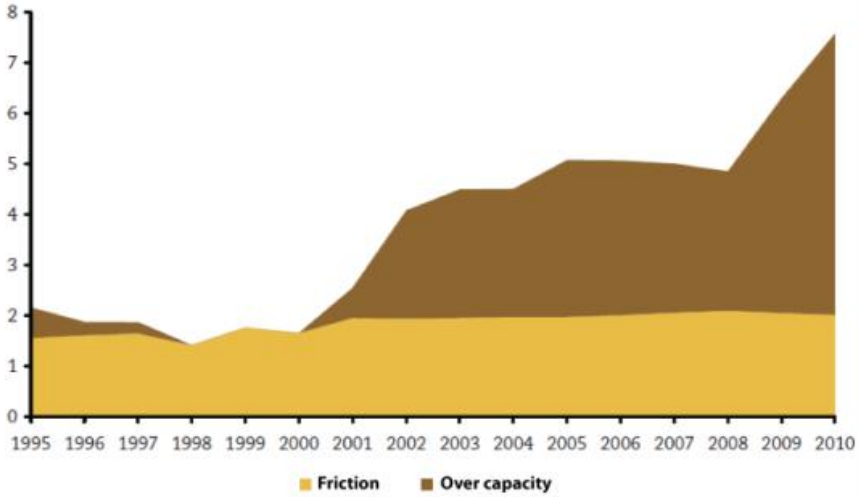


Figure 34 Friction vacancy and over capacity, in million square meters (Source: EIB et al., 2010)



Besides friction vacancy there is also structural vacancy. Structurally empty offices are offices for that are vacant for three years or longer. This can be caused by either the size or pricing. Also this has to do with the fact that developers and investors in the late nineties were developing ‘on risk'. This means that there was being developed without having a user before the completion of the building. This growth in additional new buildings is almost entirely the cause for the additional vacancy provided until 2002. After 2002, the proportion of new buildings was reduced, although vacancy remained at new buildings. Still the same actions took place partly. Due to the changing trends and changing demands of the end user the current supply no longer meets the demand of the user. These negative effects of vacancy lead to a reduction of rental income and depreciation of the capital and locations. For example, it may happen that the quality of the building and the amount of rent price

are in order, but the accessibility or the image of the location is significantly unsatisfactory (locational vacancy). In other cases, the structure of the building no longer meets the current requirements (operational vacancy). It is equally conceivable that both the location and the building quality are good, but that the supply is not quite in line with the demand (market technical vacancy).

Mismatch current demand and supply results in 27% office vacancy

The actual office vacancy according to DTZ Zadelhoff (2012) concerns 14.1%. At the moment the vacancy rate is three times higher than in a 'healthy' office market. Next to this vacancy there is 6 million unused square meters that is still being leased until the end of the contracts. According to a report by consultancy company 'AOS Studley' (Coenders, 2013) this unused space will raise the current vacancy rate up to 27% in the near future. This doubling of vacant office space has to do with hidden vacancy that will enter the Real Estate market in the coming years when current lease contracts are ended and renewed or extended for less space per company. According to the director of 'AOS Studley' Harold Coenders this hidden vacancy is caused by the crisis whereby organisations had to lay off employees. Also the needed space per employee has decreased by 20% over the years due to the transition to offices landscapes, flexible workplaces and the emergence of new ways of working. Organisations cannot easily adapt their use of real estate by 'long-term' leases. At the municipalities there still is land available to build an additional 12.5 million square meters of offices. It has been decided to bring this planned stock back to 5.5 million square meters, which is a potential additional vacancy is 11.5%.

Figure 35 Development total employment and office employment, index numbers, 1995 = 100 (Source: EIB et al., 2010)

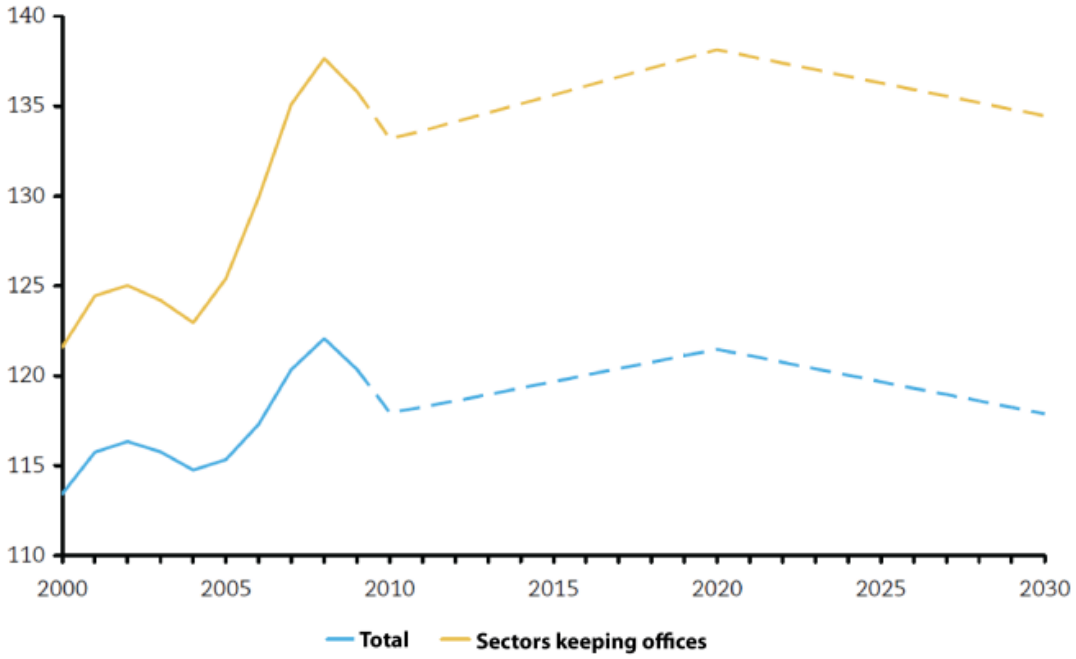
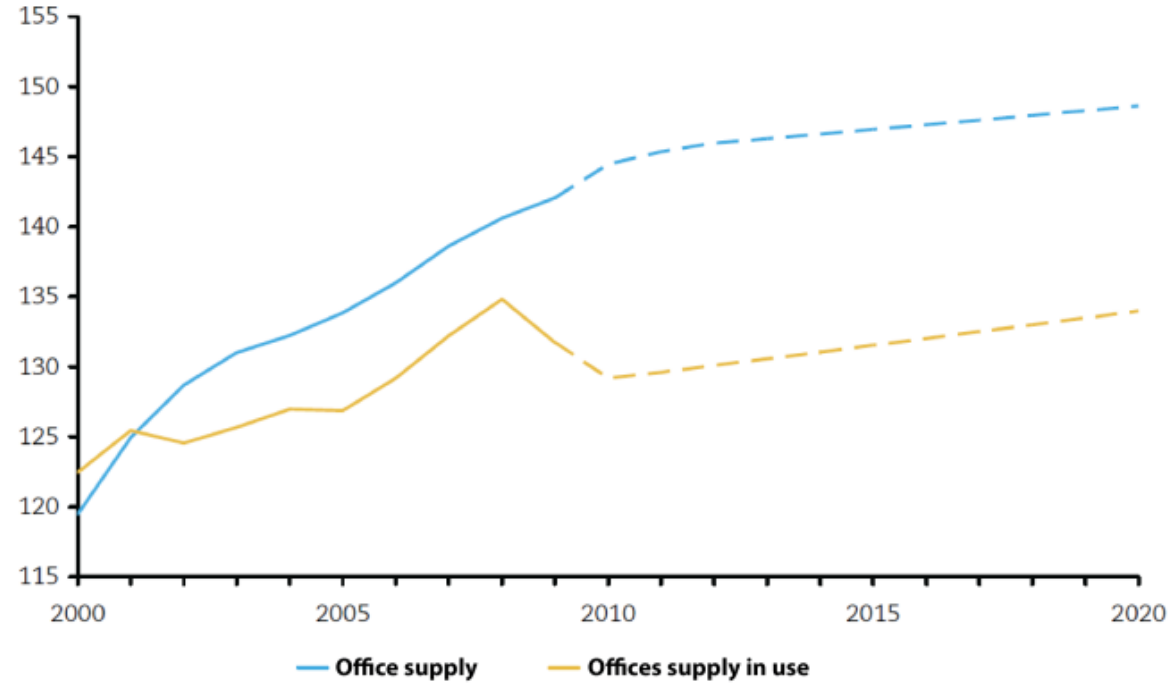


Figure 36 Development office supply and office supply in use, index numbers, 1995 =100 (Source: EIB et al., 2010)

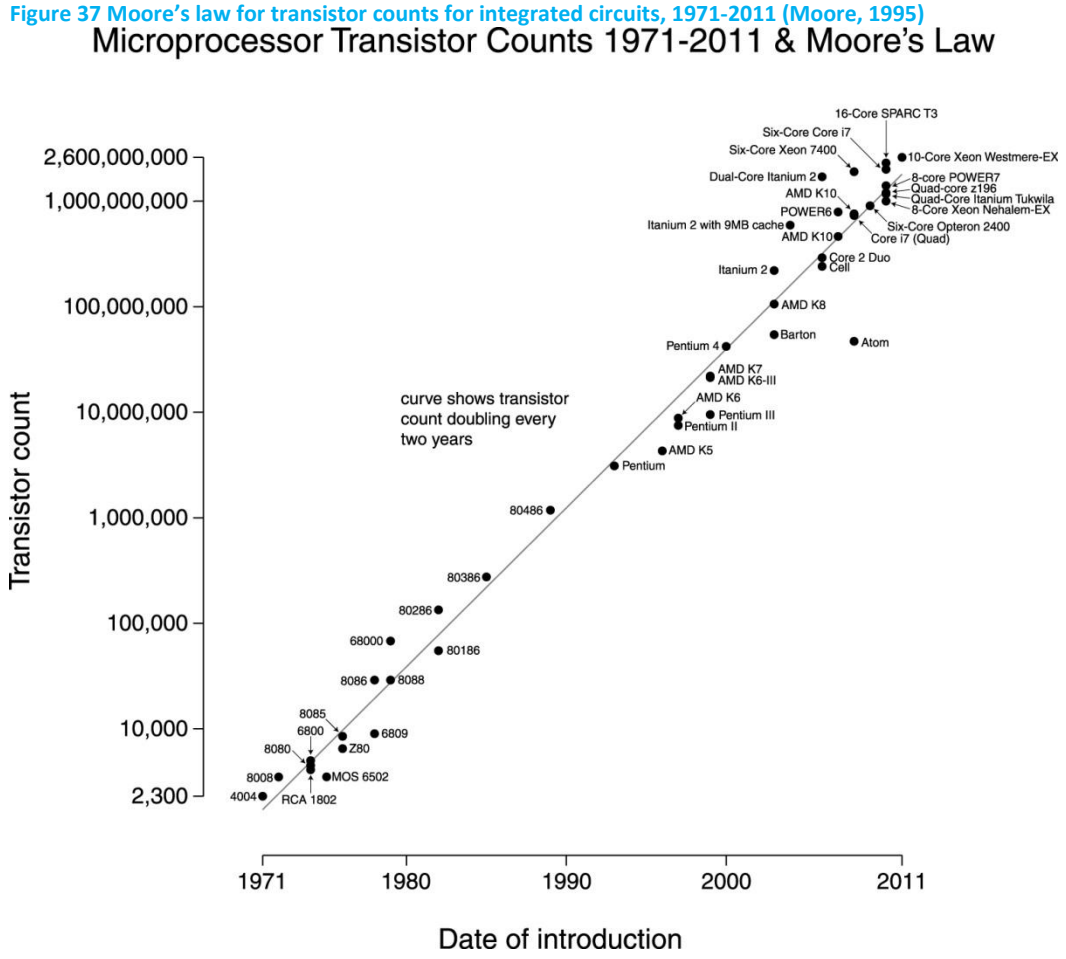


More frequently than ever before, town planners will have to deal with unoccupied, abandoned and even partially dilapidated buildings, especially in unimportant and unattractive locations. It will often not be possible, in weak regions in particular, for the original function of every building to be preserved. If the price, or rent, per square meter no longer needs to be high, new groups intending to use the property for other purposes will emerge. Empty and low-priced storage areas, vacant shops and offices, these all help, not least, small enterprises, business start-ups and low-income businesses to try something new, whether it be in retailing, the catering trade or a tradesman‘s business.

4.3 ICT innovation changed the demand for office use

General purpose technology (GPT) has dramatically changed the world in terms of production and connectivity and the change will continue even faster. Moore’s law is often used to imply the rapid development in ICT and therefore limiting speculation on future developments. Figure 37 plots Moore’s law, which documents that since the invention of the integrated circuit in 1958, the number of transistors that can be placed on an integrated circuit doubles every two years. According to Weel et al. (2010) this trend is continuing. Because of the accuracy with which Moore's Law has predicted past growth in IC (integrated circuit) complexity, it is viewed as a reliable method of calculating future trends as well, setting the pace of innovation, and defining the rules and the very nature of competition. And since the semiconductor portion of electronic consumer products keeps growing by leaps and bounds, the Law has aroused an expectation of a continuous stream of faster, better, and cheaper high-technology products. Even the policy implications of Moore's Law are significant: it is used as the baseline assumption in the industry's strategic road map for the next decade and a half.

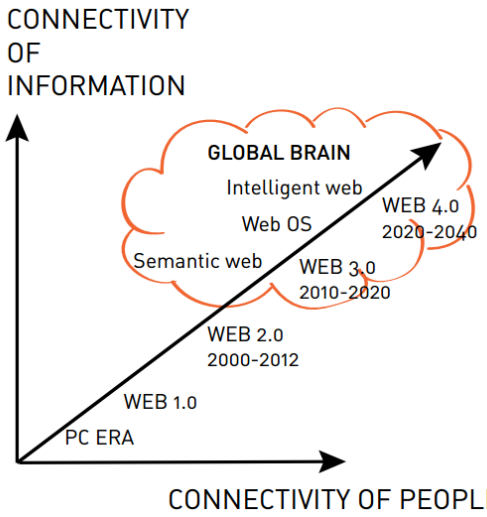
Figure 37 Moore's law for transistor counts for integrated circuits, 1971-2011 (Moore, 1995)



In fact, adoption is occurring so fast that failure to actively assess new technology can be catastrophic. Companies that wait too long to utilise technology may be replaced by companies with better systems and more useful information. Besides fast developments within ICT, the diversification of ICT must not be underestimated. In short periods of time, new devices or functionalities are invented and further developed without much notice by those who not constantly follow ICT developments.

Internet can be considered as the basis of our future well-being. But what is the future of the Internet itself? The world of Web3.0 currently is emerging and Web4.0 is already in sight. Figure 38 illustrates the development of internet. Web1.0 was about offering information. Web2.0 is about interaction between people on the basis of the presented information, resulting in new information and thus new value. Web3.0 is about the Internet itself becoming intelligent Although Web4.0 still is in developing mode and the true shape is still forming, first signals are in that Web4.0 will be about a linked web which communicates with us like we communicate with each other (like a personal assistant) (Hoff, 2011).

Figure 38 Connectivity of information and People (source: (Hoff, 2011)



Making the computer mobile in combination with the use of internet on mobile devices changed the way of work significantly.

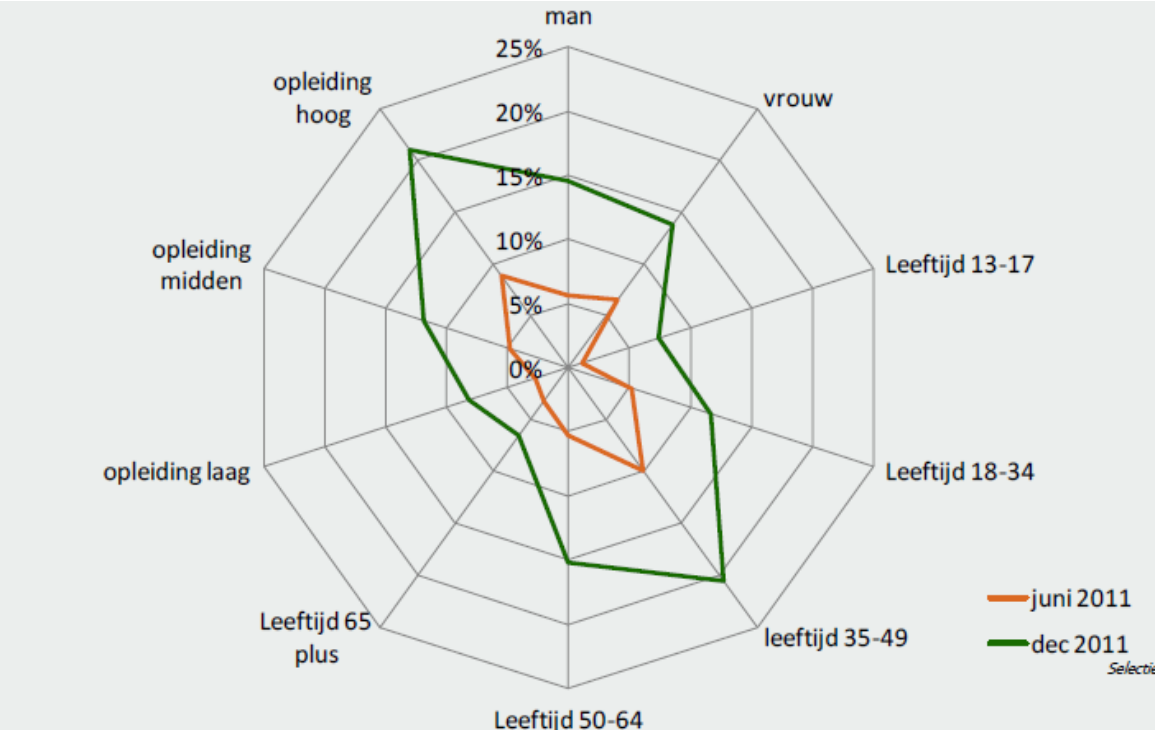
Mobile devices

A mobile device (also known as a handheld device, handheld computer or simply handheld) in this research is referred to a small, hand-held computing device, typically having a display screen with touch input and/or a miniature keyboard. Mobile devices are divided into laptops, smartphones, tabs and pads. As can be seen in Table 8, from 2005 until 2010 households reduced the use of desktop computers to access internet and increasingly made use of laptop computers and mobile phones instead. Mobile devices are the most important factor in the workers mobility and therefore the mobility of office work.

Table 8 Devices used to access internet (source: (Akkermans et al., 2011)

	2005	2006	2007	2008	2009	2010
	% van huishoudens met internet					
Desktop computer	93	91	89	84	83	78
Laptop computer	27	32	42	54	62	68
Mobiele telefoon	12	13	19	22	28	35
Palmtop computer	3	4	5	6	7	6
Spelcomputer	1	1	4	7	12	16
TV met set top box	0	1	3	4	8	10

Figure 39 Tablet users (source: Infomart GfK / June 2011)



Telecommuting and telework

Traveling for business used to put workers out of touch with the office and its equipment for at least the duration of a plane flight. In 1988, telephones became available on Japanese airlines--calls were relayed by satellite. Nowadays, most airlines provide in-seat telephones complete with data ports for e-mail and file transfer. Hotel chains, too, have acknowledged the trend toward offsite business. Many have installed laptop power ports, fax machines, and extra phone lines in guestrooms and some have even designed "business centres" equipped with the latest office technology. In addition, copy centres in cities around the world have become surrogate offices complete with staff, videoconferencing facilities, and computer workstations.

The concepts of "telecommuting" and "telework" are closely related, but there still is a difference between the two:

- all types of technology-assisted work conducted outside of a centrally located work space (including work undertaken in the home, outside sales calls, etc.) are regarded as telework. It moves the workplace to the workers, instead of moving the workers to the workplace which is the typical scenario for professionals.
- telecommuting refers more specifically to work undertaken at a location that reduces commuting time. These locations can be inside the home or at some other remote workplace, which is facilitated through a broadband connection, computer or phone lines (Ellison, 2004).

Teleworking and telecommuting have in common that the employee does not exercise his activities on the fixed workplace at the employer. Telecommuting is done from your own home. It is not necessary that the employee has access to the information of the employer. In contrast, access is a prerequisite for teleworking. For mobile work, access to the Internet from a mobile device is critical. Access to the information systems of the employer is therefore not a prerequisite.

Nielander et al (2010) deliberately present hard data on commuting information in the Netherlands. Travel between home and work in 2010 took a total of 600 million hours. This travel time can either be used in a more efficient way or be reduced. In 2010 place and time are independently on a modest scale in the Netherlands. Three out of ten workers report that they occasionally work from home. On average, over 6 hours per week is worked at home. Seven per cent

of employees reported that they structurally home work for the employer. Teleworking also has some input found: 16 per cent of the employees in 2010 worked outside the business establishment with access to the enterprise from that location. Teleworkers can be found especially in financial and business services, with both more than 25 per cent.

As a broader concept than telecommuting, telework has four dimensions in its definitional framework Garrett, Danziger and Leonhard (Garrett and Danziger, 2007, Leonhard, 1995):

- work location, that can be anywhere outside of a centralised organisational work place;
- usage of ICTs (information and communication technologies) as technical support for telework;
- time distribution, referring to the amount of time replaced in the traditional workplace;
- the diversity of employment relationships between employer and employee, ranging from contract work to traditional full-time employment.

Teleworking provides employees with better possibilities to perform work that requires concentration. The disadvantage is a decrease of peer interaction and, in relation to that, feelings of social isolation. A frequently repeated motto is that "work is something you do, not something you travel to" (Leonhard, 1995). Variations of this include: "Work is something we DO, not a place that we GO" (Microsoft, 2012) and "Work is what we do, not where we are" (Staff, 2011). Here, virtual communication becomes an important factor.

Virtual communication

Virtual communication has changed the physical and central office paradigm. Next to this thesis, a literature study has been done on Virtual Communication. The literature study contributes to the understanding of virtual communication among virtual team members. These team members will have a different demand for workplaces and locations, which are especially important for corporate real estate managers, real estate developers, and the way organisations do businesses and how that affects the spatial organisation of office workers. For this research it was interesting to know to what extent office workers can work location independent by communicating virtually with geographically dispersed team members. For the Capita Selecta literature study the following hypothesis was stated: *If virtual communication is successfully implemented amongst virtual teams, then it is not necessary for team members to physically meet at all.*

This resulted in the following research question for the literature study: *To what extent can ICT replace physical communication between office workers or between office workers and clients?*

When looking at when natural inter-team member communication really is required, according to the literature findings it can be concluded that natural communication cannot be replaced in the following situations:

- when it is necessary to transfer of tacit knowledge, or knowledge that is not written or definable, but gained through experience.
- when building up trust
- when it is really important to understand the meaning of some communication.

Sometimes physical meetings are almost impossible due to the costs and/or organisational factors like scheduling all participants together at the same place and at the same time. In these cases, communication technology should be tending to Face-to-Face Communication as much as possible to communicate as much relevant information as possible to obtain clear understandings and prevent misunderstandings. However, many observers argue that there is no replacement for face-to-face contact, regardless of how far technology has evolved (Duke, 2001). Only time will tell how close technology can bring virtual communication to natural communication.

Once these teams operate successfully physical meetings will always be desired when it is really important to understand the meaning of some communication, in order to build up trust and if there are other solutions used for these situations, team members will always have to meet physically to

transfer tacit knowledge, or knowledge that is not written or definable, but gained through experience. This does not mean that virtual communication amongst team members will remain the same. When workers are increasingly willing to work virtually, physical presence amongst team members will occur less frequently. This allows larger distances between the central office and the second and third places. Increasing geographical dispersion of workers will challenge organisations to manage their employees and the environment they work in concerning locations, buildings and facilities on a larger scale. Virtual communication and telecommuting allowed a new way of doing business, namely the 'new way of working'.

4.4 New ways of working (Bits, Bytes and Behaviour)

New Ways of Working (NWW) is often defined on the basis of the three B's: bricks (accommodation), bytes (ICT) and behaviour (human / organisation) (Baane et al., 2010). Baane et al. (2010) elaborate more on the beginning of the new way of working. In 2006 Microsoft started:

'de reis naar Het Nieuwe Werken'

(the journey to the new way of working) in the Netherlands. This phenomenon was inspired by Bill Gates vision in his white paper '*The new world of work' (2005)*. Since 2008 this new way of working played a prominent role in the Dutch office market (Meer and Feijt, 2010). From the technology push from Microsoft a change in the deployed nature of work, work organisation and work environment where the core is that the individual office worker can decide where, with whom and when work takes place. New technology makes remote working possible and is an alternative for physical cooperation. However, for people to constantly be connected to each other Microsoft wielded some principles, namely every employee has a smartphone, laptop or tablet PC. At the introduction of the new way of working, Microsoft noted the gap between flexible working

"Anytime, Anyplace and Any device"

and the actual flexible working. To demonstrate the vision of the new way of working, an office is built at the Dutch main airport Schiphol. Microsoft is not the first company who started with the new way of working. To give an example, a small company named 'e-office' stared since 1991 with new ways of working.

Different companies have already implemented the new way of working. One started earlier than the other and for different motives. Bijl (2009) elaborates more on the theory, implementation and experiences from practice. The implementation of the new way of working in an organisation is one of the most complex intentional types of process change. The complexity is caused by the mix of hard factors (i.e. ICT, accommodation) and soft factors (i.e. organisation, people).

Examples of companies who already implemented the new way of working are: SNS Real, UVIT, Sogeti, Achmea, Capgemeni, Phillips, ING, Rabobank, HP, Vodafone. However these companies have different names for this new way of working like, Rabo Unplugged, Achmea WerkConcept, HP's Workplace Transformation and Phillips WorkPlace Innovation.

Van der Meer and Feijt (2010) also elaborate on the new way of working, but also relate this to the Dutch office market. For office users the new way of working in particular means a way to work smarter and more efficiently, while improving the company results and reduce costs. The main themes are saving on accommodation costs, increasing flexibility, reducing mobility costs and boost productivity while using ICT that facilitates working remotely as a corner stone for the phenomenon.

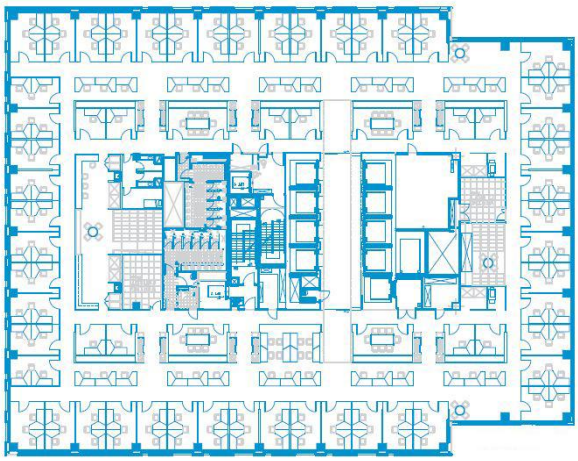
The majority of the way of working programs has recently started. The effects are manifested in a decrease in demand for office space and in smaller, high quality offices. A holistic concept of workspace innovation and ICT solutions is needed, giving due considerations to the different

viewpoints and instruments: market pressures, people issues, and workplace organisation (Groat and Wang, 2002).

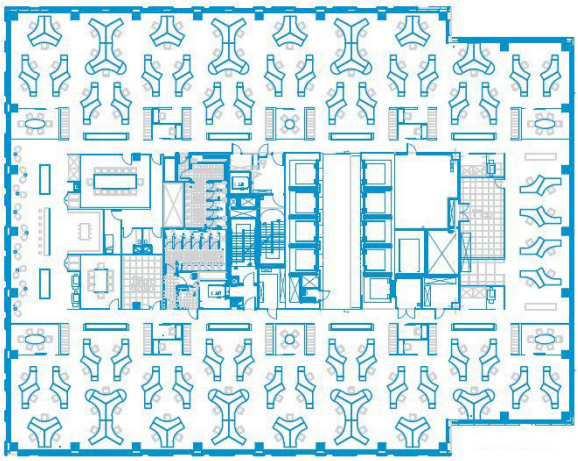
The impact of ICT and working needs on workplace design

As the ways in which is worked has changed, so has office design and space planning. Whilst the shift towards a more network driven way of working continues, as well as the shift to the need for more flexible, collaborative space. However, the needs between different companies, their branches and departments can vary a lot so it is hard to generalise the needs and design solutions for all offices. Nevertheless there are noticeable changes to space planning techniques if we look at the changing designs of office space since the early 1990s. Figure 40 shows the kind of office layout still favoured by large Law firms and is typical of the 1980s and early 1990s with heavy use of perimeter cellular office space with some open plan desking. This type of layout where the cellular offices occupy all the natural light from the windows is not regularly used today. A more modern approach to a heavily cellular space which also supports some open plan desking would put offices and meeting rooms in toward the centre of the building allowing most of the natural light to flood through the open plan space around the perimeter. Moving through the late 1990s and early nighties, this office design begins to adapt a more open plan environment for staff. This is partly driven by the requirement to fit more desks into offices and to encourage knowledge sharing and interaction between employees. When flat-screen technology was introduced desk design changed again to more traditional, smaller branch-style open plan environments allowing maximum workstations within a given space.

Figure 40 Office space 1980s-1990s (source: (Harrington, 2012))

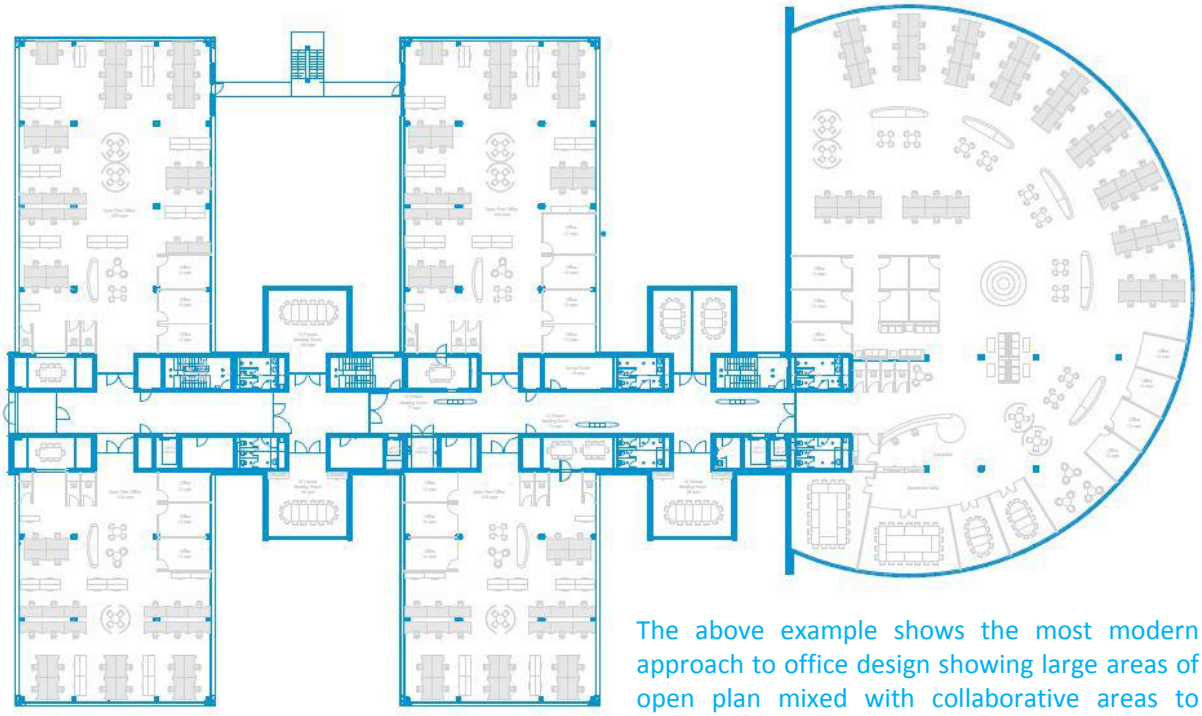


This example is typical of the 1980s and early 1990s with heavy use of perimeter cellular office space.



The above example, typical of early 2000s, shows an almost completely open plan office floor with small one-to-one rooms for quiet phone calls and meeting spaces allocated to the central core of the building.

Figure 41 Modern office space (source: (Harrington, 2012))



The above example shows the most modern approach to office design showing large areas of open plan mixed with collaborative areas to encourage knowledge sharing and providing more generous spaces for all employees.

The modern approach is to provide more collaborative working areas where staff can easily come together informally to discuss business. More fun areas have also been introduced where staff can meet, chat and take a break from the daily routine. In addition, private, quiet areas have been incorporated where employees can make private phone calls and work undisturbed. Equally, and just as importantly, more space has been provided for all employees both at their desk area and in the office space generally.

This change toward more open, flexible and collaborative space is driven by the demand and need for social interaction and group working within an office. Companies that satisfy these needs are typically better performing businesses. Harrington (2012) launched a research project amongst their Generation Y staff to see how they could be made to feel happier and more productive through workplace innovations. Overall there was a preference for offices that support collaborating, provide common areas and a decent degree of the latest IT. Though they do like flexibility and open places, 70% of Gen Y staff would rather have their own desk than sharing or having to book a new desk every day. It was also clear that Gen Y staff wanted more private desk-space comprising at least 12 m².

Collectively the emphasis has been on enabling and encouraging employees to enjoy the office space more. Combined with policies which support flexible office hours and permit staff to work remotely, employees feel more valued as individuals.

Change of place, space and use

Vos et al.(1999) describes de goals of an accommodation as an optimal fit is needed between organisational goals and values, activities, management style and building layout. A well-designed building may contribute to efficient and effective activity patterns, optimal productivity and high levels of satisfaction among managers, employees and customers. Buildings should create optimal physiological conditions in terms of temperature, air quality, daylight, artificial lighting and acoustics. Buildings have a symbolic meaning, too. They can be an expression of corporate identity, power, reliability and so on. Finally buildings have an economic function. They should be designed in a cost-effective way in order to reduce investment costs and running costs. ‘Good’ buildings fit with all

these requirements. Requirements are not static. Office design takes places in a context of dynamic social, technological, organisational and economic changes. Table 9 illustrates changes in accommodation attribute from 1950 till 2010 and beyond. In more detail, change can be seen on different scales, namely on place, space and use.

Table 9 Changes in accommodation attributes

	1950-1970	1970-1990	1990-2010	2010- and beyond
Attributes	Industrial (Place-Centric)	Industrial/"Informated" (Place-centric)	"Informated" (Place Centric)	Virtual Enterprise (Network-Centric)
	Hierarchical Task-oriented Specialised Centralised control	Process-oriented Flatter organisation Early distributed work Decentralised control	Team-based Broadly distributed Empowered employees Federalised	Knowledge-based Contingent workforce Role-based Alliance, Agile
	Knowledge Workplace			

From the literature study it can be concluded changes in the workplace (partly) as a result of ICT innovations. It can be noticed that protection against the weather will still remain the same. The changes are noticeable in the way information is stored, in the interior design and ICT. Also changes in organisations contribute to the workplace trends. These changes brought the modern office worker to a new way of working. It can be concluded that there is a movement in the working field from labour to service oriented work.

"Office innovation is often supported by information technology, such as laptops, portable phones and other advanced systems to let people work at a distance of their colleagues. As flashy as these tools might look, it is of utmost importance that they work properly! Installation of a help desk with a short response time and fast resolving of problems may contribute to a positive opinion on the new concept." (Vos et al., 1999).

However, accommodations themselves will not change much. The function will always remain providing protection to the outside world. However, the activities, and streams of goods and people are variable. With changes in ways of working, different objects intended for other purposes are used more and more as accommodation of workplaces. What is changing is the change of place, space and use (Vos et al., 1999). At a conceptual level three major trends can be distinguished: a change of place, space and use (see Figure 42):

1. **Change of place: teleworking**

This means that employees work at a distance from the central office, for example, in a satellite office or a business centre, at a clients' office, at home or in a place that is not primarily intended for work ('instant office').

2. **Change of space: new office-layouts**

This means that the layout of the office is changed to adapt to new activities. For instance a change from a traditional cellular office to an open plan office or to what-is-called a combi-office or cocon office – a concept that combines open spaces for *co*mmunication with cellular spaces for *con*centration.

3. **Change of use: flexible workspaces**

One component of flexible use of space is 'place rotation'. The employees move from place to place, depending of the activities of that moment. This requires a variety of workspaces, e.g. quiet cells or 'cockpits' for concentration work, group offices or open space for team work and interaction, touch down workplaces for short term activities, coffee corners for informal meetings and so on. A related concept is desk sharing. Instead of having one's own workspace people share one with colleagues or choose the place which is free at that moment.

These three trends cannot be seen in isolation because they are strongly interconnected. Teleworking, for example, results in lower occupation densities at the central office building. For this

reason teleworking is often combined with desk-sharing and non-territorial offices. Other crucial changes that come along with office innovation are changes in *supportive facilities,* particularly office furniture, ICT and filing systems. Modern technologies, such as fast computers, mobile equipment, Internet and Intranet, are both a prerequisite and a catalyst for other interventions. Most innovations include a shift away from individual, paper archives to central digital filing systems, supported by professional office management. The idea of the 'paperless office' has revived.

Figure 42 Typology of office organisations (Source: Vos et al., 1999)

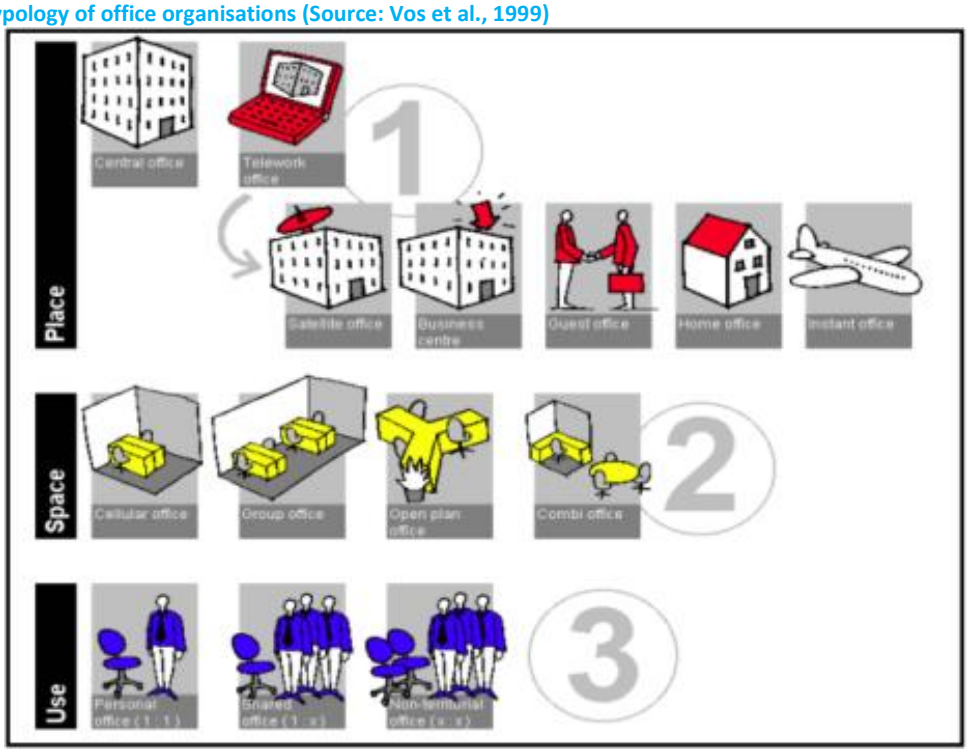
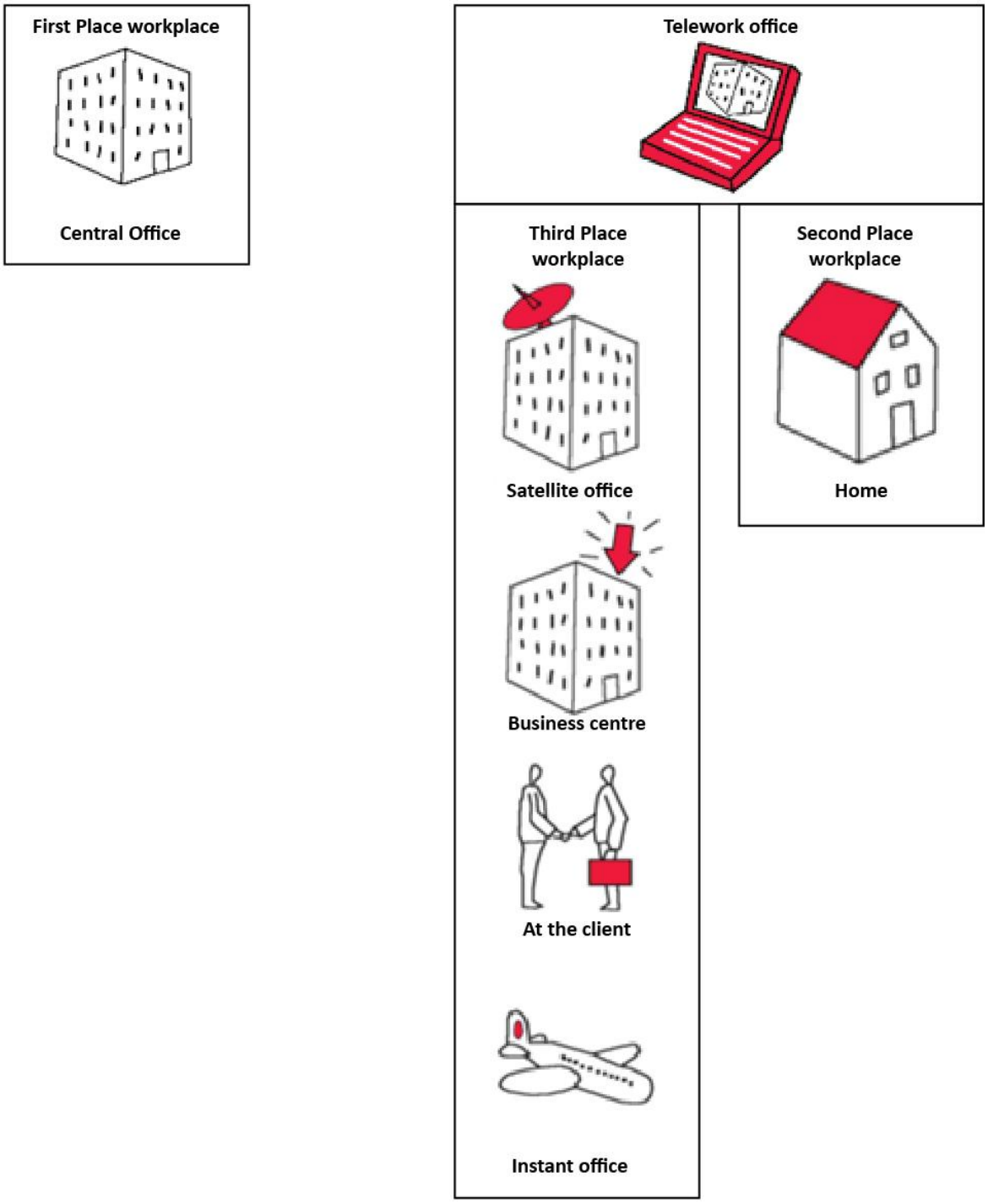


Figure 43 Office types and places



Vos et al (1999) elaborate on the different office typologies and the aspects of office place, space and use (see Figure 42). Besides the historical characterisation, the different types of firms are also distinguished by the location at which is worked at. The word 'place' is referred to the physical distribution of workplaces. There are two types of places that can be distinguished: the central office and the teleworking office.

The central office

The central office corresponds to the traditional notion of an office. In this view, the office is seen as an accommodation of workplaces for the employees of the same department or department within the organisation. A feature of the central office is the direct (face to face) contact between

employees. In addition, the central office can be used as a medium to the identity (image) of the organisation by its appearance. Employees who are not bound to the central office make use of the telework office.

Telework office

Tele means distance. A teleworking office is thus an office which is remotely located from the central office. To keep in contact with colleagues 'teleworkers' rely on the information technology like the mobile phone, laptop, etc.). There are different types of telework places. These workplaces do not need to be placed in an office, but can also be formed at places that are not primarily intended as an office workplace, see Figure 43). The satellite office is facilitated by the employing organisation. The satellite office accommodates workplaces and supporting facilities for teleworkers within the organisation. In a 'business centre' are remote workstations and support services hired by a commercial party. These workstations can be rented for a short time (one hour or one day) and can be used by different organisations. Average costs to make use of satellite offices or business centres around the world are around €25,- a month excluding the costs of consumption (i.e. paper, food, telephone etc.) while average cost for a co-work space €325,- varying in amount of time (hours or days per week) the space and facilities are used. Telecommuting is becoming more popular. According to Vos et al (1999), the central office will always remain as a meeting place, where the contact with colleagues is maintained.

As Vos et al. (Vos et al., 1999) emphasise about people to be able to work at a distance of their colleagues that it is important for information technology to work properly! The conclusions by Vos et al. (1999) that are relevant to this research is that:

- New filing systems can safe space by digitising information and sharing of centrally stored documents. However, people need some training and support to get used to new ways of filing.
- The use of innovative concepts makes organisations more technology-dependent. This can be a problem as employees perceive (small) technological failures as a major annoyance. A short response time for dealing with these problems is absolutely crucial.
- Desk sharing and teleworking are much more appropriate for ambulant professions such as consultants than for professions such as secretaries who stay put at the office.
- Furthermore, it is important to look at an organisation’s culture and psychology. A hierarchic culture, for example, can be an important obstacle, as managers do not wish to give up their spacious offices. Another cultural issue is the extent to which people feel comfortable with new technologies. IT firms are much more at ease with new ways of working than relatively traditional sectors such as government. So, a thorough organisational analysis is crucial before getting started.
- Another crucial factor for success or failure lies in the implementation of new office concepts.

With radical changes, the process is just as important as the product. Therefor different concepts come and go.

Real estate concepts: office and business units

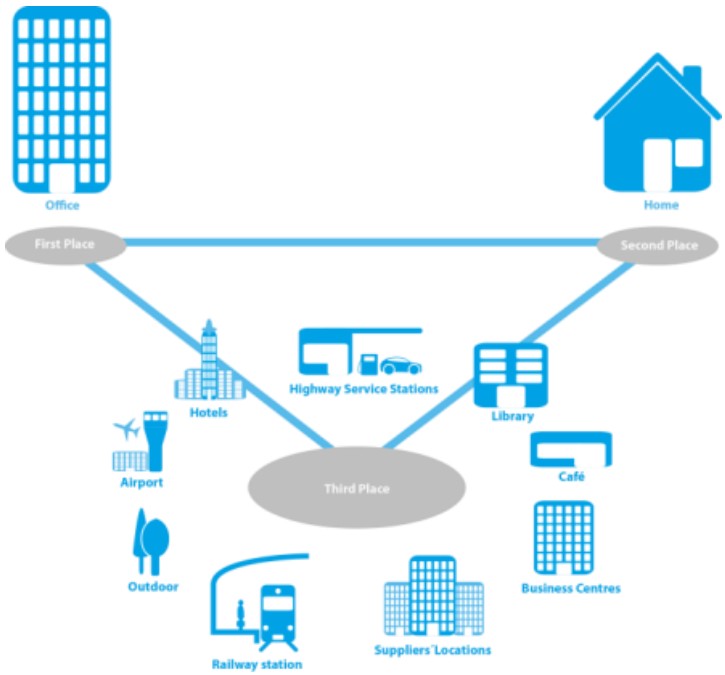
Van Elst (2005) explains that because of the often temporary character of the accommodation of organisations in a business complex it is logical to link it to a real estate concept. It turns out to be worth it while users get more connection with the building and therefore stay longer. When a real estate product is an office or business unit, an office building can create value by using a real estate concept. Office concepts can be seen as a collection of basic principles for interior design of offices. Many of these concepts have been around for years. However, the use of office concepts is a dynamic process. Circumstances will change again and again and so must the concept. In the sphere of real estate concepts that have to do with office and business units the flex office concept is

known, full-serviced office, business facility point's, innovative office concept (combi office), Community Technology Centres (CTCs), Office condominium's, non-organisation-related offices (near neighbourhood offices) and the related home offices.

An inventory of real estate concepts in the field of office and business units has led to the following concepts: Business Facility Point's, Innovative office (combi office), Community Technology Centres (CTC's), Office condominium, Phoenix (USA), Non-organisation bound offices (neighbourhood offices) and Home teleworking. These concepts are discussed in Appendix 2 Flex Offices Concepts.

This inventory of real estate concepts yielded various types of offices that seem to satisfy different users. Still, user's demands change and new concepts arise. Figure 44 illustrates the combination of the different types of office places explained by Vos et al. (1999) and other third place offices or teleworking locations. It seems that the use of offices tends to go towards a mixed offer of office places for the office users. From the research done by Twynstra Gudde (Meer and Feijt, 2010), it becomes clear that 37% of the office users expect to reduce accommodation cost on the long run. 27% stated that it is important to increase the flexibility of their accommodation, particularly in the central and provincial governments. This enables the users to anticipate quicker to changes in the demand at the lowest possible cost. 30% remark that increasing the quality of their accommodation is regarded as an important pillar of the accommodation strategy. 6% intend on minimalising the demand for office space.

Figure 44 Office places



The current demand for alternative workplaces strategies

Besides the current economic recession, new technologies regarding communication and information processing change the demand for ways of working. These ways of working are affecting office use in terms of how, when and where people work and therefore demand other types of workplaces, facilities and locations also referred to as Alternative Workplace Strategies (AWS). AWS is certainly nothing new, having been around since the early 1990s. It is one of many terms coined to describe the myriad ways in which businesses have reshaped their workplace as a result of the growth of the internet and telecommunications technology. Notably, by enabling staff to work from home or in alternative locations. In the white paper from Colliers International about 'Generation Y' (Harrington, 2012), the demand for these AWS are discussed. It seems that from a corporate perspective, "space optimisation" (79%) and "cost savings" (74%) are the main reasons for

companies to implement alternative strategies. Furthermore many companies see lots of potential for improvement in terms of space usage efficiency - only 55% of offices are utilised at a satisfactory level, according to research produced by New Ways of Working's Benchmarking Study; 2010. Employee demand is also fuelling the needs for AWS. Home-based working (89%), the use of drop-in spaces/hoteling (82%), non-company offices (37%) or satellite offices (35%) are used by an increasing number of enterprises to satisfy employee demand. It is also known that employees want to be able to have a flexible workplace that can be taken wherever they go. This suggests a big drop in the use of traditional office space and that traditional office space itself has a requirement to be more flexible in order to accommodate companies wherever they may go. Whilst it is difficult to put this into numbers based on individual companies, there is an underlying raft of factual evidence which points to the growth in mobile working. There are clear growing trends that will impact office space demand across Europe in the future:

Remote Working

-The growing trend toward remote working will erode the demand for desk-space within a traditional office environment. Whilst hot-desking/hoteling will absorb some of the growth in remote working within the 'traditional' office (remote workers will not spend every day of the week at home), the major recipients of this new demand will be the home-office and the increased use of satellite or 'non-company' offices.

Space Planning

-The growing need for flexible, collaborative space and more generous personal desk-space will actually increase the demand for 'traditional' office space, per person. If companies move from 8-9 m² per person toward 12m² per person in response to employee and corporate demand, this equates to a 25-33% increase in the volume of space required per person.

-Equally, it will help drive demand for bespoke data centres as IT storage and management is increasingly outsourced. The reduced requirement for office-based servers and IT equipment within will release some space for other forms of use.

When considered in relation to the other major driver of office space demand, which is working population growth, it can be understood whether the combination of these factors will lead to a decline or increase in the demand for office space.

Activity-based workplaces

The findings from the case studies done by Appel-Meulenbroek et al. (2011) underline some known benefits and disadvantages of activity-based office concepts, and provide insight in the importance of several physical, social and mental aspects of the office environment in employee choice behaviour. This study shows that the office concept is not always used as intended what could result in a loss in productivity, illness and dissatisfaction. People's personal preferences seem to have a bigger effect on the use of certain types of workplaces than some workstation facilities, although ergonomics and IT equipment and systems are expected to be satisfactory everywhere. Miss usage of the concept is often the consequence of critical design (process) failures.

Overall implications for office demand

When considered in relation to the other major driver of office space demand, working population growth, some understanding can be gained of whether the combination of these factors will lead to a decline or increase in the demand for office space. When assumed that as of 2012 the amount of space provided per person is 9m², for an office comprising 200 staff. This equates to an office environment of 1,800 m². So, if we look ahead to 2030, what is the likely scenario, using the table opposite as a basis for calculation. Even though the main office-based population is set to shrink by almost 25%, the increase in the amount of space per person will mitigate against this erosion in office space demand. Overall the message is that we do not necessarily believe there will

be a significant change (fall) in the amount of space required for traditional office use, despite a fall in office-based employment. There will, however, be a great deal of change in how office space is used and configured. Given the effect on the bottom line of reducing rental outgoings, there will be increasing pressure to utilise technology and other flexible office solutions to cut the regular rent demand whilst keeping core staff happy, motivated, productive and wanting to come to work. Amidst ever more competitive labour markets, having the right workplace strategy will be key to a company's future success. For developers and landlords, having the right type of space that can accommodate changing layouts and needs and provide the sustainable building solutions which occupiers and investors are now demanding will be paramount to the success of an office portfolio.

For the past 100 years business leaders have been trained to manage teams that are similar intellectually but widely disparate psychologically a group of engineers, say, whose members might be disciplined, introverted, anxious, cooperative, or any of a million combinations. That structure worked fine when business models lasted decades. In tomorrow's world the leader's job will be reversed. As companies revamp business models continually, the only teams that can do the job fast enough will have members who are highly diverse intellectually; the engineers, marketers, and designers will meet in the same room. And because the challenges the world throws at them will change rapidly and unpredictably, team members will have to share certain psychological traits, especially flexibility, adaptability, and resilience. Effective leadership will demand a new set of skills built around choosing team members, tuning the culture, and integrating radically different types of expertise. As Drucker (Drucker, 2009) described, "The modern organisation should be the destabiliser, the building design, the team, the project would all become more dynamic, real-time, to balance change and continuity".

4.5 Conclusion

Before solving any problem, it is important to understand the problem and especially the cause of that problem. The current mismatch between the supply and demand of the Dutch office market is mainly caused by four different factors. The changing processes (the new ways of working), technological innovations (continuing automation) determined the qualitative change in demand for certain types offices and locations. The decrease of the labour force by the recession from 2008 determined the quantitative decrease in demand office space. This financial crisis caused a lower net absorption of office space while the development of new office building was not only continued by construction lag, but also by investors who provided financial means for construction.

Mismatch current demand and supply results in 27% office vacancy

The actual office vacancy according to DTZ Zadelhoff (2012) concerns 14.1%. According to a report by consultancy company 'AOS Studley' (Coenders, 2013) this unused space will raise the current vacancy rate up to 27% in the near future by hidden vacancy. Vacancy leads to a reduction of rental income and depreciation of capital and the surrounding area of the vacant buildings.

ICT innovation changed the demand for office use

General purpose technology (GPT) has dramatically changed the world in terms of production and connectivity and the change will continue even faster. Moore's law is often used to imply the rapid development in ICT and therefore limiting speculation on future developments.

Internet can be considered as the basis of our future well-being. From offering information with Web1.0 to Web3.0 Internet itself is becoming intelligent while Web4.0 seems to be about a linked web which communicates with us like we communicate with each other (Hoff, 2011). Making the computer mobile in combination with the use of internet on mobile devices changed the way of work significantly. Mobile devices are the most important factor in the workers mobility and therefore the mobility of office work by teleworking and telecommuting. Teleworking and telecommuting have in common that the employee does not exercise his activities on the fixed workplace at the employer.

Work can be done anywhere, which disrupts the link between work and location. A frequently repeated motto is that "work is something you do, not something you travel to" (Leonhard, 1995). Variations of this include: "Work is something we DO, not a place that we GO" (Microsoft, 2012) and "Work is what we do, not where we are" (Staff, 2011). Here, virtual communication becomes an important factor.

When looking at when natural inter-team member communication really is required, according to the literature findings it can be concluded that natural communication cannot be replaced in the following situations:

- when it is necessary to transfer of tacit knowledge, or knowledge that is not written or definable, but gained through experience.
- when building up trust
- when it is really important to understand the meaning of some communication.

This allows larger distances between the central office and the second and third places. Increasing geographical dispersion of workers will challenge organisations to manage their employees and the environment they work in concerning locations, buildings and facilities on a larger scale. Virtual communication and telecommuting allowed a new way of doing business, namely the 'new way of working'.

New ways of working (Bits, Bytes and Behaviour)

New Ways of Working (NWW) is often defined on the basis of the three B's: bricks (accommodation), bytes (ICT) and behaviour (human / organisation) (Baane et al., 2010). According to van der Meer and Feijt (2010) the new way of working for office users in particular means a way to work smarter and more efficiently, while improving the company results and reduce costs. The main themes are saving on accommodation costs, increasing flexibility, reducing mobility costs and boost productivity while using ICT that facilitates working remotely as a corner stone for the phenomenon. The effects are manifested in a decrease in demand for office space and in smaller, high quality offices.

A holistic concept of workspace innovation and ICT solutions is needed, giving due considerations to the different viewpoints and instruments: market pressures, people issues, and workplace organisation (Groat and Wang, 2002). Harrington (2012) launched a research project amongst their Generation Y staff to see how they could be made to feel happier and more productive through workplace innovations. Overall there was a preference for offices that support collaborating, provide common areas and a decent degree of the latest IT.

Collectively the emphasis has been on enabling and encouraging employees to enjoy the office space more. Combined with policies which support flexible office hours and permit staff to work remotely, employees feel more valued as individuals.

Change of place, space and use

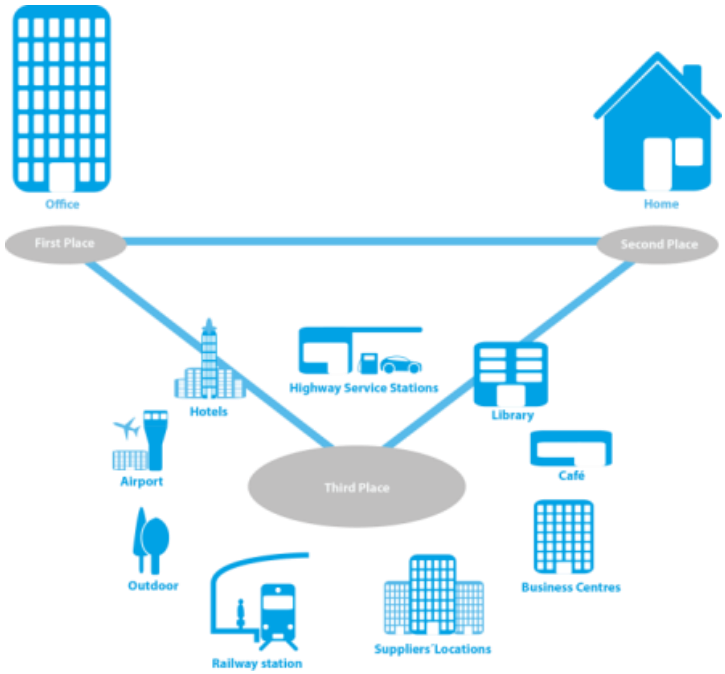
Vos et al.(1999) describes de goals of an accommodation as an optimal fit is needed between organisational goals and values, activities, management style and building layout. However, accommodations themselves will not change much. The function will always remain providing protection to the outside world. However, the activities, and streams of goods and people are variable. With changes in ways of working, different objects intended for other purposes are used more and more as accommodation of workplaces. What is changing is the change of place, space and use (Vos et al., 1999) At a conceptual level three major trends can be distinguished: a change of place, space and use (see Figure 42):

1. Change of place: teleworking
2. Change of space: new office-layouts
3. Change of use: flexible workspaces

These three trends cannot be seen in isolation because they are strongly interconnected.

There are two types of places that can be distinguished: the central office and the teleworking office. Figure 44 illustrates the combination of the different types of office places explained by Vos et al. (1999) and other third place offices or teleworking locations. It seems that the use of offices tends to go towards a mixed offer of office places for the office users.

Figure 45 Office places



The current demand for alternative workplaces strategies

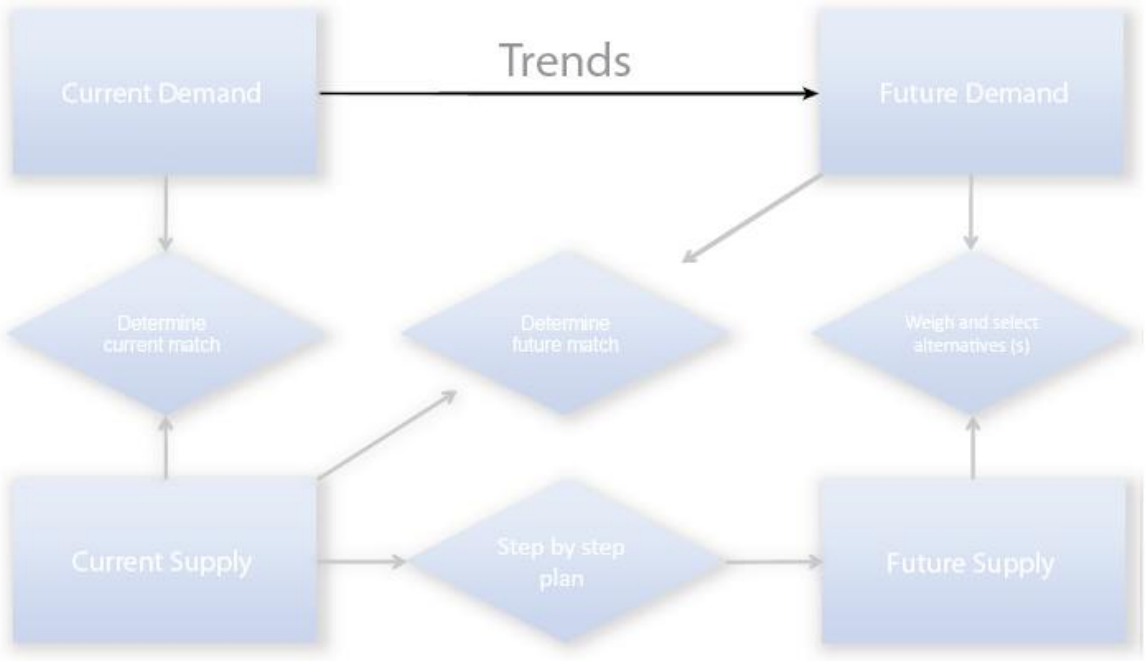
In the white paper from Colliers International about 'Generation Y' (Harrington, 2012), the demand for these AWS are discussed. It seems that from a corporate perspective, "space optimisation" (79%) and "cost savings" (74%) are the main reasons for companies to implement alternative strategies. Employee demand is also fuelling the needs for AWS. Home-based working (89%), the use of drop-in spaces/hoteling (82%), non-company offices (37%) or satellite offices (35%) are used by an increasing number of enterprises to satisfy employee demand. It is also known that employees want to be able to have a flexible workplace that can be taken wherever they go. This suggests a big drop in the use of traditional office space and that traditional office space itself has a requirement to be more flexible in order to accommodate companies wherever they may go. There are clear growing trends that will impact office space demand across Europe in the future: remote working, space planning, activity-based workplaces and overall implications for office demand.

As Drucker (Drucker, 2009) described, "The modern organisation should be the destabiliser, the building design, the team, the project would all become more dynamic, real-time, to balance change and continuity".

III. The Future of work

"People are definitely a company's greatest asset.
It doesn't make any difference
whether the product is cars or cosmetics.
A company is only as good as the people it keeps"
–Mary Kay Ash-

5. Trends towards 2040



5.1 Introduction

Predicting the future is a difficult job, as not only meteorologists can tell you. In general, most prediction methods have a high potential of failure, due to the complexity of the real world, which cannot be modelled, understood fully and may change discontinuously in unexpected ways. Furthermore, predictions themselves may influence the future because people try to make them come true or to avert them. Especially the future of information technology seems to be hard to predict, as past developments have shown. In this research it is not about prediction, but about expectations of future ICT based on current innovations and trends that influence Corporate Real Estate strategies. Therefore, theoretical and practical research has been done on the current trends in ICT to answer the first sub question of this research.

Sub question 1

What are the current trends in ICT that influence the future demand for corporate real estate portfolios in the Netherlands?

Research done by 'trend watching' via literature study, interviews with ICT developers and trend watchers resulted in 14 relevant trends. First the qualitative input about these trends retrieved from literature will be discussed followed by the interviews.

Changes in society, such as a more mobile workforce and workers' demands for flexibility, have fuelled the development of portable office equipment. Laptop computers, cellular phones and facsimile machines now equip a growing telecommuting workforce and, in some cases, have eliminated the need for central offices altogether. The option of telecommuting has become a valuable tool for companies competing for skilled employees who are tired of commuting long distances from the suburbs. Deciding the future is not possible but some see opportunities.

"The future depends on what we do in the present." ~ Mahatma Gandhi

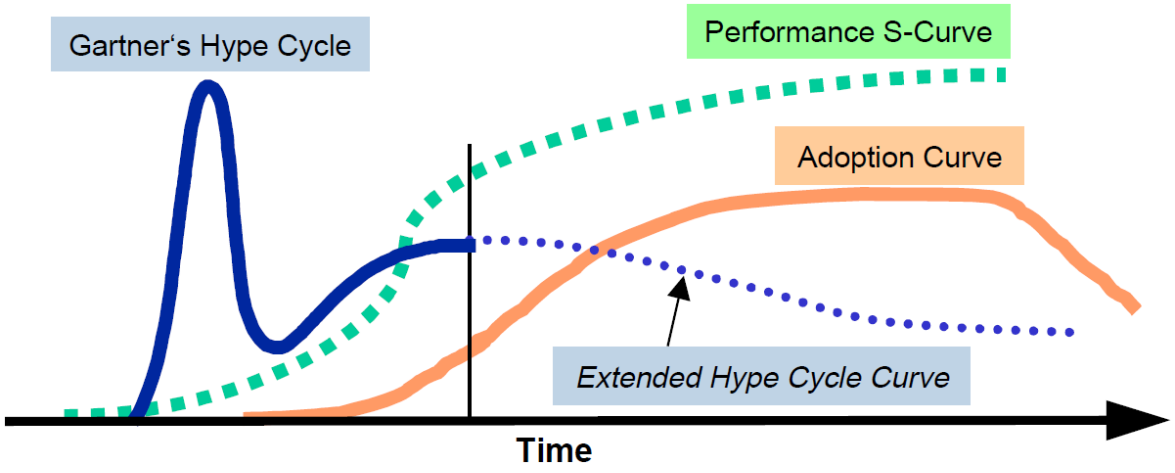
"The best way to predict the future is to invent it." ~ Steve Jobs

To be able to anticipate on anything about 2040, current developments that might have influence on the future demand for real estate needs to be analysed. Analysing and following developments is called trend watching. When a new innovation emerges in the coming decades, it may manifest itself in different ways. It may be primarily science-based, in the sense that universities or R&D departments develop new technologies, which spin off to the market. Or it may develop towards a more application-based phase, where large firms require extensive laboratories and test sites to innovate in the new technological fields. However, it is also possible that the a revolution takes longer to occur—thus, after our thirty-year window, due to the sheer complexity of the technology and the long time needed by innovations to mature. In that case, ICT would remain the world's dominant.

5.2 Trend watching and adoption rates

Being able to predict mid-term and long-term technology innovations, trends and user requirements in an early stage is an important competitive advantage. Knowing the future allows organisations to prepare for what is coming, but trend watching is not about futurism. Trend watching is about observing and understanding what is already happening. As already described in chapter 2, trend watching in this research is done by in-depth interviews with professionals and literature studies concerning trends in ICT. Business decisions often depend on a good understanding of the maturity and evolution of technologies. There are many ways to gain this understanding, for example, by using the performance S-curve and adoption curve models (see Figure 46). However, they do not provide information about the early stages of a technology's life cycle and how it may evolve.

Figure 46 Understanding of the maturity and evolution of technologies (Source: (Linden and Fenn, 2003))



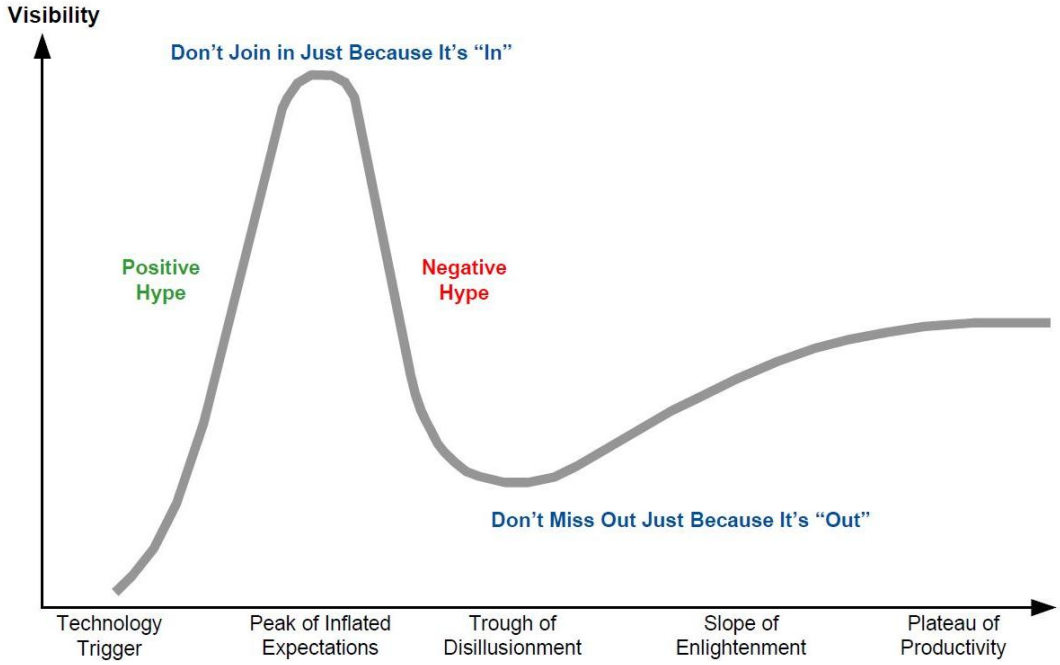
Gartner's Hype Cycle model adds another dimension to technology life cycle models: it characterises the typical progression of an emerging technology from user and media overenthusiasm through a period of disillusionment to an eventual understanding of the technology's relevance and role in a market or domain. Gartner's Hype Cycle report assesses the maturity, business benefit and future direction of more than 1,900 technologies and trends. The Hype Cycles are used to track technologies and to help make decisions that maximise impact and value. Hype Cycles offer a snapshot of the relative maturity of technologies, IT methodologies and management disciplines. They highlight overhyped areas, estimate how long technologies and trends will take to reach maturity, and help organisations decide what and when to adopt. It is important to understand the Hype Cycles before just reading them of the graphs.

Understanding Gartner's Hype Cycles

Gartner created the Hype Cycle to measure and predict expectations regarding new technologies. In other words, Gartner found that for any new technology, peoples' reactions to it follow the same pattern, no matter what technology it is. The key here is people**.** By understanding the reactions of people to new technologies, the adoption of new technologies can be predicted better and smarter product planning (and even personal purchasing) decisions can be made. "Gartner's Hype Cycles offer an overview of relative maturity of technologies in a certain domain. They provide not only a scorecard to separate hype from reality, but also models that help enterprises decide when they should adopt a new technology" (Linden and Fenn, 2003). The Gartner Hype Cycle graphs the visibility (often stated as expectations) on the vertical axis and adoption of a technology over time on the horizontal axis, as the technology matures, and shows how a new technology quickly jumps to centre stage in the press as people get excited or hyped up about it, and then almost disappears from view as the wild expectations bump up against reality and frustration sets in. For example, the hype around the internet in the late 90's and then the 'dot.com' crash of 2001. However, lessened visibility and reduced pressure from investors can allow for a quieter and saner development which eventually culminates in a stronger, and often world-changing technological advance. So, World.com, Inktomi, and Geocities are long gone and almost forgotten, but the internet is here to stay.

To better understand the five individual phases, the same graph with explanations is stated below in Figure 47.

Figure 47 The Hype Curve (source: (Linden and Fenn, 2003))



1. Technology Trigger

A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.

2. Peak of Inflated Expectations

During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicised activity by technology leader's results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organisers and magazine publishers.

3. Trough of Disillusionment

Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.

4. Slope of Enlightenment

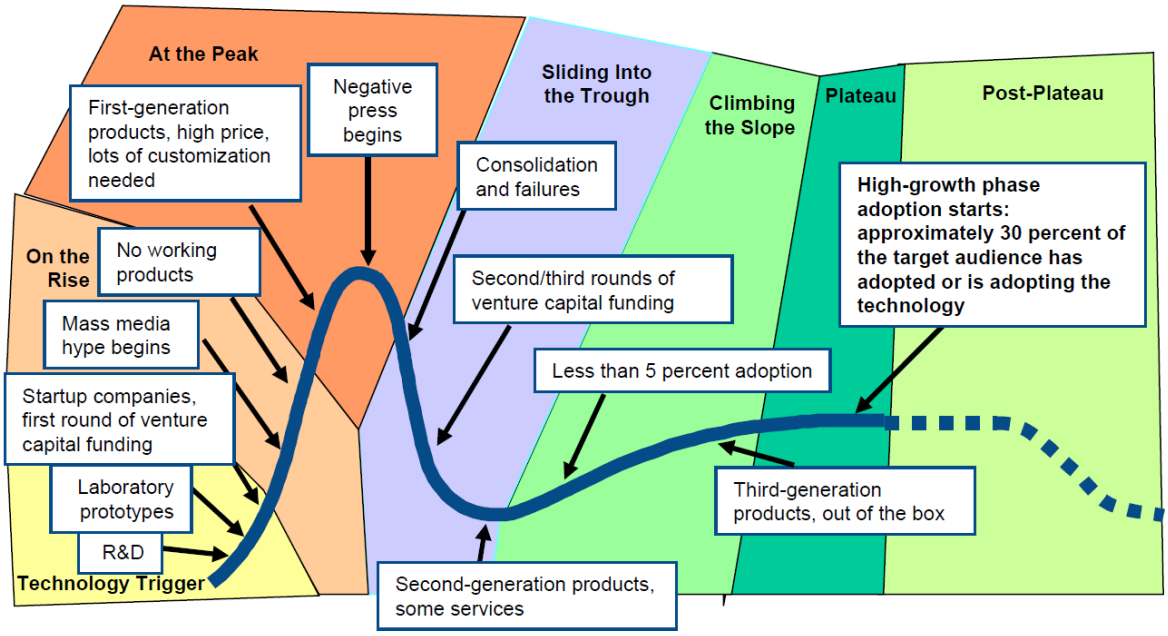
Focused experimentation and solid hard work by an increasingly diverse range of organisations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.

5. Plateau of Productivity

The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organisations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.

The predictions and scenarios were not made exclusively by computer scientists, but originate from an interdisciplinary group of academic and industrial experts from various software application areas, among them mechanical engineering, managerial economics, and electrical engineering. To break it down in terms of the news people are used to hearing about new technology, see Figure 48 for the more detailed explanation.

Figure 48 Hype Cycle breakdown (source: ((Linden and Fenn, 2003))



Hype Cycles allow technology planners to compare their understanding of technologies' evolution against Gartner's analysis of the technologies' maturity. An important Hype Cycle lesson is that enterprises should not invest in technologies just because the technologies are being hyped. Enterprises also should not ignore technologies just because the technologies currently are not living up to early over expectations (Fenn, 2010). As Jackie Fenn (2010), vice president and Gartner fellow notes:

"Hype Cycle for Emerging Technologies targets strategic planning, innovation and emerging technology professionals by highlighting a set of technologies that will have broad-ranging impact across the business. It is the broadest aggregate Gartner Hype Cycle, featuring technologies that are the focus of attention because of particularly high levels of hype, or those that may not be broadly

acknowledged, but that Gartner believes have the potential for significant impact". Although the benefits the hype cycle provides, there is criticism about its nature.

Criticisms of the Hype Cycle

There are numerous criticisms of the hype cycle, prominent among which are that it is not a cycle, that the outcome does not depend on the nature of the technology itself and that it is not scientific in nature. Another criticism is that the "cycle" has no real benefits to the development or marketing of new technologies and merely comments on pre-existing trends. Specific disadvantages when compared to, for example, technology readiness level are:

- With the (subjective) terms *disillusionment*, *enlightenment* and *expectations* it cannot be described objectively or clearly where technology now really is.
- The terms are misleading in the sense that the wrong idea can be generated about what a technology can be used for: I do not want to be disappointed, so should I stay away from technology in the Trough of Disillusionment?
- No action perspective is offered to move technology to a next phase.

An interesting part that is left out is the moment when the "trigger" takes place. There are lots of would-be triggers that do not result in the cycle. Actions before the trigger mostly take place in silence or secrecy, like in Research and Development departments. These criticisms raise awareness about some inconsistencies of the Hype Cycle and therefor it is important to understand the context of the Hype Cycle. As a matter of fact, the hype cycle is not a cycle from the perspective of an individual hype. A hype starts with innovation (the Technology Trigger) and ends with the adoption (Plateau of Productivity). However, the process from innovation to adoption as a whole can be seen as a cycle. Indeed, the outcome of hypes does not depend solely on the nature of the technology itself. The adoption rate of innovations mostly depends on the technology's applicability, risks and benefits. It must be considered that some proposed technologies do simply crash without recovering.

The Hype Cycle is most useful in explaining why the recommendations from technology planning groups may be different than what enterprises are hearing or reading in the media. At the Peak of Inflated Expectations, technology planners will caution. It is best to adopt only if it is strategically important for the organisation. Otherwise, let others learn the hard lessons. In the Trough of Disillusionment, technology planners will recommend to start looking at the technology now because there are some solid products emerging and real-world experience about how to use the technology.

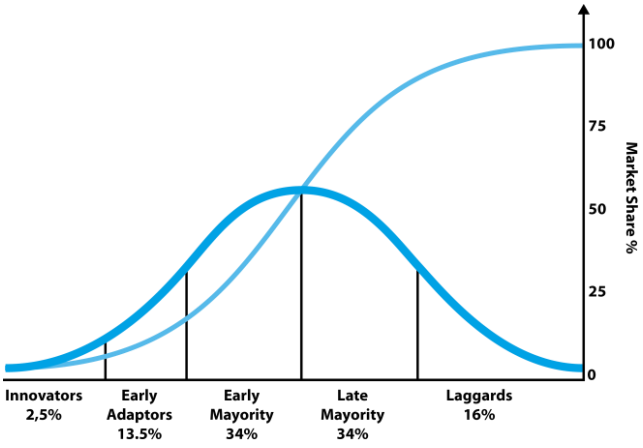
While Gartner gets far more specific about particular industries with its paying clients, once a year they release the Hype Cycle for Emerging Technologies, evaluating the maturity of the entire field of next big thing. Despite presented as individual technologies, Gartner encourages enterprises to consider the Hype Cycle technologies in sets or groupings, as many new capabilities and trends involve multiple technologies working together. Often, one or two technologies that are not quite ready can limit the true potential of what is possible. Gartner refers to these technologies as "tipping point technologies" because, once they mature, the scenario can come together from a technology perspective. Other than hypes, the implementation of these innovations can influence the way ICT is used.

Implementation of ICT innovations

In theory, plenty of ICT innovations seem to work. In practice not always the technology works as intended. User-friendliness, bugs and flaws might discourage users. However, some people desire the latest of technology to try it out, others prefer to wait and see what happens and whether it really works or not or wait until the technology has been further developed. Of course there are those who do prefer not to change because of emotional or economic reasons. Rogers (1995) divided these personalities into five different classifications of members of a social system on the basis of innovations, namely Innovators, Early adaptors, Early majority, Late majority and Laggards (see Figure 49). The rate of adoption is defined as the relative speed in which these members adopt an

innovation. Rate is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation (Rogers, 1995). Dominant attributes of each category are: Innovators-venturesome; early adopters – respect; early majority – deliberate; late majority – sceptical; and laggards – traditional.

Figure 49 Diffusion of ideas (Source: (Rogers, 1995))

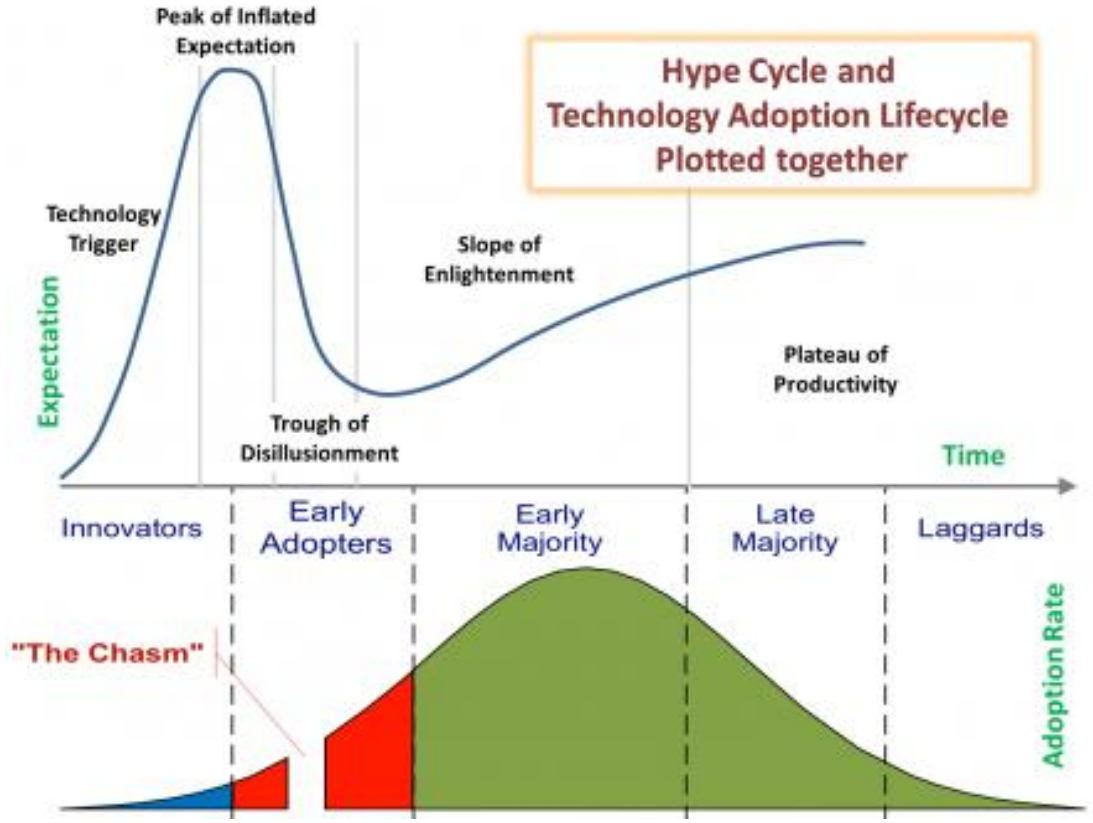


The accepted premise is that every new technology goes through the following phases:

1. **Hype:** Search for next big thing leads to Hype around any new technology.
2. **Struggle**: Adoption of these Bleeding Edge technologies depended on the Visionaries who had the vision, energy and money to make it work.
3. **Success**: Mainstream adoption required convincing the Pragmatists who needed success stories and support system around the technology.

Not all technologies made it to mainstream. All these are from the perspective of an enterprise. Consumers had very little role to play in this lifecycle. This underlying theme comes out in both the Gartner's "Hype Cycle" and the "Technology Adoption Lifecycle" model popularised by Everett Rogers and Geoffrey Moore (see Figure 50).

Figure 50 Hype Cycle versus Adoption Lifecycle



Though the curves are different and the upper curve (the hype cycle) plotting “Expectation” (also stated as visibility) and the lower curve (the adoption cycle) is plotting “Adoption Rate” against time, both of them are based on the same three basic premises as stated earlier.

While the technology trigger takes place, the innovation starts to be adopted by innovators. At the point where expectations and the visibility about the innovation are approaching the peak, the enthusiasm about the innovation drops which causes “the Chasm”. But after some time has passed and the innovation is maturing, the early adopters continue to adopt the innovation. The more an innovation is adopted, the more people will follow. This process will decrease because of those who still wan t to wait and observe the success of the innovation.

With a better understanding about the route from technological inventions to actual products used by the majority, the relevant trends in ICT can be discussed. To anticipate on the probable changes to come, the most relevant trends in ICT and changes in organisations and accommodation are studied in order to answering the first research sub question.

5.3 Theoretical research: current ICT trends

Networking fosters rapid communication, enables collaboration among workers regardless of geography, and permits access to the wealth of information posted on the World Wide Web. ICT in itself is not a trend, but it is the underlying products and services that allow information sharing and communication which are (re-)invented, innovated and (re-)developed. Trends in ICT seem to be converging to a platform for different types of networks, information and devices that work together. It is important for ICT to work and be easy to work with. Before looking further in to the future, the current trends will be discussed.

12 hypes on the 2012’s Hype Cycle

Twelve hypes on the 2010s’ and the 2012s’ Hype Cycle have been identified (highlighted in blue in Figure 51). These identified hypes map to where products that influence ways of working seems to be going in the near future (see Appendix 4). Relevant trends have been filtered out by looking at their relation with the activities of the knowledge workers as described earlier in chapter 3.1 . The primary processes of office users are performing professional, managerial, or administrative work.

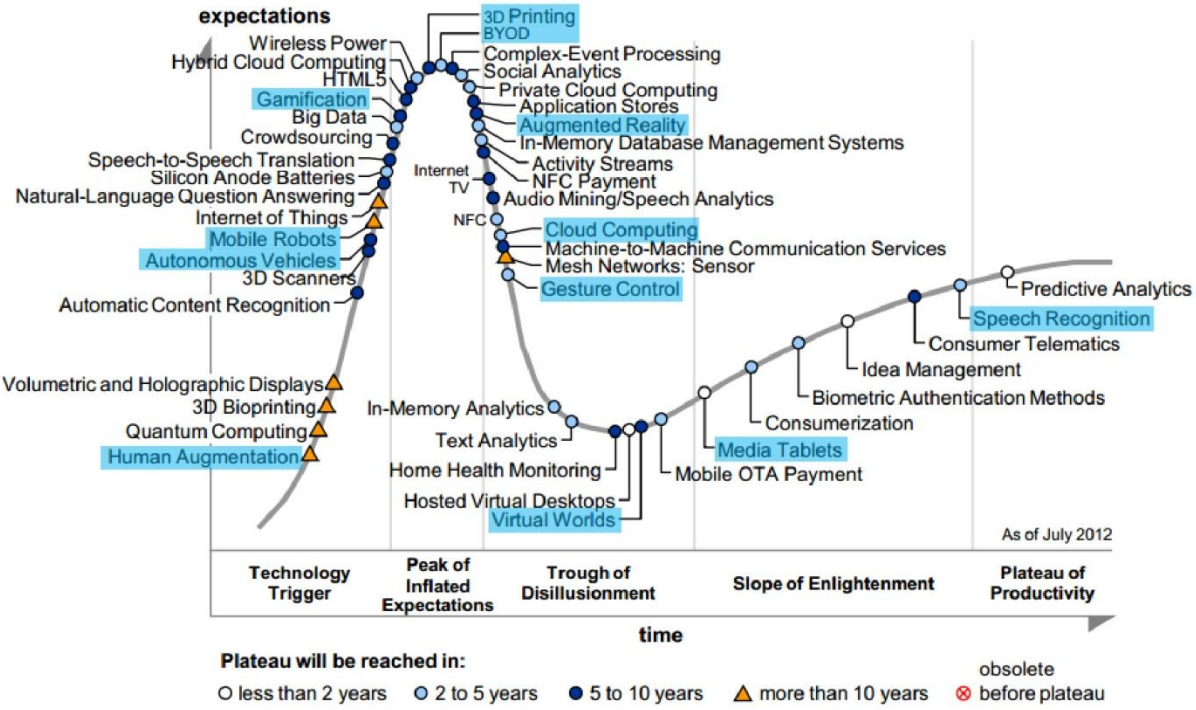
Hereby they communicate with audio and visual information via ICT. Data is processed using software, input and output of machines and devices. Trends mentioned in the Hype Cycle that might have any influence on the how, where and when office workers process and communicate information are selected. There is not only being looked at the activities, also trends influencing the mobility of workers are considered. Per trend, in the Hype Cycle, the business impact is explained, which allows one to understand the influence of the trend after implementation. First all trends have been defined. Once it became clear what each trend actually is or does, each trend has been analysed to clarify whether or not the trend has influence on one or more of the knowledge workers’ basic activities as:

- Reading
- Listening
- Watching
- Writing drawing
- Operate computer applications
- Computer mediated Communication (CMC)
- Natural communication
- Commuting

Figure 51 ICT related office worker activities

Office worker activities			
Computer mediated Communication (textual, audio and/or video)	Inter action with physical products (Marquette's, prototypes etc.)	Input/output (e.g. keyboard, mouse etc.)	Data (storage, sharing or processing)

Figure 52 Emerging Technologies Hype Cycle 2012 (Source: Gartner, 2012)



Form the Hype Cycle, the following trends have been filtered according to their influence on the activities performed by knowledge workers (see Appendix 4 Relevant ICT Trends). After selecting the trends relevant to ways of working and/or the office workplace the trends are divided into two subjects, namely 'control and input' and 'mobilisation' (see Table 10). Dividing the trends allows to focus on ways and means workers perform their primary activities in workplaces separately form the time and place where the activities take place.

Table 10 Theoretical trends

Time to plateau (years)	Trends	Control and input:	Mobilisation:
2-5	**1** Speech Recognition		
<2	**2** Media Tablets		
5-10	**3** Virtual Worlds		
2-5	**4** Gesture Control		
2-5	**5** Cloud Computing		
5-10	**6** Augmented Reality		
2-5	**7** BYOD (Bring Your Own Device)		
5-10	**8** 3D Printing		
5-10	**9** Gamification		
>10	**10** Mobile Robots		
5-10	**11** Autonomous Vehicles		
>10	**12** Volumetric and Holographic Displays		

Has influence

Control and Input:

The three relevant trends that might influence the way office workers perform their activities are Speech Recognition, Speech Recognition and Gesture Control. These three trends will be discussed.

Speech Recognition

Speech recognition systems interpret human speech and translate it into text or commands. Primary applications are self-service and call routing for call centre applications, converting speech to text for desktop text entry, form-filling or voice-mail transcription, and user interface control and content navigation for use on mobile devices and in-car systems. Control of consumer appliances (such as TVs) and toys is also commercially available but not widely used. Phone applications such as call routing or content navigation (for example, obtaining a weather report) often use various techniques, ranging from directed dialogue, in which the system walks the caller through a series of questions, to natural-language phrase recognition, in which the user can respond freely to an open-ended question. Depending on the application, the speech recognition may be performed on the device or on a server in the network (which offers superior accuracy but slower response times) or as a combination of both.

Speech Recognition might speedup data entry and voice-controlled interfaces by speech recognition might upend the current (computer) interface providing a more seamlessly interaction with ICT. The combination of more data and more computing power means things can be done today that just could not be done before. For speech recognition to work properly extra skills (dictation) are needed for most general office workers and a quite environment is needed influencing the acoustic requirements for of the workplace where this feature is used.

Media tablets

A media tablet is a device based on a touchscreen display, typically multi-touch, that facilitates content entry via an on-screen keyboard. The device has a screen with a diagonal dimension that is a minimum of five inches. Media tablets feature connectivity via Wi-Fi or via 3G/4G cellular networks. Tablets typically offer day-long battery life, and lengthy standby times with instant-on access from a suspended state. Examples of media tablets are the Apple iPad, Samsung Galaxy Tab, Acer Iconia HCL ME X1, Micromax Funbook, Milagrow TabTop. Media tablets can partly replace desktop computers and smartphones providing an intermediate mobile computing device the can be taken with the user. No square of space for the conventional interfaces (no keyboard, no mouse) is needed. The touch device is quicker, more intuitive and maybe even more fun to interact with than using a mouse or trackpad.

Gesture control

Gesture recognition and control involves determining and interpret the movement of a user's fingers, hands, arms, head or body in three dimensions through the use of a camera; or via a device with embedded sensors that may be worn, held or body-mounted in order to interact with and control a computer system without direct physical contact. The term “natural user interface” is becoming commonly used to describe these interface systems, reflecting the general lack of any intermediate devices between the user and the system.

One of the most visible examples is the newly launched Microsoft Kinect (previously known as Project Natal) gaming controller. In some cases (for example gaming controllers such as the Nintendo Wii Balance Board or the Microsoft Skateboard controller), weight distribution is being added to supplement the data available.

The primary application for gestural interfaces at present is in the gaming and home entertainment market. However, the potential of hands-free control of devices, and the ability for several people to interact with large datasets, opens up a wide range of business applications — including data visualisation and analytics, design, retail, teaching, and medical investigation and therapy. As computing power moves from a single device to an "on-demand" resource, the ability to interact and control without physical contact frees the user and opens up a range of intuitive interaction opportunities, including the ability to control devices and large screens from a distance.

Conclusion Control and Input

Speech Recognition, Media tablets, Gesture control (see Appendix 4 Relevant ICT Trends for definitions), these three trends influence the control and input of computing devices. All three trends leave out the keyboard, mouse or any other controlling element. Hereby users have more freedom to move around while interacting with the devices. This allows redesigning workplaces into more open and comfortable spaces. For example, Media tablets can be used anywhere without the need of a desk. The device can simply be held or put on a small surface, like on the side of a couch, or a chair with small table's attached. With speech recognition and gesture control, devices can be controlled from a distance leaving the user to perform other task at the same time will assuming any position (standing, sitting lying down, walking etc.). Besides freedom, these three trends allow quicker, more intuitive and maybe even more fun to interact with than using a keyboard, mouse or trackpad. Control and Input are important factors for innovations to be adapted. As can be observed, a rigid interaction with ICT can cause stress and frustrations.

Mobilisation

The following trends allow workers to perform their activities with extra mobility within and between workplaces and time.

Media Tablets

(See 'Media Tablets' above)

Virtual worlds

Figure 53 Holographic performance

Virtual communication technology refers to any means of interacting with others in virtual reality. Virtual reality, more commonly referred to as cyberspace, exists as a product of computer-mediated communication (CMC). There are two types of CMC: synchronous and asynchronous. Synchronous CMC allows for simultaneous communication, while asynchronous CMC doesn't (Walther, 1996):

Synchronous CMC:

- Synchronous CMC allows for simultaneous communication through incorporating a real-time element. Common forms of synchronous CMC include videoconferencing and chat rooms.

Asynchronous CMC:

- The most common form of asynchronous CMC is email. Internet forums, where people can post comments publicly or send private messages, represent another common asynchronous CMC.

Virtual communication is used in different ways by different devices and technologies:

- Teleconferencing: Conferencing via digital audio-visual means.
- Virtual collaboration and interaction: Working together on a project while sharing digital information.
- Hologram: Visual representation of an object or human in 3D.
- Augmented reality: A combination of digital and real life picture.
- In my elective course Capita Selecta a more elaborate literature study has been done about Virtual communication. Some relevant results will be used for this research.

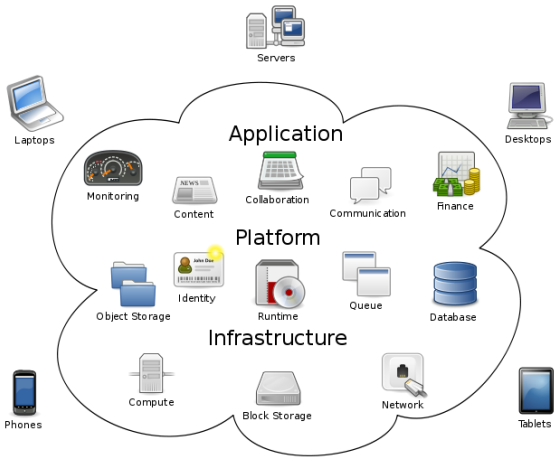
Cloud computing

Cloud computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centres that provide those services. It is shared computing and storage over long distances. The data centre hardware and software is what we will call a *cloud*. (Armbrust et al., 2010). Cloud computing makes it easier and cheaper to safely access, process and share information from around the world via internet.

Augmented reality (AR)

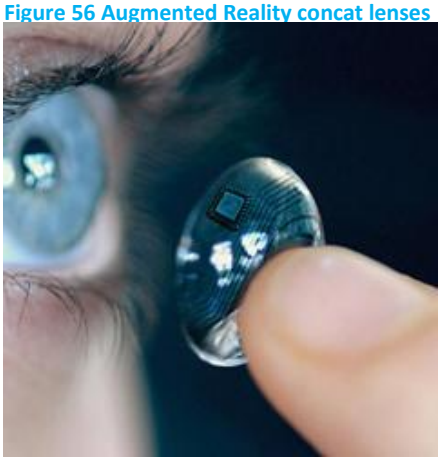
The principle of AR is based on the use of the computer to superimpose artificial objects in the real world view, whether directly or reproduced by the media. It was now very common in movies where creatures made by modelling studios are mixed with the actors in the final view. But it is in terms of increasing reality in real time where the prospects seem the most impressive. The algorithm of processing the original video is called 3D Surface Tracker Technology. It can accommodate objects that pass before the surface where the image is placed encrusted and thus hide the parts of them when something passes by.

Figure 54 Cloud Computing (source: (Armbrust et al., 2010)



Any augmented-reality system includes three key features, according to Mark Billinghurst, director of the Human Interface Technology Laboratory at the University of Canterbury in New Zealand, in the article, "Annotating the Real World" (2008). These include: "virtual information that is tightly registered, or aligned, with the real world; the ability to deliver information and interactivity in real-time; and seamless mixing of real-world and virtual information." The keys to advancing AR are advances in display technologies ("virtual" eyeglasses, for example), processors and graphics chips for mobile devices, along with tracking systems and cameras.

Figure 56 Augmented Reality concat lenses



AR through contact lenses (see Figure 55) reveals information on the surface of the lens. A layer is composed of polymers that correct the vision. To these are added circuits of control, communication, and a tiny antenna using a source of energy without wires. The image superimposed on the real world is formed by a network of LED reconstructing words or objects.

Figure 55 Augmented Reality

With the advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable. Artificial information about the environment and its objects can be overlaid on the real world.

BYOD (Bring Your Own Device)

What information worker does not have their smartphone or iPad with them at their desk, in their briefcase or sitting next to them on the couch? We all do. And more and more workers want to be able to access company information without having to carry a second device or login to the corporate network via a desktop/laptop. The days of issuing pagers to employees seems to be over. Individuals own their device already and do not want to carry around a second 'company issued' device. So companies are under strong pressure to support and manage access for a wide range of employee owned devices. Gartner considers BYOD (bring your own device) as another group of tipping point technologies. It includes hosted virtual desktops, HTML5, the various forms of cloud computing, silicon anode batteries and media tablets. BYOD is driven by the consumerisation trend that is making it acceptable for enterprise employees to bring their own personal devices into the work environment, which improves productivity.

3D Printing

3D fabricating technologies have been available since the late 1980s and have primarily been used in the field of prototyping for industrial design. More recently, the 3D printing quality has increased, and printer and supply costs have decreased to a level that broadens the appeal of 3D printing to consumers and marketers.

Additive 3D printers deposit resin, plastic or another material, layer by layer, to build up a physical model. Inkjet 3D printers image successive layers of plastic powder, hardening each layer on contact, to build up the piece. The size of the part varies with the specific manufacturer's printer and whether support structures are required.

The commercial market for 3D print applications will continue expanding into architectural, engineering, geospatial, medical and short-run manufacturing. As a result, demand for scarce 3D design skills and easy-to-use consumer software tools will explode in the consumer and business arenas. When virtual products do not provide the rich interaction as a physical object 3D printing can be used to obtain the product without any the logistical effort.

Gamification of the workspace

The term "gamification" is a neologism that designates that art to make human activities fun. The transformation of work into game has its leaders, Dr. Byron Reeves of the Department of Communication at Stanford, David Helgason CEO of Unity, producing development tools for games. In what areas can we already see the gamification developing?

- Learning and teaching: In a world artificially recreated in 3D, employees can become familiar with their future work environment and to experiment without causing damage. The use of games, like Sim City and simulators, like flight simulator, has long been the best way to learn in conditions close to reality.
- The human body: Using Unity, the company Argosy has made a model of the human body inside which to move virtually as we can moves through a world, a way to teach anatomy to medical personnel. A demonstration is presented on the site Visible Body.
- Work: this is the area where one expects more development. Using tools such as Earth, augmented reality, robotics, we will inevitably transform gradually the work and reduce the difference with computer games.
- Second Life (a virtual world) has shown that a purely virtual world could give rise to a sort of real economy with land acquisition, display advertising, an area of interaction where belong real economic actors and simple players.

The transformation of work into games provides a fun and interactive way to collaborate virtually with colleagues.

Mobile robots

Mobile robots move and navigate in an autonomous or semiautonomous (that is, via remote control) manner and have the ability to sense or influence their local environments. Mobile robots may be purely functional, such as vacuum-cleaning or lawn-mowing robots, or may be humanlike in their appearance and capabilities. Evaluate mobile robots for cleaning, delivery, security, warehousing and mobile videoconferencing applications. As robots start to reach price levels that are comparable to a person's salary, prepare for mobile robots to appear as new endpoints in corporate IT networks. Longer term, mobile robots will deliver a broader spectrum of home help and healthcare capabilities, and, as costs fall, they may play a growing role in automating low-wage tasks in activities such as food preparation. In the future, humans can be replaced by Robots doing routine-work.

Autonomous Vehicles

An autonomous vehicle is one that can drive itself from a starting point to a predetermined destination in "autopilot" mode using various in-vehicle technologies and sensors, including adaptive cruise control, active steering (steer by wire), anti-lock braking systems (brake by wire), GPS navigation technology and lasers.

Autonomous vehicle efforts focus on safety, convenience and economical applications, positioning this as a driver-assistance technology as well as an autopilot system in future deployment scenarios. Autonomous vehicles can help to address distraction issues for in-vehicle content consumption with the rise of infotainment applications. While driving on auto pilot the ‘driver’ could perform work related activities and thereby using travel time efficiently. Once travel time can be used to work, the period spent in the car can be a less limiting factor which allows travel time to be longer and resulting in a further distance. This makes a larger reach for physical presence.

Volumetric and Holographic Displays

Visual representations of objects in three dimensions, with an almost 360-degree spherical viewing angle in which the image changes as the viewer moves around. True volumetric displays fall into two categories: swept volume displays and static volume displays. Swept volume displays use the persistence of human vision to re-create volumetric images from rapidly projected 2D “slices.” Static volume displays use no major moving parts to display images, but rather rely on a 3D volume of active elements (Volumetric Picture Elements, or voxels) changing colour (or transparency) to display a solid option. Volumetric and Holographic Displays can be used to simulate real situations, objects or even humans located elsewhere, while giving a realistic image. This creates very thin line between reality and virtuality.

Conclusion Mobility

The nature of all of these before mentioned trends makes physical presence less important. Weel et al. (2010) means that cities will become smaller because of advanced communication technology substituting for face-to-face contact. Improved information technologies make production processes and workers more autonomous. This induces the splitting up of headquarters and production plants at different locations. Concentration in dense cities becomes less important. At the same time, further improvements in ICT influence the division of labour and tasks.

On the one hand, better communication technologies reduce the costs of coordination and communication, and lead to further specialisation of work. Together with the decreased need to cluster, virtual communication between specialists all over the world becomes possible. On the other hand, improvements in information technology reduce the need to ask for specialist help and input. When instructions are in one-syllable words, people can produce on their own. This increases autonomy. Together with the trend to spread, workers become less dependent on fellow workers, in terms of both tasks and face-to-face interactions.

More and more work can be done remotely due to the accessibility of information via internet (e.g. could computing) and advanced communication technologies (e.g. virtual communication).

Although some workers will still go to formal offices, a growing number of people will come together in informal settings and work from home more often. “The nature of work has changed due to the popularity of virtual work and an increase in collaboration,” Wilen-Daugenti says. “People no longer have to migrate to a physical location except for important meetings.” For many of us, this will mean the end of cubicles and office potlucks. People can expect to find themselves working together more often in local cafés or hotel lobbies, or setting up informal communal office spaces where people can share resources such as Internet connections and printers, rather than working at home or renting formal office spaces.

There will be a more level playing field. In the past, companies were structured around hierarchies, where a boss was in charge of several levels of employees and had little interaction with, say, an entry-level employee. But hierarchies will become less formal, Wilen-Daugenti forecasts. “Tomorrow’s firms will be more interested in hearing ideas from everyone in an organisation,” she explains, “in order to harness the collective intelligence of all their employees and develop new innovations, better products and services.”

An important success criterion is the convergence of different platforms, networks and devices. It seems that we are heading to a blended market were a network of people, businesses, projects, products and advertisement is integrated into one mix of virtual and physical world. In the next paragraph the empirical findings will be discussed, which will later be compared with the findings from literature.

5.4 Empirical Research: current ICT trends

For the empirical part of this research, in-depth interviews have been taken. In Appendix 5 Interview Protocol, the interview protocol is listed. Based on this protocol each interview has been adapted to the interviewee’s background on beforehand. After having studied the interviewee’s background, specific questions have been added. In the end, the interview questions were sometimes slightly changed to present the context and sometimes were divided into parts. But the aim always was to get the as much elaborated answers to the sub questions. These sub questions are divided into theme´s, namely ICT and real estate.

The interviews were held in two different groups, namely office users and the office or workplace suppliers. The respondents can be seen in Table 11. Of the 21 respondents that were approached 18 were interviewed. Sander Ruben-Van Dinther from Regus was one of the first to be visited and interviewed. iGluu and Spaces did not respond to be interviewed.

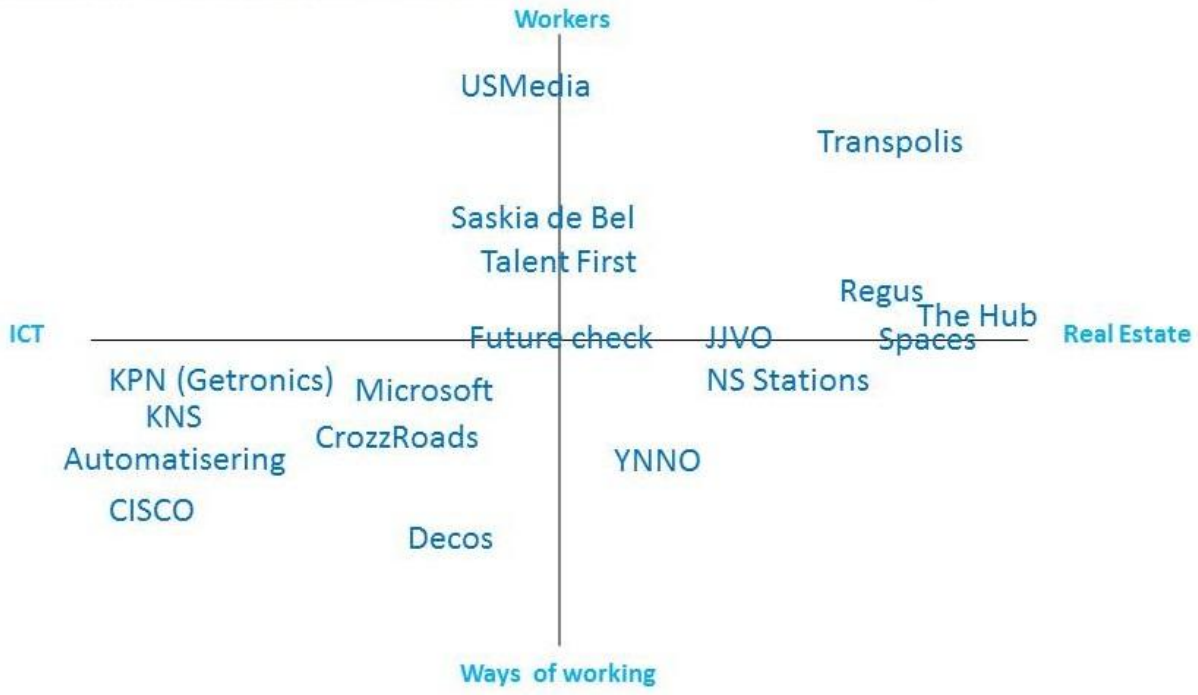
Table 11 Respondents

#	Interviewee	Position	Company	Branche	Date	Location
1.	Sander Ruben-Van Dinther	Centre Manager	Regus	Offices	01-06-2012	Den Haag
2.	Martin de Boer	ICT Business Consultant	KPN (Getronics)	ICT	27-06-2012	The Hague
3.	Marcel Bullinga	Futurist	Futurecheck	Trendwatching	29-06-2012	Sint Pancras
4.	Urwin Rijkaart	Co-owner	CrozzRoads	Creative industry	Multiple	Amsterdam
5.	Sebastiaan de Wilde	Director Asset Development	NS Stations	Transport	03-07-2012	Utrecht
6.	Erik Swart Koen Dibbets	Head of Collaboration System Engineer	CISCO	ICT	11-07-2012	Amsterdam
7.	Jan-Jaap van Os	Entrepreneur Advisor	JJVO		18-07-2012	Amsterdam
8.	Sander van Holland	Development Manager	Regus	Offices	07-08-2012	Amsterdam
9.	Casper van Schie	Director and Partner	USMedia	Creative industry	20-08-2012	Amsterdam
10.	Peiter Burghouts	Sales and Marketing	Microsoft	ICT	27-08-2012	Amsterdam
11.	Merk de Jager	CEO	KNS Automatisering	ICT	18-09-2012	Amsterdam
12.	Saskia Langenberg	Entrepreneur	Talent First	Couching & Training	15-10-2012	Amsterdam
13.	Saskia de Bel	Entrepreneur	Saskia de Bel	Phycology	16-10-2012	Den Haag
14.	Joyce Bruin	Office manager	Transpolis	Offices	03-01-2013	Hoofddorp
15.	Paul Veger	CEO	Decos	ICT	01-03-2013	Noordwijk
16.	Pieter van der Laan	Senior consultant	YNNO	Ways of working	08-03-2013	Utrecht
17.	Paul Somers	Associate	Spaces	Work Places	29-03-2013	Amsterdam
18.	Thijs Croon	ZZP	The Hub	Real Estate	01-04-2013	Amsterdam

19.	Bert Franse	MD	iGluu	Work Places	No respond	Utrecht
20.	Gustav Elmont	Unit manager	Hot Item	Business & IT	No time	Amsterdam
21.	Richard Westerg Merle Blok	- -	TNO	ICT	No respond No respond	Delft

Figure 57 illustrates the distribution of the fields in which the respondents operate. What can be concluded is that most of the respondents (5) operate in the field of ICT. Three respondents provided practical knowledge about workers, while two of them are psychologists. These psychologists provide knowledge about different types of workers (as described in paragraph 6.2). A remarking fact is that trend watcher 'Marcel Bullinga' from 'Futurecheck' provided knowledge about all four fields and interlinked them. Bullinga was one of the anchor points in this research.

Figure 57 Respondent field distribution



Current ICT trends

This section provides answers to the following sub question 1:

What are the current trends in ICT that influence the future demand for corporate real estate portfolios in the Netherlands?

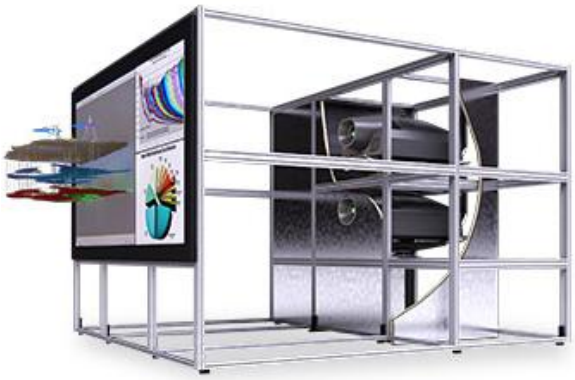
To this question both the users and providers have similar answers. Marcel Bullinga mostly elaborated about trends in ICT, ways of working and organisational changes. De Boer (Interview, June 27, 2012) was one of the first interviewees who clarified how trends exist, change and are adopted. Hypes are new and upcoming innovations and de Boer refers to the Hype Cycle of Gartner. De Boer recognises two important hypes, which are Cloud Computing and Big Data. De Boer explains that these two innovations could take up to five to ten years to be generally adopted. This has to do with the fact that there is no such thing as a company. Companies can be of different sizes, employing from one to 40.000 employees or even more. These different size companies have different adoption curves. Smaller companies who are competitive are able to switch over to something quit easy and fast. For example, small companies can easily switch to cloud computing, because this is financially more attractive, while outsourcing servers, maintenance and making backups. For larger companies it is more difficult to switch over because of all the investments that have been done already, a lot more effort is needed to switch all employees over to cloud computing and sometimes policies do

not easily allow certain changes in handling intern data of the company. This difference in company sizes is an example of the difference in adoption of innovations.

According Bullinga (interview June 29, 2012) trends in the ICT is the most driving factor that you can imagine next to the economy, greying etc. and are things you cannot control. ICT will change the whole building on which you do have control over. If you look a bit further at the moment, then you will see that ICT will change the essence of the building, the use of materials, the people who are in it and the form of the building itself. This is because the streams of people and products will change due to virtualisation. If you are not keeping yourself busy with all these futuristic aspects, and you do not see the break troughs that are being made in medical, accommodation, technical and other areas, people assume that it will take quite a time for these changes to take place. But it is changing fast. We will get robot colleagues and helping robots, more frequent even outside factories.

There will be holograms replacing you at your office place (Bullinga, interview June 29, 2012). CISCO has already hologram like solutions. During my interview, Swart (interview July 11, 2012) referred me to their latest development of collaborative environments created by a display wall of Cyviz (see Figure 58). These walls are not the science fictional version of holograms that appear in mid-air, but are images projected from the back onto walls creating a 3D image observation without the use of any type of 3D glasses.

Figure 58 Cyviz wall (source: www.cisco.com)



The most discussed trends during my interviews have to do with virtualisation, namely the combination of displays and images send over the internet, like TelePresence, holograms or other kinds of video communication.

Figure 59 Microsoft Lync (source: www.microsoft.com)

Bullinga (interview June 29, 2012) explained how we are surrounded by screens and we do things with screens. The whole wall in our houses will be a screen on which you do your homework. Those walls already exist, namely walls on which you do your homework as child. Nowadays children grow up with screens and it will be normal for them to get certain functions on screens. They could learn on screens, they could work on screens. For them it is like a game. Whether you are playing a shooting game or with a learning game, the border is not as clear. That is the oncoming game generation for whom it is very normal to cope with screens and gain satisfaction from, do their work and let out their frustration

Swart and Dibbets (interview July 11, 2012) stated that video over internet is one of the biggest and most important trends in communicating and collaborating from a distance. According to a research done by Gartner, 90% of internet traffic will be video related. During my visit to the CISCO office, Swart and Dibbets extensively gave a thorough demonstration of the latest virtual communication and collaboration products from entirely designed Teleconferencing rooms to an application on an iPad. It is important for the software as hardware to be compatible with different platforms and networks for this mean of communication to work easily. In the near future, these virtual communication means will consist holographic or 3D imaging for a more realistic experience.

Burghouts (Interview August 27, 2012) also clarified that virtual communications is an important backbone to make teleworking possible. A demonstration is held where collaboration software developed by Microsoft called 'Lync' is used for virtual meetings, teamwork or just to ask a question to a colleague. It seems as good working software for collaboration, but nevertheless a specific setup of screens, cameras, speakers, microphones and other acoustic measures is required for meetings and collaboration to take place fluently and clear to all participants.

During the visit to Microsoft, a demonstration is given of their latest collaboration product as seen in Figure 60. A 360-degree panoramic view of the entire room is sent to all far-end participants, providing a continuous view of everyone in the meeting room. In addition, a second video view of the active speaker is also sent, using advanced technology that automatically focuses on the current speaker and tracks the flow of conversation so that the active speaker can always be identified. Both of these video views plus the content being shared are all shown on the same screen for remote participants who are connected to the same live meeting session.

Figure 60 360 degree camera & microphone: Polycom CX5000 (source: www.polycom.com)

All respondents indicate that virtual communication will be used as much as possible unless physical meeting is required, for instance at the first meeting.

To summarise, De Boer (Interview, June 27, 2012) clarified the emergence, changes and adoption of trends. Trends can be described as hypes, which are new and upcoming innovations. De Boer refers to the Hype Cycle to follow the latest trends and their adoption. Different rates of adoption are caused by different sizes and culture of organisations.

Bullinga (interview June 29, 2012) trends in the ICT is the most driving factor that you can imagine next to the economy, greying etc. and are things you cannot control. The most discussed trends during my interviews have to do with virtualisation, namely the combination of displays and images send over the internet, like TelePresence, holograms or other kinds of video communication. These trends are already adopted by the majority, but still are in its infancy compared to what really is possible. Virtualisation will become more and more seamless with the reality in the next five to ten years. An important factor is the costs for equipment needed for TelePresence, as an example. When

these cost drop as much for small and midsized companies to make use of it, the adoption rate will increase rapidly. Unless virtual communicators are satisfied with simple solutions like iPad to perform video calls with. According to the interviewees, the most important trends are Cloud Computing and Big Data and are likely to be adopted by the majority in the next five to ten years. Next to these trends, robots and holograms, this will really influence the decision that travellers have to make. The decision whether they should go personally or whether they should present themselves as a hologram or robot. These trends are likely to be adopted in a slower pace over the next ten years. Unlike the fact that CISCO already has a holographic like wall system that recreates 3D objects or even persons. While organisation will become smaller, dynamic and flexible adoption rate of ICT innovations could increase. This will create a more attractive environment for future office workers.

To what extent can ICT replace natural communication between office workers or between office workers and clients?

All respondents answered that virtual communication will be used more and more during the next coming decades.

Seven respondents (van Os, Langenberg, de Bel, Bullinga, Swart, Burghouts and de Jager) state that virtual communication and collaboration will be used as much as possible because of time and travel efficiency, unless physical meeting is really required, for instance at the first meeting or to interact with physical object (even though digital representatives of physical object also are becoming popular). Van Os (interview June 29, 2012) states it is noticed that virtual communication is being used more and more while you can still see that working from home is accepted for a maximum of two days to prevent losing social cohesion. Langenberg (interview, October 15, 2012) explains the video conferencing is preferred over traveling for a physical meeting and finds video chat a good mean to communicate with her clients to save time, energy and costs on meeting people physically. Except for conversations with emotions involved is preferred physically. Langenberg also explains that by video conferencing some emotions will become vague or even disappear. This could be used as a filter to keep meetings pragmatic and straight to the point. Like the other six respondents, she prefers to meet new people physically for the first time.

At the 'CoreNet Eindgebruikersdebat 2012: Corporate huisvesting 2030' debate Bullinga explains in his presentation during the PROVADA 2012 that the current use of holographic like images of the deceased rapper 2Pac at a performance at Coachella in 2012 and a presenter of CNN will enter the office. Bullinga states that in 2030 it is almost impossible to tell the difference between virtual and physical.

De Bel (interview, October 16, 2012) explains that no matter what, the need for physical contact and belonging to a group of people will remain. The human factor remains important. She explains that the amount of people who collaborate virtually depends on character of the people. Most people (circa 50%) need people around them and prefer to meet colleagues or clients physically. Also does this type of worker prefer guidance from their team leader because of their lack of self-management. There is a good chance that a part of these workers are capable of self-management, but due to the desire for assurance of having work and doing their job well, they do not make the step to become more independent and work remotely or to even freelance. Due to the fact that more than 50% of workers are capable to work remotely or independently, chances are that in the future they will. Guidance, couching these workers and flexibility of their bosses and clients is indeed important to be successful.

De Bel (interview, October 16, 2012) also explained that office workers can be divided into two different types of people. She described that society exists of 20 per cent wolfs and 80 per cent sheep. They have different personal structure. Also do the office workers have different styles in behaviour, which can be determined by tests like the Belbin test.

We need to obtain the power to guide and manage teams who literary are less visible. We need to find ways to sustain the core values of the company. Therefor we will continue to meet physically,

but what will be physical? Nowadays we know that the persons sitting in front of you are made of flesh and blood, but in 2040 we will not see the difference, whether you have a physical deputy of yourself or present yourself in the form of a hologram. 2Pac has become a hologram so you can become a hologram as well.

The stories about holograms and robots are seen by most people as an old-fashioned futuristic story. That is not the case, because over the past fifty years that people talked about it, the technology was not as far. Now the technology is going to be that far. For the biggest part, the technology already is as far. It is just a matter of dripping down from very high and expensive segments to normal life. It will happen fast (Bullinga, interview June 29, 2012).

Combining the seven respondents answers, from the present until 2040, more than one out of three meetings is going to be virtually due to the improvements of remote communication means, but physical meeting will remain.

Looking at remotely collaborating on a global scale level, video conferencing is quite popular. Businessmen who used to travel several hours and sometimes need a hotel just for a two hour meeting now prefers to use video conferencing. Therefor Regus must keep up with communication means for voice over IP, which is used for (video) calls, to be compatible on the other side of the world. In bigger cities like London, Paris and New York we also have Teleprecense, which is quite expensive, but if there is more demand in the Netherlands, then we could implement it here (van Holland, July 7, 2012).

However, Teleprecense cost between $33,900 (TelePresence System 500) $340,000 (TelePresence System 3200) which is still too high for small businesses to afford. And the network would have to be "pretty robust" to support the bandwidth required.

With the possibility of collaborating on a global scale level, competition between organisations and companies will increase significantly the whole world will become everyone’s work and playground. Companies are taking places in chains where before the do not even have to dream about. Virtually, everything lies open and you can go everywhere. A telecom company can become a bank. The functions where strictly separated from each other and never touched each other. Virtually, everything touches each other and that is the earthquake we are going to see the coming 10 to 15 years where whole branches are turned upside down because total newcomers enter due to the fact that everything is virtual. They will shake up everything (Bullinga, interview June 29, 2012).

If we have such technology that we can communicate that well with each other as if it was real and that you cannot separate whether it is real or not, Bullinga thinks that companies in the Netherlands will hire people overseas with more skills and knowledge or for less salary to perform certain task or work for the company remotely. Now there are companies who are located in Amsterdam. They have to choose out of the labour pool in the surrounding area where those people are physically living because they all have get to the office. If you live in China, you will not commute each day to Amsterdam and back to go to work, but virtually you will. As already mentioned, competition in the future will become extremely higher. Now one have to compete locally, but in the future the competition reaches worldwide. However, it also provides many opportunities for personal development. This means that workers need to really do their best to survive in the market (Bullinga, interview June 29, 2012).

In summary, seven respondents (van Os, Langenberg, de Bel, Bullinga, Swart, Burghouts and de Jager) state that virtual communication and collaboration will be used as much as possible because of time and travel efficiency, unless physical meeting is really required, for instance at the first meeting or to interact with physical object or for conversations with emotions involved is preferred physically. Video conferencing could be used as a filter to keep meetings pragmatic and straight to

the point. Working from home is accepted for a maximum of two days to prevent losing social cohesion.

In 2030 it is almost impossible to tell the difference between virtual and physical and the virtual phenomenon will enter the office.

Most people (circa 50%) need people around them and prefer to meet colleagues or clients physically. Also does this type of worker prefer guidance from their team leader because of their lack of self-management. With guidance, couching and flexibility of their bosses and clients the amount of remote or independent workers has a good chance to increase. On a global scale, working remotely the competition reaches worldwide, which means that workers need to really do their best to survive in the market.

With the latest technology, virtual communication and collaboration can be replaced completely, but this for certain occasions it is more pleasant to meet physically. It is more likely that more than one out of three meetings is going to be virtually in the future.

The future of Corporate Real Estate

This section provides answers to the following sub question 2:

To what future demand do current ICT trends lead?

All respondents respond that cloud computing is of great importance for office workers to access any information, from anywhere at every time. Cloud computing can be seen as the backbone for teleworking. Cloud computing can be from simple solutions like Dropbox, Google Docs to highly secured and sophisticated clouds used by governments, banks etc.

De Jager (interview September 18, 2012) explains that cloud computing is interesting for small to mid-sized organisations with multiple office or work locations, or organisations that do not want or can invest in (new) ICT. For example when organisation X has a server and computers of more than three years old (it is not common to have computers and servers of more than five years old) mostly the machines become slow or exceed their capacity and it takes a year before measures are taken. Cloud Computing requires a desktop computer or mobile device (PC, Laptop, Tablet or any other device) that has access to the internet. It is important to have fast internet access to and from the cloud, preferably glass fibre. This makes editing files much more pleasant. Cloud computing does not require much hardware power as long as the data connection, input (mouse, keyboard, webcam etc.) and output (screen, speakers, printer etc.) work well. This means that no investments in sophisticated computers are necessary, even old computers work well. Also can Cloud Computing used by mobile devices, which makes it able support BYOD (Bring Your Own Device).

Langenberg as well as de Bel state that from an organisational point of view, teleworking is purely a mean to reduce costs by reducing office space, less expenses on traveling etc. For the office worker, tele-working provides a better life-work balance. Even though the demand for teleworking from bottom-up exists, in most cases it is the management team who will determine if and how much teleworking is allowed.

Swart and Dibbets (interview July 11, 2012) explain that virtual communication in combination with cloud computing creates a demand for a variety of workplaces close to traffic hubs and homes or even an instant office with a device that connects the internet from anywhere around the world. Van Os, de Bel as well as Langenberg claim that working at home isolates people from the outside world. Of course it depends on the person's character. A workplace near to home, clients or transportation hubs become more and more wanted. However, ever these third workplaces are mostly used for a few hours than for a few days. De Boer, van Os and Swart refer to the adoption cycle of Rogers to give more insight in the adoption rate.

Regus is co-working with a large company who looks 30 years in the future and keeps an eye on ICT developments and early adopters, but they only act just before the majority is going to adopt

certain innovations. From a financial point of view, early adopting has high investment costs, so you want to adopt somewhere between the early adopters and the majority, other ways you are too late (van Holland, July 7, 2012).

Bullinga (interview June 29, 2012) elaborately explains the change in future office demand. What is an office nowadays? It is a way to get jobs done, to let people do their work and to work together and therefore we put people physically together in one place. An office as we experience it nowadays is a unique physical object. In the near future we will not have unique physical objects anymore. We will only have hybrid objects where physical and virtual comes together.

Till today it is a nice way to work together and nothing else was known. But in the future there will be ways of working where teams are being guided, teams who are working together, partly virtually and partly where they physically come together in the same place. It will be capricious and unpredictable. There will be industries that do not need offices, because they will work at a Starbucks or elsewhere to get a project done. Office work will change. Because as far as office work is routine, administrative and controlled, these tasks will disappear. It will be replaced with software, because this software will be far smarter, more handy and efficient than letting people do it. We will focus more on creative processes, design processes and developing tools to remove administrative, hazardous and routine work. However, these tools need to still be designed. Instead of controlling workers, in the future workers will be co-guided. They will be helped with finding their focus in their work and coaching in general. These are all tasks that will maintain.

What you will get is that people who are sitting in offices nowadays will not have to work anymore. They will be sitting in those offices being useless. That is also a reason for not talking about office portfolios anymore, because they will be left out one way or another. The demand for office space is going to reduce anyway. Next to that, as a matter of fact, getting together in other ways will become easier. Work can be done everywhere. That way you will only have different moments left. One, two or three times a week or at least se less than five times a week to physically get together. At that moment you also have two choices, whether you will physically go to the inspirational drink, in the future there will not be work meetings anymore because those are done virtually in the future, or you should go there physically but send your hologram instead if one could not tell the difference. What will happen if someone else cannot see the difference? However, the threshold to go somewhere physically will become very high. For example your presence here to conduct this interview actually is too crazy for words. It is a useless waste of money, utilisation of train capacity and a waste of time that could be used to interview other important people. Due to the fact that technology is not as far developed to make it possible to do this interview from a distance. In the coming five to ten years, the technology will be as far advanced to make it possible. We are going to make choices about that.

Besides ICT trends, trends within organisations manly caused by ICT trends are discussed as well. Each colleague at Cisco has their own workplace at home for which they get a financial compensation. Microsoft at Schiphol has a rule that only 20% of work is allowed at the central office. The other 80% office workers should work from home or other workplaces. This 20-80 rule has been introduced as a pilot to maximise teleworking. It becomes less important where you work, no desk is mandatory for a worker to perform his/her activities. A shift needs to be made from managing on working hours to managing on output instead. This is difficult to measure, even so when checking on the amount of hours sitting behind a desk. However, it is better to let workers do their work when they are productive as much as possible. In the end, that is what counts.

Organisation will become smaller, dynamic, and flexible. The core of the organisation will be reduced. Further to the year 2040, office workers will demand certain facilities to support their desired way of working, if not, they will find a job elsewhere. Toward 2040, more and more people will be working at different hours during the day at the most convenient location while using the most convenient device for a certain job at a certain time (de Jager, interview September 18, 2012).

Bullinga (interview June 29, 2012) doubts that there still will be permanent contracts. Not for rent or lease neither of buildings nor for people. It will be short term and project based. The whole story about independent entrepreneurs will become larger and larger. There will be more freelance work which requires other working conditions. For example, a Jamaican start-up company that attracts people with two promises: twice a week your whole house will be cleaned for free and you have unlimited holidays. Does that mean that you can lie on the beach 365 days a year? No, because it does not matter how many holidays you take as long as you finish your tasks or finalise your project in time.
In the past and today still, you are cut off from your work environment. You could answer your mails, but that is about it. In the future we will see that the whole work environment, in which we are now, is merged into screens. You have access to all the companies' critical data. You have everything you need to do your work as long as it is virtual work that you do. In the case of a construction worker for example it becomes difficult, because he really needs to physically be present at his work. There are two types of jobs. A job where you physically need to be at the location and jobs where you do not need to be physically present. Until today, office work belonged to the first category, but that is not the case anymore. One could work everywhere for a company that is located anywhere in the world, but therefor environments are needed in which everything is transparent. The worker needs to be transparent. It is critical to know what the worker is able to, his qualifications, whether he is telling the truth, if he is not defrauding with his Curriculum Vitae, does he have a proven track record of tasks and projects, are payments done, is he checked? Those are environments that are currently emerging, like 'Elance' for example, which an environment in which one can bid on tasks and auctions etc. That is currently in development, with its ups and downs however. Transparent environments are a necessity for working from a distance for different jobs to work. It is in development which will take some time, but soon several standards will come out (Bullinga, interview June 29, 2012).

Looking at the current generations, Generation Z who currently are growing up with those screens Bullinga have mentioned earlier and other devices, soon there will be a tipping point in ways of working and communicating and collaborating. Because when this generation starts to enter the market, they want to immediately work in an entirely other way than the current and old generations of office worker.

Bullinga (interview June 29, 2012) has concluded this from the research done by CISCO. This research questioned 3000 young professionals of which 79% said that they do not want to work inside an office. They just do not want to anymore, because they grew up with all these screens. But it will take a while for those who have the power, and who obviously are a bit older, are prepared to go along with this. They would do it only when they are being forced to. They will not do it voluntarily.

You will do things based on two reasons. Because you think something is the best next thing or because it must be done due to external pressures like the economy and the labour market. Apart of the people who switch to virtual are pioneers. Pioneers are people who do things because they are fascinated by something. This group is called the 'Innovators'. However, the majority do things because it has normal. If at a given time one cannot hire young people with an office located at one location, then you should be scratching behind your ears and wonder if you are not doing anything wrong. That is how it will go.

Every real estate strategist who says that they would have an office portfolio in 2040 is insane (Bullinga, interview June 29, 2012).

In 2040, companies in the Netherlands do not have an office portfolio, but workplace portfolio. There will be a shift from offices to workplace. These workplaces are situated everywhere, around the world, throughout the Netherlands, at peoples home, petrol stations (which will not exist

anymore and are transformed to other functions). Offices will not exist anymore in 2040 (Bullinga, interview June 29, 2012).

All respondents respond that cloud computing is of great importance for office workers to access any information, from anywhere at every time. Cloud computing can be seen as the backbone for teleworking. Cloud computing can be from simple solutions like Dropbox, Google Docs to highly secured and sophisticated clouds used by governments, banks etc. From a financial point of view, switching towards cloud computing is interesting to prevent from investing in ICT. From an organisational point of view, smaller companies can more easily switch over than large companies. On the long run, Cloud Computing is beneficial when it comes to mobility, flexibility and outsourcing ICT maintenance. Teleworking is purely a mean to reduce costs by reducing office space, less expenses on traveling etc. For the office worker, tele-working provides a better life-work balance. Even though the demand for teleworking from bottom-up exists, in most cases it is the management team who will determine if and how much teleworking is allowed.

Early adopting has high investment costs, so you want to adopt somewhere between the early adopters and the majority, other ways you are too late

In the future there will be ways of working where teams are being guided, teams who are working together, partly virtually and partly where they physically come together in the same place. It will be capricious and unpredictable. Routine work will diminish and done by software. We will focus more on creative processes, design processes and developing tools to remove administrative, hazardous and routine work. The threshold to go somewhere physically will become very high. In the coming five to ten years, the technology will be as far advanced that we are going to make choices about that whether to go somewhere physically or virtually. Microsoft at Schiphol has a rule that only 20% of work is allowed at the central office. The other 80% office workers should work from home or other workplaces. A shift needs to be made from managing on working hours to managing on output instead. However, both ways re difficult to measure, it is better to let workers do their work when they are productive as much as possible. In the end, that is what counts. Organisation will become smaller, dynamic, and flexible. The core of the organisation will be reduced. Further to the year 2040, office workers will demand certain facilities to support their desired way of working, if not, they will find a job elsewhere where they can work at different hours during the day at the most convenient location while using the most convenient device for a certain job at a certain time. Transparent environments are a necessity for working from a distance for different jobs to work. It is in development which will take some time, but soon several standards will come out.

Current supply versus the future demand.

This section provides answers to the sub question 3:

What is the best possible solution for corporations to obtain a real estate portfolio stays aligned with the future demand?

To answer this question, a more specific question was asked first.

To what extent do current corporate real estate portfolios match the future demand?

De Bel (interview, October 16, 2012) states that in 2040 big organisations will not exist anymore, also does van Os (interview June 29, 2012) but he defines that in 2040 organisations will not exceed 100 colleagues. Larger organisations will be to cumbrous compared to small, flexible and agile organisations. This means that large, mono-functional office buildings (like at the Zuid As) will be otiose. These large buildings can be transformed to mixed-use buildings providing workplaces, housing and eventually recreational purposes.

In 2040 there will be more company collective buildings like Seats2Meet, Regus Spaces etc. where different people from different companies will work. The mix of different workers from different companies provides cross-fertilisation for new projects or services. It also increases the speed in doing business faster and more efficient compared to arranging this via internet or phone.

Your vision on the world will expand, because of the constant flow of new people you meet. The social aspect remains when using third place workplaces. Furthermore van Os (interview June 29, 2012) finds that offices need to be fun, cosy and more homelike.

The co-working places which are currently emerging are the precursors of the future office. This is because herein they have let go the idea that a fixed group of people need to work in the same space during fixed hours. It will be unpredictable and spontaneous, but still organised. It is organised spontaneously and you will incidentally meet people who do not have anything to do with your "scope" of work (Bullinga, interview June 29, 2012).

Regus

We are busy with new concepts of which some are already implemented have to do with the new way of working, for example our cooperation with the NS. Our first community centre that we have opened and we are looking to roll out as much as locations as possible in the Netherlands. But these locations will be more and more situated at locations with a lot of traffic. These locations can be a bit smaller and function as a hub where people get in quickly to work or meet and leave again. At the moment we have almost fifty locations and it is expected to grow to 100 locations within a year. This doubling in locations expectation is based on the demand for the new way of working. We want to facilitate people on the location where people need us at that moment that we think they need us. For example you are traveling by train from The Hague to Amsterdam and you miss the train, then you need to call the office that you are running late. Instead, we offer a Regus Gold Card from €25,- per month that gives you access to our business lounge situated in the train station where you can work, get some coffee and save time. If your meeting is very important, a video conference can be set-up instantly. Regus want to facilitate people there where the need us at that particular moment (van Holland, July 7, 2012).

Worldwide Regus has 1200 locations, in the Netherlands we are a test country for all new concepts. The Station2station project in collaboration with NS is a pilot project provided by Eduard Schaepman (General Manager of Regus) who also is a pioneer in new ways of working which allows us to unroll these kinds of test projects in the Netherlands. From there on, if it is noticed that the concepts works, it will be transferred to other countries, same as the community centre at Laaren. Regus as a whole intends to expand to 100 locations within the Netherlands and worldwide to 3000 locations in one or two years Looking back at the Dutch history, the Dutch always have been entrepreneurs and have been around the world. In the Netherlands they always are innovatory. The Netherlands is so small that we look beyond our borders (van Holland, July 7, 2012).

In the past Regus provided standard office layouts and interior worldwide. Nowadays Regus is changing this standard interior. This has its pro's and con's for the user. What we really do is providing our network. With the Regus Gold card you get access to all their Regus centres, business lounges and you get access to an online platform where you can meet other Regus users. A research is done by Mark Dixon founder of Regus) and Phillip Ross in which they state that there barely was internet 20 years ago, there were almost no mobile phones, but there were offices. Regus predicts that over 30 years the internet will exist in a superlative degree; we will make more use of smartphones, social media etc. Maybe even offices will vanish. This might be a bluntly conclusion, but it is important how to deal with these changes. People should work where they are most productive. But when people work at home, they will need professional spaces to meet people. Also people who work from home prefer to have a professional address, which also can be arranged with Regus to use one of their addresses while mail will be forwarder to your home address. The same can be done with telephone, a phone number with a city code representing a city with status and where a Regus office is located can be used. A Regus phone attendant picks up stating your firm name and can put the caller trough to your own phone number or just leave a message.

Regus is now looking at developments to renew certain services and interior. Currently Regus has a corporate image, but now we are looking at the demand in the Netherlands and even locally. What we do is thinking global, but acting local.

New developments are station to station locations, which is a sort of hub where users can easily hop in a Regus office located on a train station. Here, the users can do their work or have a meeting physically or by video conferencing, drink some coffee, maybe have a bit and leave again Regus centres are located in business parks and in city centres. Besides locating at train stations, we are considering moving even closer to the users, namely to villages. In these villages, there are many people who commute to cities to go to their office. We have recently developed a community centre in the centre of Laaren. This community centre is provided with on the ground floor a Starbucks, a small shop, a caterer and different types of trendy workplaces for users to perform different activities. On the first floor there is a standard Regus division with a gym (van Holland, July 7, 2012).

Regus does not really provide ICT devises. Some computers are available and of course beamers, telephony and video conference devices are present. Regus mainly provide an internet connection that suit the user's needs.

Bullinga (interview June 29, 2012) thinks the majority is already switching over to virtual. It is happening very fast. I think it has accelerated with the introduction of the iPad and the iPhone around 2010, which can be seen all around us. The development of Apps gives an explosion of creativity. From these developments, several standards will be originated. Smart collaboration software and smart virtual collaboration environments that are safe and can be trusted and wherein one knows what can be expected from others literary. Actually, the village will be copied, because in a village you know the butcher, the baker and the greengrocer which is a trusted environment. You know for who you have to watch out, with who you need to be sentimental because he does not give back enough and also who is honest. That is what is going to happen as well, but then virtually. The village will be recreated. It is not the city that will be recreated, because in the city people do not know anything about each other. Bullinga thinks that we will get there around 2020. Why? Because everybody is individually trying out and getting along with an iPhone, and when you arrive at the office, you need to work on that stupid computer. People will feel like doing things smarter and better. I suspect that individuals are faster than companies this time. Companies are carrying the weight of all those buildings and ICT the old-fashioned with them. While companies that are starting over again, or starting up from scratch decide to do it in another way. They decide to do it transparent and with BYOD (Bring Your Own Device) and with a Starbucks workplace instead of offices. If you see how huge their lead is in terms of cost reduction and have more fun doing their work and being more motivated. Research shows that 86% of the co-working place users find to be more motivated and more productive (Bullinga, interview June 29, 2012).

In eight years' time when the majority has switched, we still have all those buildings left. They will be standing there being useless. The magic word is 'transformation'. They must get rid of all those zoning plans. They want to determine everything. They should really stop doing that. It is so annoying. The best zoning plan is no zoning plan. 'Offices' that are left over will be glorified restaurants. In a restaurant it is fun to meet each other.

There still are companies planning to construct new buildings or at least are planning on constructing new buildings even when there still are vacant buildings. We cannot prevent this from happening again, as long as the financial interests are such that the demand does not matter, this will remain. Therefore there is a desire for transparent markets where future users are involved in designing a building. Constructing something while not worrying what is going to happen inside because your business model is there already is not the way to do it. In their opinion the profit already exists. They took the profit, like bankers do, and let the neighbour, or actually the citizens, pay the depts. Therefore a vacant office found will be created.

To match the supply to the future demand user participation is needed that is, however, an element that allows for more transparency and that buildings are constructed for something that is

really demanded. People are going to work at a third, fourth or fifth workplace like a Starbucks, but then you will get a shift in building ownership. It does not matter to be the owner of a building. Unless you see a building as a goal, then it does matter. But when a building is a mean to perform a certain function like education, collaboration, learning etc., then it does not matter to own property. It does not interest me to own solar panels. It costs me a lot of financial investments while I need to see when I will receive my return on the investment. That does not work. I just want to have access to energy. That does not mean that I specifically need those solar panels, I just want to lease electricity and that I am ensured of getting energy. The same when I want to be ensured for a work stream. This could be a building, a part of a building or a temporarily part of a building. It could also be something else.

If Starbucks is smart, then they will also head to co-workplaces, because co-workplaces in definition are set up to be a workers gathering place with a restaurant function. The restaurant function will seamlessly merge with the working aspect, because that is what makes it fun. Moreover the environment and the building should be inspiring and needs to have a strong identity. Then people like go there. I do not like to go into an office. Everyone who has an office portfolio in his portfolio with offices that are replaceable can forget it. Or you have an office with identity or you have nothing. The co-workplaces have their location and their building designed from Horeca and working. They make it possible that the people who work there are able to meet each other. It is not a must, it is possible. They provide the tools. They do not command to talk with certain people at a certain time. They can make use of the opportunities that are present. Starbuck comes from the private segment. They are a restaurant, a lunchroom or a coffee shop, but that is it. It If they are smart, then they will see a new market and also head towards the co-workplaces. They could develop two identities, like the old traditional Starbucks or the Starbucks Pleasure and the Starbucks business or Starbucks workplace or something like that (Bullinga, interview June 29, 2012).

Larger organisations will be to cumbrous compared to small, flexible and agile organisations. This means that large, mono-functional office buildings (like at the Zuid As) will be otiose. In 2040 there will be more company collective buildings like Seats2Meet, Regus Spaces etc. where different people from different companies will work. The mix of different workers from different companies provides cross-fertilisation for new projects or services. It also increases the speed in doing business faster and more efficient compared to arranging this via internet or phone. Your vision on the world will expand, because of the constant flow of new people you meet. The social aspect remains when using third place workplaces. Offices need to be fun, cosy and more homelike. The co-working places which are currently emerging are the precursors of the future. The office will be unpredictable and spontaneous, but still organised. In the past Regus provided standard office layouts and interior worldwide. Nowadays Regus is changing this standard interior. Also they have developed a community centre provided with on the ground floor a Starbucks, a small shop, a caterer and different types of trendy workplaces for users to perform different activities.

To summarise, the future demand for office use depends strongly on the characters of the users and the how ICT really performs, especially virtual communication. It can be concluded that the amount of third place offices will increase, organisations will become smaller and the world in which we work will be closely related to the life we live.

The majority is already switching over to virtual and has accelerated with the introduction of the iPad and the iPhone. Smart collaboration software and smart virtual collaboration environments that are safe and can be trusted and wherein one knows what can be expected from others literary. Actually, the village will be copied, because in a village you know the butcher, the baker and the greengrocer which is a trusted environment.

For every company a moment will come when they decide to do things transparent and with BYOD (Bring Your Own Device) and with a Starbucks workplace instead of offices. This will lead to co-working place where users find to be more motivated and more productive.

Buildings that are left behind empty should be transformed or demolished. Therefore the zoning plans need to get rid of. As long as the financial interests are such that the demand does not matter, construction of new offices will continue.

People are going to work at a third, fourth or fifth workplace like a Starbucks, but then you will get a shift in building ownership. It does not matter to be the owner of a building. What matters is to be able to make use of workplaces and they need to be attractive. A restaurant function will seamlessly merge with the working aspect, because that is what makes it fun. Moreover the environment and the building should be inspiring and needs to have a strong identity. Then people like go there.

After conducting the interviews there was little differences between the trends found in literature and the obtained trends trough the interviews. During the interview with Paul Veger (interview March 1, 2013) we passed through the trends that we both found relevant for new ways of working. The trend 'Crowd sourcing' I did not find in literature yet.

From the interviews the trends 'Speech recognition' and 'Gesture Control' have not been obtained, while screens, software that takes over human routine work and crowd sourcing were not yet found in literature. Big Data was both found in literature and from the interviews, but it is not relevant ways of working or to workspace.

Furthermore, all interviewees discussed only trends that could be related to real estate and/or office work. Much input was obtained immediately about the influence of the trends on the future demand. In Table 12 the trends acquired from theory and the trends from the interviews are set out.

11 trends from the interviews were similar to the trends acquired from literature. Speech recognition and gesture control were not mention during none of the interviews, while big data (which appeared to be irrelevant), screens, software for routine work and crowdsourcing where not clearly retrieved form literature on beforehand.

Table 12 Comparison, relevant ICT trends from literature and interviews

Trends from Theory		Trends from Empirical research
1	Speech Recognition	
2	Media Tablets	Mobile devices
3	Virtual Worlds	TelePresence/Video Virtual communication
4	Gesture Control	
5	Cloud Computing	Cloud Computin
6	Augmented Reality	Augmented Reality
7	BYOD (Bring Your Own Device)	BYOD/CYOD
8	3D Printing	3D printing
9	Gamification	Gamification
10	Mobile Robots	Robots
11	Autonomous Vehicles	Autonomous Vehicles
12	Volumetric and Holographic Displays	holograms
13		Big Data. (not relevant)
14		Screens
15		Software for routine work
16		Crowdsourcing

What is the future demand of office workers for real estate portfolios in the Netherlands in the year 2040 as a result of ICT developments over the next two decades and how can the supply be matched with this demand?

Most interviewees repeated most of Bullinga's answers to the questions, but some added extra or more in depth answers. It can be expected that a trend watchers provide the most information about trends compared to other ICT or real estate professionals. Of course, ICT developers and real estate professionals have more in-depth answers to their field of interest. Bullinga described the link between ICT and real estate quit thoroughly. Whether or not Bullinga's predictions about the future are true can only be verified in the future, but that does not really matter in this research. What really matters is for real estate managers to understand possible futures to be able to anticipate on

changes. This anticipation will lead to a better fit to the demand of the users over the next twenty years or more.

Cloud computing is an important way of accessing and processing data. Cloud computing allows users to get access to data from any internet access point all over the world. Also does cloud computing allow different users to process the same data. This makes collaboration and co-working from a distance easy and reliable which stimulates more collaboration between other colleagues and clients worldwide.

As an interim answer gained from the interviews and literature, it seems that office workers demand variety in office types, locations and working hours. ICT, especially virtual communication means therefor need to be reliable, compatible and provide a high quality output (i.e. sound, image and real-time). Of course these trends partly depend on developments of other ICT to be enhanced and made ready for used by the majority from a timespan beginning now till ten years or even more, depending on the position and characteristics of the trend as illustrated on the Hype Cycle. In the end, technological changes will have impact on business and society.

5.5 Impacts of advances in ICT on Business and Society

Information technology will elevate the degree of automation in many application domains. Advances in software engineering will allow to rapidly develop software and to support an increasing number of business processes. At the same time, more people will be capable and willing to use information technology due to improvements in human-computer interaction and user interfaces. Connectivity and standardisation will facilitate the coordination and integration of different applications and systems on a large scale. From a general point of view, the main contribution of information technology in the short and medium term is improved efficiency. Still, this does not preclude major impacts on business and society, as quantitative improvements in efficiency may surpass a threshold, resulting in fundamental qualitative changes. Some of these probable consequences, as well as some of the involved chances and risks will be outlined:

Unemployment:
Unemployment due to technological advances is mostly seen as a danger today, as it threatens the existing social structures. In the long term, the implications may be positive or negative, depending on whether the released forces are used for constructive or destructive goals.

Technology Dependence:
The increasing use of information technology in many aspects of everyday life leads to an increasing dependence on this technology which in turn leads to an increased vulnerability to failure and sabotage.

Individualisation:
The advances in flexibility together with the reduction of overall development costs allow to customise products literally to a single customer. This results in higher diversity and the possibility of rather different lifestyles for each individual person. The individual may perceive this development as an increased ”quality of life”.

Global Surveillance:
The increasing pervasion of everyday life with information technology allows to gather and analyse an unprecedented amount of data about each individual. While this data may be used to detect criminals, for example by creating a movement profile based on credit card transactions and mobile phone activity, there is also a growing potential for information misuse by governments and

other organisations to establish a global surveillance system for its citizens. The advances in technologies like language or image interpretation will enable a limited semantical analysis of gathered data that was previously impossible. While this risk of misuse should definitely not be taken lightly, there is also a growing public concern for these developments as demonstrated by recent strong disapprovals about hidden global serial numbers in widespread hard- and software products. Although generally society as a whole is responsible to install and enforce stronger data protection laws, there are also means for the individual to protect its privacy by using strong encryption technology, for example.

Communication Behaviour:

Although permanent availability for communication is possible, it is generally not desirable. This leads to a growing importance of asynchronous communication as it allows to combine availability with the freedom to interact at a suitable point in time. As a consequence, it is no longer necessary to communicate in person at all times. While business has accepted this change in communication behaviour (in some companies electronic mail has become more important than phone), it is not clear if this trend carries on to private communication. On the one hand, improved facilities allow communication on a global scale as well as interaction possibilities also for previously handicapped groups in society. On the other hand, susceptible individuals may substitute electronic for personal communication and subsequently lose contact with reality. It is the responsibility of the individual to balance the available modes of communication.

5.6 Conclusion

This chapter discussed the expectations of future ICT based on current innovations and trends that influence Corporate Real Estate strategies. These expectations have been obtained by 'trend watching' which resulted in ICT trends that have been extracted from literature, the Hype Cycle and from in-depth interviews. With the combination of relevant trends, the following research question can be answered:

Sub question 1

What are the current trends in ICT that influence the future demand for corporate real estate portfolios in the Netherlands?

The current ICT trends that influence the future demand for corporate real estate portfolios in the Netherlands are stated in Table 13.

Table 13 Current ICT trends that influence office work

Trends	Control and input:	Mobilisation:
16. Speech Recognition		
17. Media Tablets		
18. Virtual Worlds		
19. Gesture Control		
20. Cloud Computing		
21. Augmented Reality		
22. BYOD (Bring Your Own Device)		
23. 3D Printing		
24. Gamification		
25. Mobile Robots		
26. Autonomous Vehicles		
27. Volumetric and Holographic Displays		
28. Screens		
29. Software for routine work		
30. Crowdsourcing		

Trend watching

Trend watching is about observing and understanding what is already happening and in this research it is about what innovations or further developments are happening in ICT. Business decisions often depend on a good understanding of the maturity and evolution of technologies. Hype Cycles offer a snapshot of the relative maturity of technologies, IT methodologies and management disciplines.

Although, there are criticisms of the hype cycle that it is not a cycle, that the outcome does not depend on the nature of the technology itself and that it is not scientific in nature. The hype cycle is indeed not a cycle from the perspective of an individual hype. The process from innovation to adoption as a whole can be seen as cycle for different and new hypes. The outcome of hypes does depend on the nature of the technology itself as well as how the technology is accepted by the (potential) users. Some proposed technologies do simply crash without recovering. Hype cycles highlight overhyped areas, estimate how long technologies and trends will take to reach maturity, and help organisations decide what and when to adopt. The right timing (not too early and not too late) of adoptions is can work as a competitive advantage for businesses. The adoption rate of innovations mostly depends on the technology's applicability, risks and benefits. Considering timing, Rogers (1995) has divided personalities into five different classifications of members of a social system on the basis of innovations, namely Innovators, Early adaptors, Early majority, Late majority and Laggards. The rate of adoption is defined as the relative speed in which these members adopt an innovation. Rate is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation.

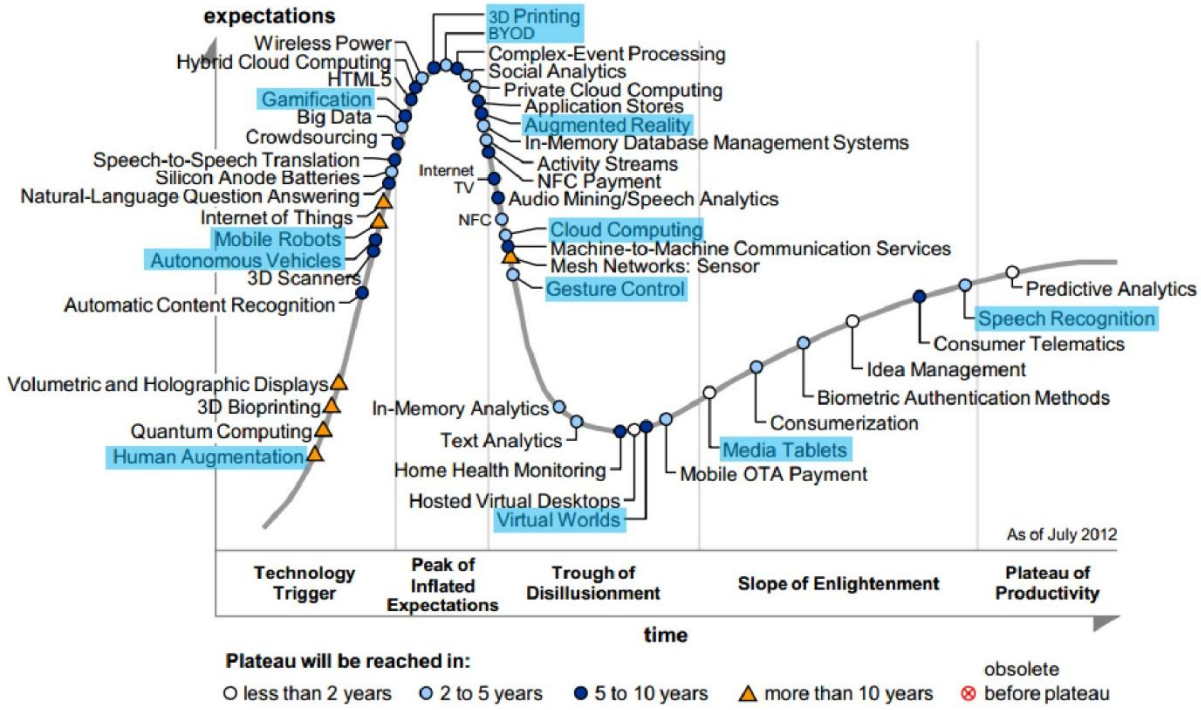
The accepted premise is that every new technology goes through the following phases:

4. **Hype:** Search for next big thing leads to Hype around any new technology.
5. **Struggle**: Adoption of these Bleeding Edge technologies depended on the Visionaries who had the vision, energy and money to make it work.
6. **Success**: Mainstream adoption required convincing the Pragmatists who needed success stories and support system around the technology.

Theoretical research: current ICT trends

Twelve hypes on the 2010s' and the 2012s' Hype Cycle have been identified (see Figure 61). After selecting the trends relevant to office work and/or the office workplace the trends are divided into two subjects, namely 'control and input' and 'mobilisation'.

Figure 61 Emerging Technologies Hype Cycle 2012 (Source: Gartner, 2012)



Control and input

The three relevant trends that might influence the way office workers perform their activities are Speech Recognition, Media tablets and Gesture Control. These three trends influence the control and input of computing devices. All three trends leave out the keyboard, mouse or any other controlling element. Hereby users have more freedom to move around while interacting with the devices. This allows redesigning workplaces into more open and comfortable spaces. Besides freedom, these three trends allow quicker, more intuitive and maybe even more fun to interact with than using a keyboard, mouse or trackpad. Considering user friendliness, control and input are important factors for innovations to be adapted. Rigid interaction with ICT can cause stress and frustrations

Mobilisation

The following trends allow workers to perform their activities with extra mobility within and between workplaces and time: Media Tablets, Virtual worlds, Cloud computing, Augmented reality, BYOD (Bring Your Own Device), 3D Printing, Gamification of the workspace, Mobile robots, Autonomous Vehicles, Volumetric and Holographic Displays. These trends (except for 3D Printing, Mobile robots and Autonomous Vehicles) make it easier and cheaper to safely access, process interact and share information from around the world via (mobile) devices and/or via internet. 3D Printing, Mobile robots and Autonomous Vehicles provide workers to use their travel time to physically meet and interact with persons or goods more efficiently.

From the literature study it can be concluded that the current developments and innovations in ICT can replace physical presence more and more with virtual communication. More and more work can be done remotely due to the accessibility of information via internet (e.g. could computing) and advanced communication technologies (e.g. virtual communication).

Also improved information technologies make production processes and workers more autonomous.

More and more work can be done remotely. Although some workers will still go to formal offices, a growing number of people will come together in informal settings and work from home more often. People no longer have to migrate to a physical location except for important meetings. People

can expect to find themselves working together more often in local cafés or hotel lobbies, or setting up informal communal office spaces where people can share resources such as Internet connections and printers, rather than working at home or renting formal office spaces.

There will be a more level playing field. In the past, companies were structured around hierarchies, where a boss was in charge of several levels of employees and had little interaction with, say, an entry-level employee. But hierarchies will become less formal, Wilen-Daugenti forecasts. “Tomorrow’s firms will be more interested in hearing ideas from everyone in an organisation,” she explains, “in order to harness the collective intelligence of all their employees and develop new innovations, better products and services.”

It seems that we are heading to a blended market were a network of people, businesses, projects, products and advertisement is integrated into one mix of virtual and physical world.

Empirical Research: current ICT trends

Most interviewees repeated most of Bullinga’s answers to the questions, but some added extra or more in depth answers. Bullinga described the link between ICT and real estate quit thoroughly.

Whether or not Bullinga’s predictions about the future are true can only be verified in the future, but that does not really matter in this research. What really matters is for real estate managers to understand possible futures to be able to anticipate on changes. This anticipation will lead to a better fit to the demand of the users over the next twenty years or more.

In the conducted interviews, ‘big data’ and the way to access and make use of large amounts of data and information is an important aspect for organisations to be more efficient and effective. Cloud computing is an important way of accessing and processing this data. Cloud computing allows users to get access to data from any internet access point all over the world. Also does cloud computing allow different users to process the same data. This makes collaboration and co-working from a distance easy and reliable which stimulates more collaboration between other colleagues and clients worldwide.

It seems that office workers demand variety in office types, locations and working hours. ICT, especially virtual communication means therefor need to be reliable, compatible and provide a high quality output (i.e. sound, image and real-time). Of course these trends partly depend on developments of other ICT to be enhanced and made ready for used by the majority from a timespan beginning now till ten years or even more, depending on the position and characteristics of the trend as illustrated on the Hype Cycle. In the end, technological changes will have impact on business and society.

Innovations and developments in ICT is the most driving factor next to the economy (greying, recession etc.) and are things that cannot be controlled.

Cloud Computing is stated as the most important ICT trend that is already being adopted at the moment and will be adopted by the majority in 5 to ten years’ time. Cloud computing will boost flexibility in working hours, location and devices during this period. Nowadays screens are almost used everywhere, from Teleconferencing to smartphone and media tablets. Even holographic or 3D imaging technologies are being further developed for a more realistic experience. More frequently Robot colleagues are entering the work floor, even outside factories. There will be holograms replacing physical presence at offices in 10 to 15 years’ time. All these trends will raise the threshold for workers to physically meet to do business. Decisions will be made whether they should go personally or whether they should present themselves as a hologram or robot. Virtual communication will be used more and more during the next coming decades. Virtual communication and collaboration will be used as much as possible because of time and travel efficiency, unless physical meeting is really required, for instance at the first meeting or to interact with physical object (even though digital representatives of physical object also are becoming popular).

While organisation will become smaller, dynamic and flexible, the adoption rate of ICT innovations could increase. This will create a more attractive environment for future office workers.

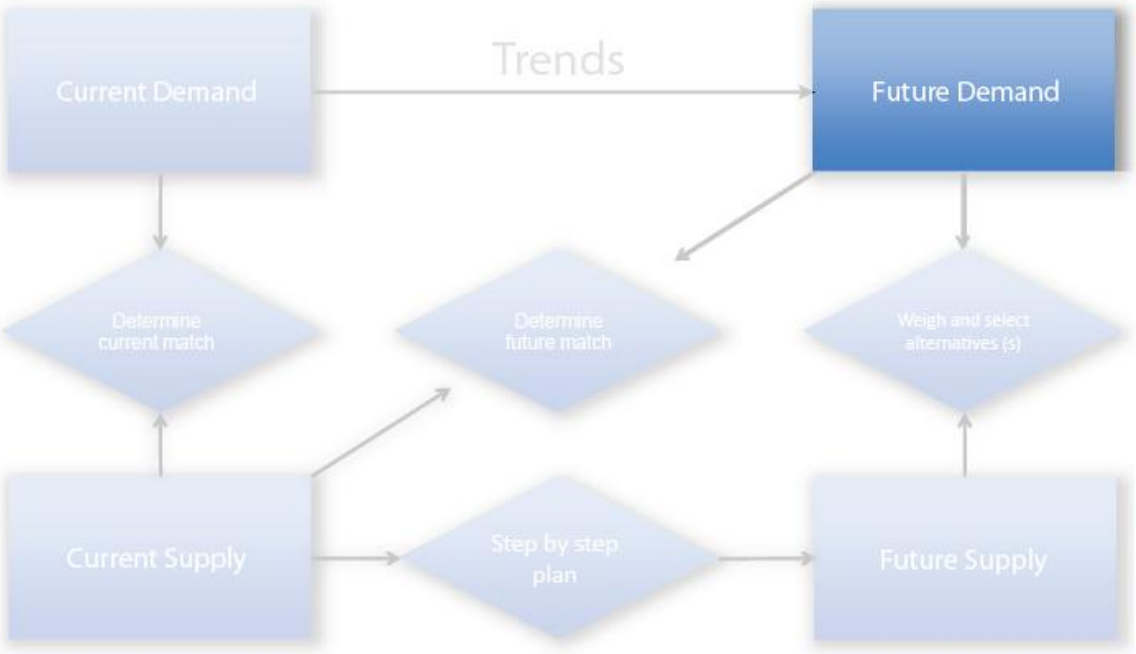
All these hypes are likely to be adopted by the majority within the next ten to 15 year, which brings us to 2030's. In 2030 it is almost impossible to tell the difference between virtual and physical.

In 2040 even the late majority will have adopted these innovations. However, the adoption rate and amount could be deviated by the behaviour of the latest generation. Looking at their environment in which they grow up, it is likely that they will easily adapt to new innovations. Unless a counter trend of digitalisation occurs where this generation desires to go back to the core. Where more handwriting is done and physical meetings and interaction takes place. But then again, global competition kicks in where those using advanced ICT can get the job done faster, cheaper and with better quality.

When organisations provide guidance and manage teams who literary are less visible workers will be stimulated to make use of their flexibility and freedom. By that time, more is known about self-management. Once working with mobile and collaboration devices at schools self-management will be taught to pupils.

Over the last three years 20 per cent of office workers in the Netherlands have been working location independent. Assuming that management of organisations are not likely to easily give up their 9 to 5 working structure, because they are afraid of losing their overview and control of their workforce, a tipping point will occur. When the generation Y or even Z starts to enter the labour market, they will demand a flexible way of working having freedom in devices they use and choice in work hours, locations and maybe even projects they can apply for.

6. Future demand 2040: *Choice in Place & Freedom in Technology*



6.1 Introduction

Transitions to the knowledge-based economy, fluctuations in the economy, current worker dislocations and future skill shortages have brought workforce development to the forefront. In a competitive business environment, companies are always looking for newer ways to reduce overhead, increase productivity and improve efficiencies. Moreover, when multinational companies expand across geographies, it is not always possible to set up permanent offices from day one. Even in the case of start-ups and small businesses, infrastructure budgets are minimal; however, it is very important that the business puts its best foot forward. Therefore it is important to understand the demand for office space and be able to optimise. Due to the inflexible nature of real estate itself, the demand for office space must become clear over a longer period of time while considering changes of the economy and demography. In this research the future demand is the accommodation requirements determined by organisations and knowledge workers in the year 2040 and will be based on trends in ICT. Therefor the second sub question must be answered:

Sub question 2

To what future demand do current ICT trends lead?

This question will be answered by, literature study (partly by Capita Selecta literature study), interviews with ICT developers, trend watchers and real estate developers and consultants.

The qualitative aspects of office portfolios can be anticipated on while the amount of office space is 'self-regulated' by the 'Hog cycle'. This cycle contains cyclical fluctuations of supply and demand in real estate space markets. Attempting to forecast quantities is likely to fail especially over a period of more than 30 years, because there are too many variables to depend on like economy, demographics, etc. In order to understand what the demand for office space is going to be like in 2040, there must be an understanding about what work is going to be like. ICT trends do not form a future demand by themselves. Innovations can provide far reaching possibilities, but this does not

mean that people (the soft factor) are willing to adopt the latest ICT innovations (as described in paragraph 5.2 of chapter 5). The future demand will be formed by the generations that will be on the work floor in 2040. Therefore it is important to better understand these generations, who currently are 27 years younger and at school. The next paragraph elaborates more on the workforce of 2040.

6.2 The next generation workforce

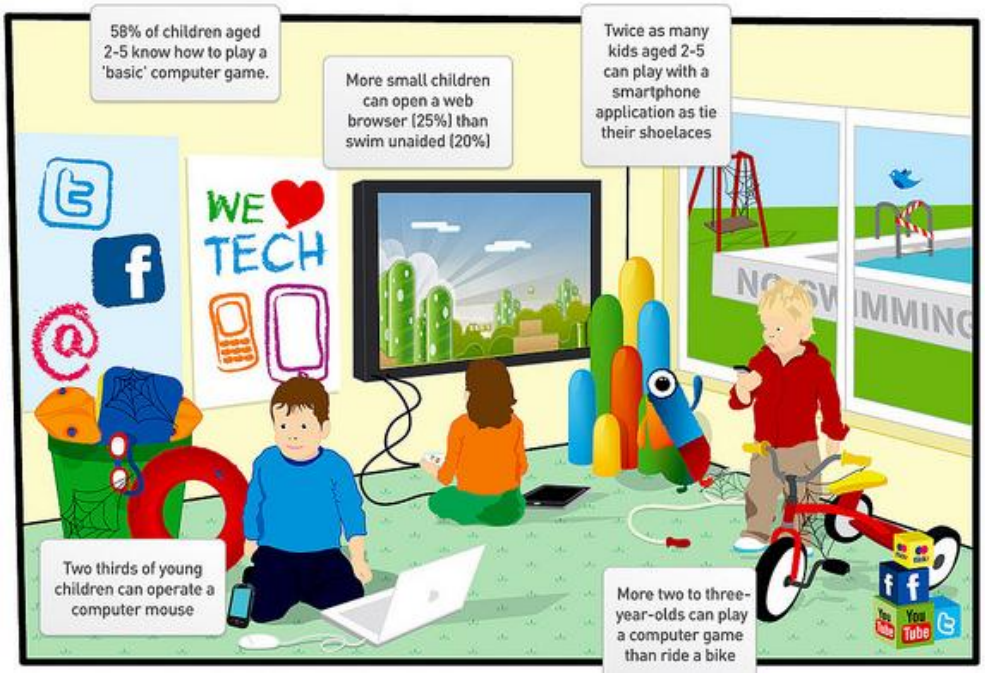
An organisation's workforce is a compilation of office workers (knowledge workers) performing their activities at workplaces. The different characters of knowledge workers (employees, professionals and personalities) in combination with different generations results in a diverse demand for workplaces over the coming decades. Initiation of these changes within organisations happens bottom-up as well as top-down. Organisations (should) change the way of work to be more efficient or competitive. In this research changes are considered changes in work environment (i.e. workplaces). Workplace innovation is not just a matter of technology. Among the key issues are: workplace organisation, regulations, cross-organisational cooperation, management and leadership, organisational structure, business models, and incentive schemes.

Introduction of new work practices and introducing new ICT must go hand-in-hand. Although there have not been many empirical studies in measuring the impact of workplace innovation, there is evidence that innovations in collaborative workspaces may further contribute to creating value, increasing productivity and improving the quality of work (Brodt et al., 2006). Different office workers within an organisation form the demand for ways of working and use of office space. While looking towards the year 2040, different generations of users will be dealt with.

Different generations: Baby Boomers, X, Pragmatic generation Y & Z on the work floor

In previous research done by Bontekoning (2008) the factors that promoted cooperation lead to a higher level of work energy and mood and a reduction of the apathy. Generations from different era's grew-up with different technological innovations and stages of technological developments. The relevant generations for this study are the Baby Boomers, generation X, Pragmatic generation, generation Y and generation Z. generation Z is grown up and educated with social media, mobile devices, internet etc. and are highly "connected,". It is likely that they will demand a connected way of working after their education.

Figure 62 Young Kids Learn Tech Skills before Life Skills (source: www.avg.com)



Generation Y will work during flexible working hours and make use of third office places, which sometimes are their first place office and having home as their second workplace. Greying implicates that people will work longer, this can be noticed in the Netherlands where retirement has pushed up to the age of 67. From the employers' side, this means that older people and thus older generations need to be retained and need to work together with younger generations. The scope of generations in this research reaches from people born between 1950 to 2015. In the Netherlands sociologist Henk Becker has played a prominent role in generation thinking. His theory from the eighties was at the turn of the century tested by researchers at the University of Tilburg and the Social and Cultural Planning Office. Between 75 and 80 per cent of the Dutch appeared to recognise themselves in the classification of Becker and the associated properties. Because we are working longer, we find four of these different generations in the workplace today. The generations on the work floor of the next decades are divided into two main types (Pre net-generations and Net generations) with several subtypes.

Pre net-generations. Generations born before the digital revolution starting in the 1980's

- ***Protest generation (***baby boomers) Born: 1940 to 1955
  The sixty year olds of today and inventors of the 'polder model'[10]. Just retired or soon enjoying their pension. In the past this group stood much on the barricade and is good at changing things. They have a treasure of knowledge and experience and are at this stage very focused on sharing them with colleagues. Most important characteristics: Idealistic and motivated, look for support for "ideas", preference for (re)structuring.

- **Generation X** (lost generation) Born: 1955-1970
  In the meantime this generation has progressed in the business world to the role as leader. It is the sober connector that is much focused on diversity and following a process. Most important characteristics: modest and down to earth, like to sort out differences constructively, process-oriented professionals

[10] The polder model is a term with uncertain origin that was first used to describe the acclaimed Dutch version of consensus-based economic and social policy making, specifically in the 1980s and 1990s.

- **Pragmatic generation** Born: 1970-1980
  They work efficiently, like to separate sense of nonsense and preferably speed up the momentum in meetings and decision-making. Most important characteristics: Motivated networkers that want fast concrete decisions, oriented on obtaining and applying knowledge as fast as possible in practise

Net generations: Generations born during the on-going digital revolution starting in the 1980s.

The millennials, Generation Einstein, screenagers Born: 1980-present. Generation Y is defined as people born in or after 1980. Although Generation Z has not been defined yet in this dictionary, the term is occasionally used to describe the Net Generation born in or after 1990. The main issue is that these teenagers were born in totally different technological surroundings than their predecessors. The digital events in the early 90's, as described in paragraph 0, are the cause of technological revolutions determining the difference in these two generations. Both generations are referred to as the millennials or the screenagers (Geck, 2007).

- **Generation Y** Born: 1980-1990 (Generation Einstein, screenagers)
  The creative multitasker who only comes to fruition if he can be himself. Meaning and purity play an important role. He must have faith in the mission of the organisation, otherwise motivation will lack quickly. The millennial generation which is comfortable with technology is currently driving the usage of technology as the interaction with services, government and work. Generation Y were the pioneering generation to actively incorporate technology in their work processes from the start (Coopers, 2007).

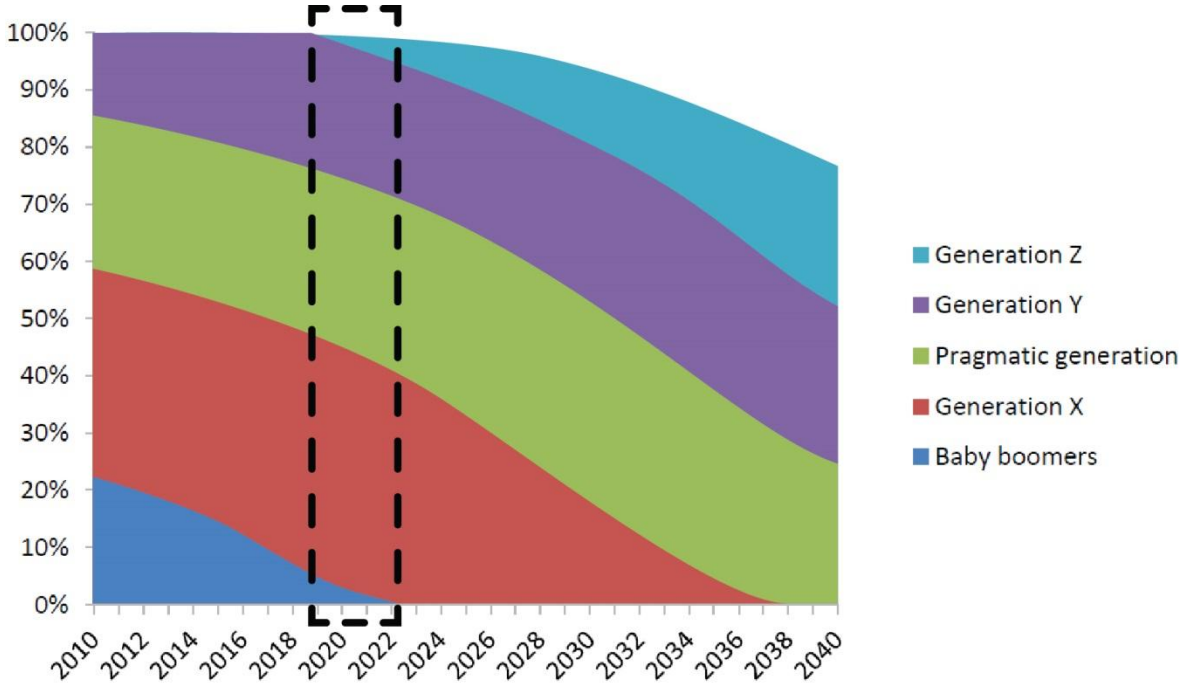
- **Generation Z (digital natives)** Born:1990–tillpresent
  Many members of Gen Z are highly "connected," having had lifelong use of communication and media technology like the World Wide Web, instant messaging, text messaging, MP3 players, and mobile phones earning them the nickname "digital natives". These teenagers have been exposed to all the technological influences and high speed networks. This allows this generation to have the most connectivity experienced in a generation so far. These teenagers will evolve into electronic multi-taskers more than any other generation before (Geck, 2007).

Different generations have different goals, expectations and desires and employers should tailor their retention plans to satisfy them. It is important to know when these generations leave, enter or remain on the work floor. Table 14 and Graph 2 illustrate the flow of different generations during a period between 2010 and 2040. Assumed is that generations start to work between the age of 20 and 25 and will retire at the age of 67. From 2005 until 2022 the baby boomers are retiring, while making room on the work floor for generation Y. In this transition, the pragmatic generation will be in charge and they will and need to make some big changes. From 2022 generation X will retire, while Generation Z will start entering the work environment. This makes 2020 (see Graph 2) a period in which changes will take place concerning generations on the work floor. In paragraph 6.5 the demand of the different generations are discussed.

Table 14 Generations joining workforce

Generation	Birth period	Join workforce	Retire
Protest generation	1940-1955	1961-1980	2005-2022
Generation X	1955-1970	1976-1995	2022-2037
Pragmatic generation	1970-1985	1991-2010	2037-2052
Generation Y	1985-2000	2006-2025	2052-2067
Generation Z	2000-present	2021-2040	2067-2082

Graph 2 Generation division on work floor 2010-2040



This paragraph discussed the diversity of the office workers who will be on the work floor for the coming decades. Not does this diversity alone play a role in the demand for office use, but also the demographic changes will.

6.3 Demographics and the Future of Work

Ten years ago there were no social networks. Ten years before that the Web did not exist. Jobs in the web programming, or mobile phone industries did not exist twenty years ago. Who knows what jobs will exist twenty years from now? People without a job nowadays will soon find jobs again but work will not be the same.

Slower Workforce Growth Ahead 2010-2040

The demographic future can be summed up in the words “fewer, older and more diverse”. An aging population will lead to a declining labor force. It is expected that for several years the population of the Netherlands will continue to slightly grow to 17.8 million people in 2040, a million more than at the start of 2012 (CBS, 2012). Thereafter, a decline in population size is foreseen. The long-term population forecast of CBS is based on assumptions about the number of immigrants, emigration propensity, birth rates and mortality risks. The prospective working population[11] shrinks from 10.1 in 2008 to 9.2 million in 2040.

At constant employment, this means that the potential workforce will decline in the coming decades. The green and grey pressure (‘groene druk’ and ‘grijze druk’) measuring the extent to which young people (under 20 years) and elderly (65 and over) "press" on the prospective working population. In 2008, the grey pressure was 24 per cent, while in 2040 this will have risen to 49 per cent. After 2040, a decrease of the grey pressure is expected (Van Duin, 2009). Over the years, these percentages may vary and will be adjusted. The ratio between the number of prospective working population and the over-65s drops nationwide from 4 to 1 to 2 to 1 in 2040.

[11] All residents between 15 and 65 years.

Figure 63 Population growth the Netherlands 1950-2050 (source: CBS, 2012)

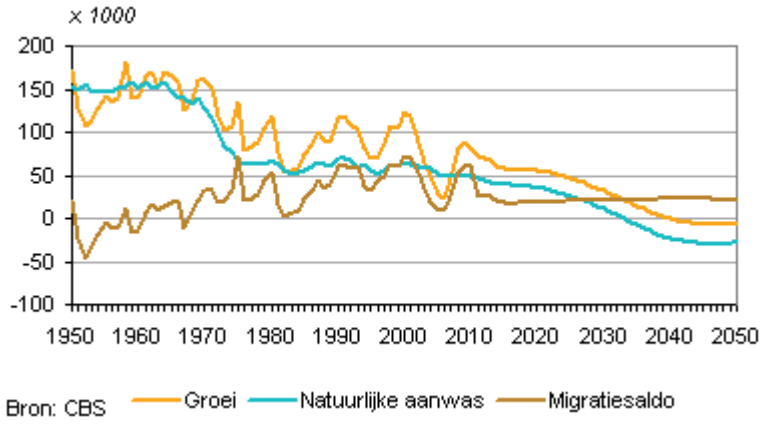
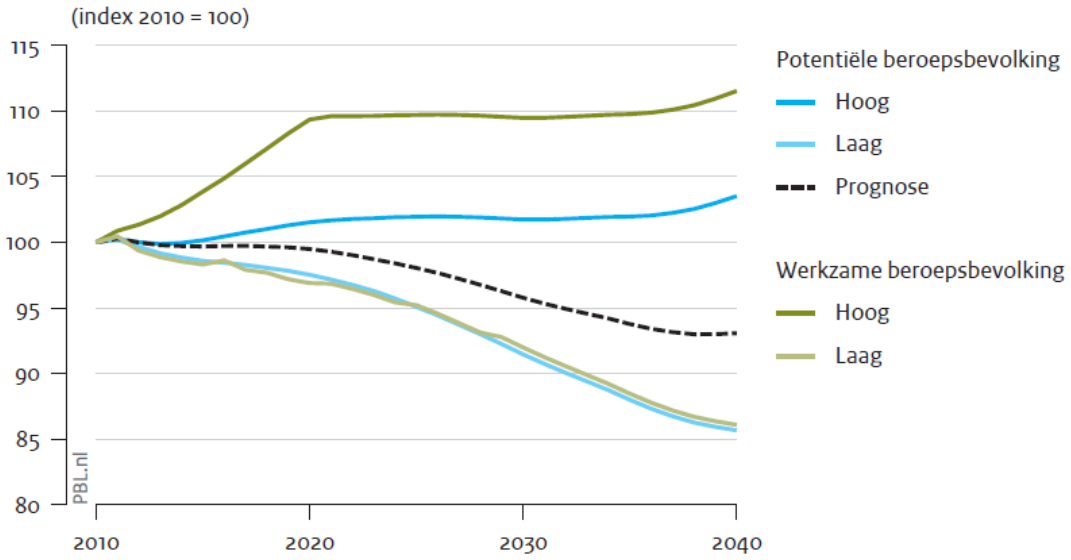
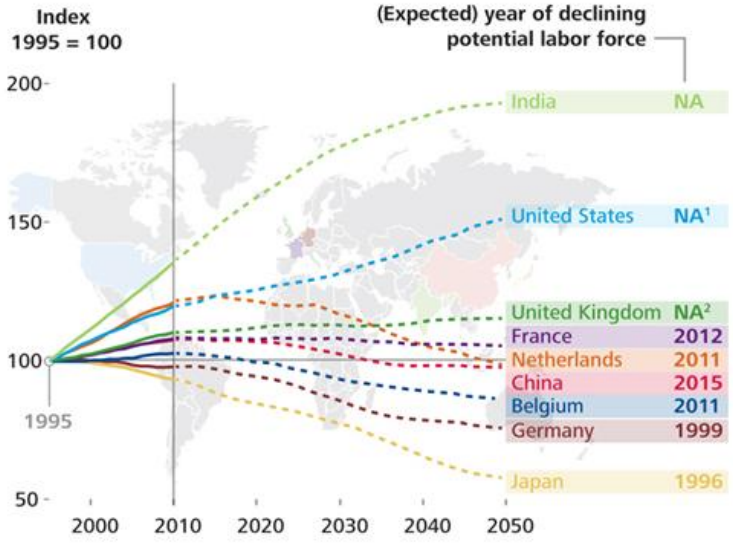


Figure 64 Scope prospective and working population (forecast and scenario's) 2010-2040 (source: (Eck et al., 2013))



This slower workforce growth is not only noticeably in the Netherlands. While Germany and the Netherlands' declines look quite similar (see Figure 65), the German decline appears to be much steeper. Germany's forecasted shortage of employees in 2050 is estimated at 8.2 million or 19 per cent of their current labour force, compared to only 275,000 or 3 per cent in the Netherlands. The main reason for this differing decline is Germany's lower fertility rate of 1.4 compared to 1.7 births per woman in the Netherlands. To envisage the magnitude of the implications, the forecasted German labour shortage in 2050 will be higher than the total current workforce in the Netherlands (Jorrit Volkers and Berkel, 2012).

Figure 65 Prospective working population development of key countries (source: (U.S. Census Bureau inJorrit Volkers and Berkel, 2012))



1 U.S. potential labor force growth is mainly driven by immigration (Population Reference Bureau, 2007: "new immigrants and their children will account for all of the growth in the U.S. labor force between 2010 and 2030")

2 Potential labor force in the UK shows decrease in 2029, followed by a stable period and growth in 2037

Countries with an aging population and a shrinking potential labour force will most likely show only small GDP growth through 2050. A declining labour force implies that a country can only boost its GDP by improving labour productivity per person. Consequently, the heavy burden of healthcare and retirement costs will be placed on fewer shoulders and lead to lower net income for the working population, suggesting reduced spending power among consumers in the 15–64 age range to drive consumption and the economy. However, a greyer population can have a silver lining. The 65+ age group could become a large addition to the labour force if countries and companies can provide appropriate incentives and, in some cases, redesign how work gets done. Flexible work arrangements, greater support, and recognition from managers can help companies retain older employees. The slower workforce growth can form problems for a country, but there are some solutions as well.

Solutions to problems caused by slower workforce growth

Recruiting by neighbours

As the Netherlands and Germany are neighbouring countries, a severe employee shortage in Germany might have implications for the Netherlands. A young, talented Dutch engineer could easily live in the middle of the Netherlands and travel east several days a week. Given the shortage of engineers in Germany—a skill shortage that, in all probability, will grow as a result of the declining labour force—the proximity and similar languages of the two countries could spur German companies to start recruiting aggressively in the Dutch market. Higher wages and excellent career opportunities can be very attractive for the talent involved, but it would leave companies in the Netherlands struggling to find employees with technical skills and incite them to take appropriate measures to counter the potential talent drain. The ripple effects of demographics, therefore, are far more intricate than the macro-level trends alone would suggest (Jorrit Volkers and Berkel, 2012).

Flexible careers and flexible hours

Companies may not be able to alter the demographics of the countries in which they operate, but adapting their talent strategies to the needs of their workforces can go a long way in offsetting demographic pressures. Cisco is pursuing a new model for career development that accommodates lateral as well as vertical moves to cultivate its next generation of leaders. The corporate lattice

model is a more flexible approach to performing work, building careers and developing talent. More flexible career paths can help retain employees with young children and older employees who want to continue working but at a slower pace.

In the Netherlands, 75 per cent of women work part time. Job sharing is the norm, especially in female-dominated sectors like healthcare and education. Part-time work has become a powerful tool to attract and retain talent—male and female—in a competitive Dutch labour market. Part-time work is not the sole province of the female workforce; 23 per cent of Dutch men work reduced hours, and 9 per cent work a full week in four days. Dutch companies are accommodating this trend by allowing for flexible hours as well as work spaces. At the headquarters of a large Dutch company, for example, designers created a space without assigned work stations, and the company allows employees to work "anywhere, anytime."

Respect thy elders (and keep them on the payroll)

When it comes to demographics, death is as significant as birth rates. Life expectancy is growing and is projected to continue growing in the coming decades. This increases population but not the potential labour force, which is currently defined as people in the 15–64 age range. In the developed world, the number of people in the 65+ age group as a percentage of 15–64-year-olds is expected to grow significantly between now and 2050.

A greyer population can have a silver lining. The 65+ age group could become a large addition to the labour force if countries and companies can provide appropriate incentives and, in some cases, redesign how work gets done. Flexible work arrangements, greater support, and recognition from managers can help companies retain older employees. A dearth of young people also implies a smaller pool from which companies can select employees, magnifying the importance of matching educational backgrounds with workforce needs. Together with the demographic changes, work in future will change along.

The Future of Work

Work in the future needs to be transparent. In the past, productivity was difficult (if not impossible) to measure. Money was wasted paying for employee downtime. Now, time and task tracking tools are revolutionising productivity measurement. No one is going to pay an employee just to show up. Each employee's work can be directly tied to the bottom line. The more productively one works, the more money will be made. The future of work is flat. No one is going to complain about their commute. In real estate the mantra is "Location. Location. Location". At work the mantra is "Communication. Communication. Communication." Work used to be considered a place. The only options for communication were landline phones and snail mail. Today, project teams use amazing web tools to work together from anywhere in the world. Tool like Skype have made long-distance calling virtually free. The organisation is now flat. Call centres used to be massive offices built in rural areas or countries like India. Organisations started to allow working from home. In the future, location will not matter. The future of work is competitive. No one is going to pay someone just for having a degree. Informal education is more accessible than ever. There is no longer an excuse not to know how. Competition for jobs is no longer limited to where one lives. It is commonplace to hire vendors and contractors from across the planet. One in four organisations plans to increase spending on outsourcing by 25% or more this year. The key benefit of outsourcing is not saving money, but innovation. In some cases, competition is not even limited to other individuals, but to crowd sourcing (to split a task into smaller pieces and unleash it to millions of people around the world) like Wikipedia, which is maintained by the crowd and reCAPTCHA puzzles which stands for Completely Automated Public Turing test to tell Computers and Humans Apart–is a method for foiling automated attacks by spammers on Web sites. Unlike most CAPTCHA systems, Google's uses images with two words. That is because Google uses reCAPTCHA for two purposes. Like other CAPTCHA systems, it is designed to frustrate spammers, but it is also incorporated into Google's efforts to digitise books. When a word in a book scan can't be recognized by Google's OCR software, it is sent to the

reCAPTCHA pool. So when a person enters a reCAPTCHA phrase into a form, Google can discover what its OCR[12] program could not, without having to hire human editors to review scanning results. More than 100 million reCAPTCHA puzzles a day are solved spending about 10 seconds to solve one. In total they amount over 150000 hours of work every day for free.

The organisation of the future will be constantly changing form to efficiently take advantage of the opportunities presented in an ever-shifting marketplace. As a result, the place, tools and systems of work will change and five themes will emerge (Williams, 2013):

- **On demand staffing*:*** The skills and availability of employees and freelancers will be matched by an algorithm against the organisation's changing needs.
- **Collision Collusion:** Physical, mobile and web workspace will be designed to ensure critical interaction between colleagues, vendors, partners and customers.
- **Improvised workplace:** With the flick of a switch, furniture and software will adapt to the changing needs of an organisation. By having access to a vast and competing variety of workplaces and supporting facilities, organisations can provide its workers to choose the best suitable workplace.
- **Living knowledge:** Information with flow across and up-and-down the organisation constantly instantly accessible by anyone who needs it.
- **Constant learning:** Employee empowered education will help staff own the direction of the company.
- **Career matchmaking:** Systems are leveraging social and contextual information to help better match companies and talent for deeper connections that create lasting value.

Population growth in the Netherlands has been decreasing for a number of decades now, an effect of the fall in the average number of children born per woman in the 1960s. Initially this was reflected in a decrease in the number of young people. Later it slowed down the growth of the potential labour force, i.e. the population aged 20-64 years. Now that the post-war generations are reaching retirement ages, the increase in the potential labour force is turning into a decrease. Although, work must continue, so these changes need to be dealt with.

For the past 100 years business leaders have been trained to manage teams that are similar intellectually but widely disparate psychologically -- a group of engineers, say, whose members might be disciplined, introverted, anxious, cooperative, or any of a million combinations. That structure worked fine when business models lasted decades. In tomorrow's world the leader's job will be reversed. As companies revamp business models continually, the only teams that can do the job fast enough will have members who are highly diverse intellectually; the engineers, marketers, and designers will meet in the same room. And because the challenges the world throws at them will change rapidly and unpredictably, team members will have to share certain psychological traits, especially flexibility, adaptability, and resilience. Effective leadership will demand a new set of skills built around choosing team members, tuning the culture, and integrating radically different types of expertise. As Drucker (Drucker, 2009) described, "The modern organisation should be the destabiliser, the building design, the team, the project would all become more dynamic, real-time, to balance change and continuity".

[12] Optical character recognition

6.4 Organisations future demand: From ownership to access

Because of internet there is not only a connection 24 hours a day, but also a connection with each other's information and collective knowledge. This puts a hold on the scarcity of information. There is an abundance of knowledge, information, labour and more. This makes 'access to' more important than 'owning', but access to what?

- Access to information about stakeholders, handed by that same stakeholder.
- Access to the collective thinking and creative power of that stakeholders.
- Access to the labour power of your stakeholders.
- Access to knowledge and all kinds of smart software on the Internet.
- Even access to money from the stakeholders.

With access to resources, organisations need to be competitive. Setting up an office in a prominent location is often a business requirement, but it is not always financially viable. Sky-high real estate prices and ever-increasing rentals often discourage companies from seeking office space at prominent locations. However, operating from a central location is a critical business requirement. Having a prestigious address can add to an organisation’s goodwill and places the organisation close to other major business entities and corporates in that region. Even employees, clients and business associates would prefer to work from a location which is well connected by all major modes of transport. But, not all organisations wish to invest in a property or enter into rigid long term lease agreements. Flexibility is important to cope with uncertain futures. Three major trends that organisations need to deal with are 24/7, boundless and mobile. The role of the office is changes. People come to the office to meet, talk to each other and work together. These recommendations focus on five themes:

1. working remotely
2. the efficient use of space
3. recruiting and retaining talent
4. contributing to a strong employer brand
5. improve the welfare of the employees.

In an ideal work environment separate areas and technologies support various types of co-working (informational, evaluative or generative meeting), where there is balance between people, space and the shared information. The primary goals of organisations in a competitive world are:

1. to reduce (superfluous) real estate occupancy costs;
2. to improve employee productivity, retention, and commitment; and
3. to enhance customer relations and business continuity.

Digital Taylorism

What is digital Taylorism? If the twentieth century brought what can be described as mechanical Taylorism characterised by the Fordist production line, where the knowledge of craft workers was captured, codified and re-engineered in the shape of the moving assembly line by management, the twenty first century is the age of digital Taylorism. This involves translating knowledge work into working knowledge through the extraction, codification and digitalisation of knowledge into software prescripts and packages that can be transmitted and manipulated by others regardless of location. Whilst honing workflows to be more productive is definitely a good thing, doing so at the expense of judgement, creativity and autonomy is not:

Digital Taylorism enables innovation to be translated into routines that might require some degree of education but not the kind of creativity and independence of judgement that is often associated with the knowledge economy. In order to reduce costs and assert proprietary rights, companies are experimenting with new ways to move from knowledge work to working knowledge; that is, from the idiosyncratic knowledge that a worker has and applies, to working knowledge,

where that knowledge is codified and routinised, thereby making it generally available to the company rather than being the 'property' of an individual worker (Phil Brown, UKCES).

In other words, anything that *can* be mechanised, routinised and outsourced, *will* be. It is akin to the famous quotation by Arthur C. Clarke: "Teachers that can be replaced by a machine should be."

War for talent

In the near future there will be a war for talent. The next ten years about 40 million Europeans will retire while only 25 million young people will enter the labour market. The 'war for talent' will be even more intense and an appropriate and inviting environments helps to be an attractive employer in order to attract and retain talented employees. Several studies, including those of Skype in 2011 under technological personnel in the United States, show that the quality of the work environment, after salary, is the main motivation for employees to go to their work. To utilise offices efficiently, the work environment must no longer be regarded as a cost, but as a factor that increases the efficiency and productivity and that contributes to achieving the best results. To retain talent, a well-equipped work environment where employees are free to choose their own workplace that best fits plays an essential role.

6.5 Meeting the employee retention challenge

Having the willingness to change is very important now. Having the ability to be "change-adaptive" is critical and leads to exploring how and where those changes are going to take place. This research does not address how to run a business towards 2040, but more insight is given to understand the importance of meeting the next generation employee's demands. The workforce is changing as new hiring brings in new types and generations of workers with new expectations for the work environment. This research does not discriminate genders while a slight difference in demand may occur between men and women because of maternity leave. In the end both genders are seen as knowledge workers.

What do knowledge workers want?

As technology, the economy and culture change, so too do employees' expectations of their employers. Only a few years ago, employees had never even heard of iPhones, would not have dared ask to work from home on a regular basis, and could not have carried their whole office with them unless they had a moving truck. However, it can be observed that employees now expect their employers to provide them the tools they need to work remotely and offer them the chance to do so. Employees expect that they will have access to technology at work that matches what they have at home. The workers that organisations are trying to attract and retain expect a different model of collaboration and flexibility, enabled by an increased use of technology, such as Web 2.0[13] for communication and productivity. As organisations compete for top talent in key functional areas, they need to be cognisant of changing workforce expectations. In a compensation survey of 1,400 CFOs conducted by Robert Half International, 46% said telecommuting is second only to salary as the best way to attract top talent. The workplaces of the future can help organisations provide flexibility for working parents, reduce commuting time, and improve collaboration, knowledge sharing and morale. To continuously adapt to these changes, companies should focus on having a culture that is open and receptive to constantly changing its talent programs to meet its employees' needs. It is no longer enough to have a "menu" of talent programs where employees can pick the ones that meet their tastes—instead, a talent strategy needs to focus on the company's and employees' core values to provide the flexibility needed to meet the demands of its talent.

[13] A Web 2.0 site may allow users to interact and collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to websites where people are limited to the passive viewing of content. Examples of Web 2.0 include social networking sites, blogs, wikis, video sharing sites, hosted services, web applications, mashups and folksonomies.

Telecommuting: The Next Big Thing?

In a compensation survey of 1,400 CFOs, 46% said telecommuting is second only to salary as the best way to attract top talent. 33% said telecommuting was the top draw.

– Robert Half International

Companies' retention strategies should take an increasingly sophisticated view of why employees are staying and leaving. Different surveys and recent data show, business and HR executives' perspectives on what they think their employees want and what employees actually want often differ—this is especially true of nonfinancial programs and priorities. So where should business and HR leaders focus their retention efforts? To successfully attract, develop and retain the key employees needed to succeed in today's economy, three imperatives emerge:

- Identifying the employees and 'skills' most critical to the organisation and strategy.
- Determining what different groups, generations and, wherever possible, individual employees actually want through increasingly personalized approaches.
- Cultivating capabilities to understand, anticipate and predict what is driving employees to leave.

These are some of the results (Lisa Hut (), 2012):

- People from different generations (Generation X 1955-1970, 1970-198, Pragmatic generation and Generation Y 'Screenagers' 1985-present) have different reasons to make use of a third place. This has to do with their preferences and is related to the career phase they are in.
- The boundaries between work, healthcare, relationship, education and leisure are blurring. At the same time there is the desire to keep work and life separate.
- Avoid distraction at home (Screenagers: TV and internet, the pragmatic generation and generation X: more household activities and family) is an important reasons to work at a third workplace.
- People have the desire to change workplace regularly.
- Being from home gives an unconscious pressure to work. The fact that people around you are at work, ensures that the motivation to work increases.
- Another reason is that people need a social identity, to be part of a group. At a third workplace they meet acquaintances and like-minded people. People are looking for reference, to discuss issues with others and to relativize them.
- The pragmatic generation and generation X appreciate a professional image. Generation X is also looking for good facilities. Screenagers appreciate this less.
- Location is by far number one factor for choosing a third workplace: a central location in a lively area. In addition, the presence of the Internet, openness and atmosphere are important elements.

The modern re-creation of the village

In an age of mechanisation, such as the 20th century, all mechanical things were glorified and hierarchal and mechanistic systems were developed to govern the creation of those mechanical things. This was necessary to enable us to develop the technology and tools that make possible a new level for mankind to scale. To help achieve this new level, there are lessons to be learned from the pre-urban era when mankind lived in villages. Villages were collaborative – everyone contributed or people did not eat or have shelter. The village was a collective and few if any were "in power." Many had no leaders or only leaders when needed. Many had rotational leadership. The village was also the source of learning through the mentorship of older members, the sharing of stories and legends, and through apprenticeships. Oral traditions, dance and song passed along history and

illustrated correct behaviour. The village was a place where privacy mostly disappeared and everyone knew your name and more.

As we build a new ecosystem based on relationships and on integrating diverse ideas into services and products, the modern re-creation of something very village-like can be seen. Smaller and flatter organisations will emerge that are much more focused on integrating people and their ideas into collective systems that deliver unique services or products. Brand management will morph into developing and nurturing relationships. Learning will be our responsibility at many levels and all the time. The urban neighbourhood will re-emerge as the equivalent of the village, augmented by the virtual world (and maybe someday absorbed into it).

6.6 Anytime/anyplace computing by knowledge workers (Smart working)

Does the possibility to work anytime and anyplace really mean that work will be done anytime at any place? No, knowledge workers will choose the best suitable place to do the job at the best suitable time. Doing a certain task at the right place and at the right time results in productivity.

Productivity in Knowledge Work.

According to Davis and Naumann (1997), there are very large differences in productivity among knowledge workers. For example, using typical measures of performance, productivity of the best performing systems analysts and programmers can range up to three or more times that of the lowest performers (who are productive enough to be retained in their positions). This high ratio is not usually found in production work and clerical work because the organisation provides work routines that reduce wasted time and effort and establish an expected pace for the work. In knowledge work, there may be some organisation standards and procedures, such as deadlines for reports, requirements for evidence of progress, and expectations about outputs. These factors provide some incentives for work completion, but quality of work and timely completion depend largely on self-management and self-pacing. The most productive knowledge workers tend to employ the most efficient work flow and work methods. More important, they tend to be better at managing the use of their time, attention, and motivation. Knowledge work productivity depends on good self-management. For example, a very productive knowledge worker will schedule for productivity (schedule important, high-productivity work activities to occur during times of high energy and attention), schedule for motivation (create motivation by frequent, short-term deadlines), and manage demands for attention (because a knowledge worker has limited attention resources and an oversupply of inputs to process). The value of unlimited computing access may depend on the knowledge work tasks. Knowledge workers whose tasks involve obtaining data from a variety of locations, activities, and people (such as a scheduler of production activities) are likely to benefit from anytime/anyplace computing and communications facilities. Less-certain benefits may be achieved if the knowledge work being performed is dependent on concentrated effort without interruptions.

Possible Beneficial Effects of Anytime/ Anyplace Computing on Knowledge Work

In unlimited access computing, a person has access at all times and all places to all information and communication resources. The access mechanisms are so portable they move with the person or are found in the places in which the person moves. Four beneficial effects of unlimited access that change the performance of knowledge work are: removal of time and space constraints to communications, removal of time and space constraints for doing knowledge work, improved access to decision makers, and increased ability to receive and process a rich stream of signals about the organisation and its environment.

Enhanced Capabilities for Communications, Coordination, Collaboration, and Knowledge Exchange.

A significant characteristic of knowledge work is communication, coordination, and collaboration. These important activities may be within a work group, within a project team, with suppliers or customers, with production or clerical workers, or with managers. These activities usually involve sending and receiving messages, holding physical and virtual meetings, or exchanging documents. With anytime/anyplace computing, a knowledge worker is no longer constrained by employment location and employment times in performance of important communications, coordination, and collaboration activities. Communication, coordination, and collaboration access are available 24/7 from anywhere. This is especially important for those whose jobs require communication, coordination, or collaboration with persons in other locations and other time zones.

Exchanging messages, holding meetings, and exchanging documents may involve data (such as data describing various attributes of events or transactions), information (data organized and analysed in meaningful ways), and knowledge (information synthesized into rules or guides for action). Pervasive computing enables prompt exchange of data because embedded computers record event data as events occur and make the data available immediately or on random demand. It eliminates delays in recording physical work and physical movement of goods and making the data available. Unlimited access computing enables exchange of information because the analyses and documents that contain information can be accessed at any time and from any place. Insights reflecting knowledge are accessed by finding documents that explain the meaning and implications of past projects or by finding individuals who have developed knowledge by working with conditions and situations similar to ones being experienced. Unlimited access computing supports search engines that find and retrieve relevant documents, analyses, and reports. It also supports finding and connecting with individuals who have desired knowledge.

Removal of Time and Space Costraints for Doing Knowledge Work.

The use of an office for work and the associated custom of set hours for the office to be open and in use have imposed both time and space constraints on performing knowledge work. These constraints may be convenient for office support services, but they may not be optimal for productivity. Anytime/anyplace computing allows the office functions to move with the knowledge worker rather than being tied to a physical office.

With unlimited access and mobile computing, knowledge work can be removed from the constraints of office hours. Knowledge workers can take advantage of productive times outside of normal work hours. Access to computer and communications resources means knowledge workers who have productive periods at times other than normal work hours can take advantage of those times. An analyst who has an idea at midnight or wakes up early in the morning with an idea can perform knowledge work with access to all the data and computer support normally available at the office. This also facilitates doing knowledge work with persons in other time zones.

Access to Critical Decision Makers at Any Time.

Many times, knowledge work is delayed in order to receive input or decisions from key stakeholders for the work being performed. Anytime/anyplace computing increases the opportunity to get access to critical decision makers at any time. A cell phone may provide voice access, but mobile computing makes the entire range of computing and communications capabilities available at any time and any place. Spread sheets, reports, analyses, and requests for comments and decisions can be sent from any location at any time to relevant stakeholders and decision makers.

Smart working

Smart Work is an act of production performed independent of time and place. In its ultimate form, the “office” no longer exists and traditional work conventions such as work hours are irrelevant. Smart Work is results-oriented: it is often social and collaborative, and the result of a networked way of operating, with exchange, collaboration, and co-creation processes optimising work and its output. The network is a key enabler of Smart Work: new networking technologies not only empower and facilitate, they also demand and determine how, where, and when work gets

done. Such technologies do not just optimise existing modes of work—they create new ones, enabling a Smart Work culture to emerge. Because of this, the network has evolved from a techno logical facilitator to a cultural blueprint that not only enables people to work smarter, but also influences and determines their personal attitudes toward work: where and when they work, and how they compete, collaborate, communicate, exchange information, and envision new approaches to work and to the processes of innovation (Boorsma and Mitchell, 2011).

6.7 Conclusion

The future demand consists of the accommodation requirements determined by organisations and knowledge workers in the year 2040. In this research this demand is based on trends in ICT, for which the following sub questions has been answered.

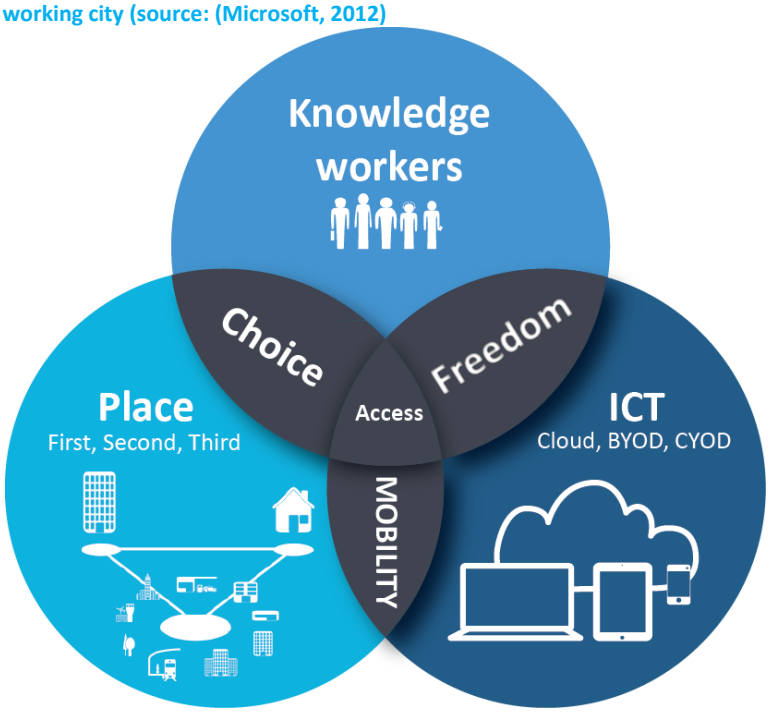
Sub question 2

To what future demand do current ICT trends lead?

ICT trends do not form a future demand by itself. The future demand will be decided by the generation knowledge workers that will be on the work floor in 2040.

The decreasing growth of the working force, which results in scarcity of talented knowledge workers, will end in a 'War for Talent'. In the competitive knowledge economy organisations must do what it takes to attract and retain talent to survive. For organisations this means satisfying the diversifying workforce by offering 'Choice' in places they desire to perform their activities while giving them 'Freedom' in using ICT the device(s) they find best to do the job (see Figure 66).

Figure 67 The anywhere working city (source: (Microsoft, 2012)



The Next Generation Workforce

Different workforce characteristics

Different office workers within an organisation form the demand for ways of working and use of office space. While looking towards the year 2040, different generations will join and leave the work floor. The workforce has different characteristics.

Different generations: Baby Boomers, X, Pragmatic generation Y & Z

As already mentioned, towards 20140 different generations will join and leave the work floor. The relevant generations for this study are the Baby Boomers, generation X, Pragmatic generation, generation Y and generation Z. These different generations grew-up with different technological innovations and stages of technological developments. They have different goals, expectations and desires and employers should tailor their retention plans to satisfy them. It is important to know when these generations leave, enter or remain on the work floor. Table 14 and Graph 2 illustrate the flow of different generations during a period between 2010 and 2040.

Generation Z grew up and is educated with social media, mobile devices, internet etc. and are highly "connected,". It is likely that they will demand a connected way of working after their education. This generation will work during flexible working hours and make flexible use of third office places, which from their point of view sometimes are their first place office and having home as their second workplace. Different generations have different goals, expectations and desires and employers should tailor their retention plans to satisfy them.

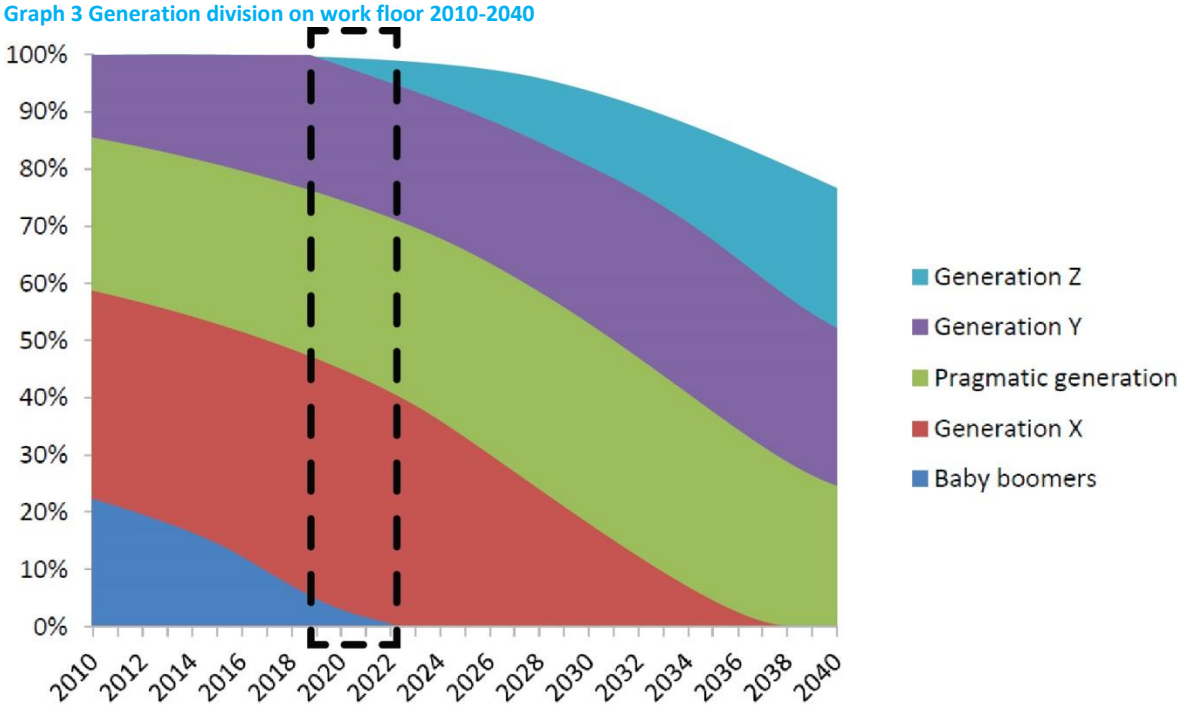
The period around 2020 is a period in which changes will take place. From 2005 until 2022 the baby boomers are retiring, while making room on the work floor for generation Y. From 2022 generation X will retire, while Generation Z will start entering the work environment.

The job of the future will have very little to do with processing words or numbers (the Internet can do that now). Nor will we need many people to act as placeholders, errand runners or receptionists. Instead, there is going to be a huge focus on finding the essential people and outsourcing the rest.

Table 15 Generations joining workforce

Generation	Birth period	Join workforce	Retire
Protest generation	1940-1955	1961-1980	2005-2022
Generation X	1955-1970	1976-1995	2022-2037
Pragmatic generation	1970-1985	1991-2010	2037-2052
Generation Y	1985-2000	2006-2025	2052-2067
Generation Z	2000-present	2021-2040	2067-2082

Graph 3 Generation division on work floor 2010-2040



This diversity of the office workers who will be on the work floor for the coming decades has been discussed. Not does this diversity alone play a role in the demand for office use, but also the demographic changes will.

Demographics and the Future of Work

The demographic future can be summed up in the words “fewer, older and more diverse”. An aging population will lead to a declining labor force. It is expected that for several years the population of the Netherlands will continue to slightly grow to 17.8 million people in 2040, a million more than at the start of 2012 (CBS, 2012). Thereafter, a decline in population size is foreseen and thus a shortage of employees. Countries with an aging population and a shrinking potential labour force will most likely show only small GDP growth through 2050. A declining labour force implies that a country can only boost its GDP by improving labour productivity per person. Consequently, the heavy burden of healthcare and retirement costs will be placed on fewer shoulders and lead to lower net income for the working population, suggesting reduced spending power among consumers in the 15–64 age range to drive consumption and the economy. The ripple effects of demographics, therefore, are far more intricate than the macro-level trends alone would suggest (Jorrit Volkers and Berkel, 2012).

Part-time work has become a powerful tool to attract and retain talent—male and female—in a competitive Dutch labour market. Dutch companies are accommodating this trend by allowing for flexible hours as well as work spaces. Also does it help to allows employees to work “anywhere, anytime.” Flexible work arrangements, greater support, and recognition from managers can help companies retain older employees. Together with the demographic changes, work in future will change along.

The Future of Work

Work in the future needs to be transparent. Time and task tracking tools are revolutionising productivity measurement. Each employee’s work can be directly tied to the bottom line. The more productively one works, the more money will be made. The future of work is flat. No one is going to complain about their commute. In real estate the mantra is “Location. Location. Location”. At work the mantra is “Communication. Communication. Communication.” In the future, location will not matter. The future of work is competitive. There is no longer an excuse not to know how. Competition for jobs is no longer limited to where one lives. It is commonplace to hire vendors and contractors from across the planet. The key benefit of outsourcing is not saving money, but innovation. In some cases, competition is not even limited to other individuals, but to crowd sourcing (to split a task into smaller pieces and unleash it to millions of people around the world) like Wikipedia.

The organisation of the future will be constantly changing form to efficiently take advantage of the opportunities presented in an ever-shifting marketplace. As a result, the place, tools and systems of work will change and five themes will emerge (Williams, 2013): *On demand staffing, Collision Collusion, Improvised workplace, Living knowledge, Constant learning and Career matchmaking.*

As companies revamp business models continually, the only teams that can do the job fast enough will have members who are highly diverse intellectually; the engineers, marketers, and designers will meet in the same room. And because the challenges the world throws at them will change rapidly and unpredictably, team members will have to share certain psychological traits, especially flexibility, adaptability, and resilience.

As Drucker (Drucker, 2009) described, “The modern organisation should be the destabiliser, the building design, the team, the project would all become more dynamic, real-time, to balance change and continuity”.

Organisations future demand: From ownership to access

To retain talent, a well-equipped work environment where employees are free to choose their own workplace that best fits plays an essential role. By providing mobility, virtual desktop and cyber security, the workforce is able to access information and Applications at anytime from anywhere. Herby each knowledge worker has the freedom and mobility to be creative and be on top of the game.

Despite the slim pool of talent, for employees to stay employed in the workplace of the future, they need to stand out. The future of work is on demand. More and more will be done by "virtual teams" a group of individuals who work across time, space and organisational boundaries using collaboration technology

The future of work is transparent, flat, competitive and on demand. Individuals will have more freedom and power than ever before. Employees will have access to a larger and more skilled workforce. Because the future of work is the employee. By providing mobility, virtual desktop and cyber security, the workforce is able to access information and applications at anytime from anywhere. Herby each knowledge worker has the freedom and mobility to be creative and be on top of the game.

Meeting the employee retention challenge

Having the ability to be "change-adaptive" is critical and leads to exploring how and where those changes are going to take place. It can be observed that employees now expect their employers to provide them the tools they need to work remotely and offer them the chance to do so. Employees expect that they will have access to technology at work that matches what they have at home. The workers that organisations are trying to attract and retain expect a different model of collaboration and flexibility, enabled by an increased use of technology, such as Web 2.0[14] for communication and productivity.

To continuously adapt to these changes, companies should focus on having a culture that is open and receptive to constantly changing its talent programs to meet its employees' needs. To successfully attract, develop and retain the key employees needed to succeed in today's economy, three imperatives emerge:

- Identifying the employees and 'skills' most critical to the organisation and strategy.
- Determining what different groups, generations and, wherever possible, individual employees actually want through increasingly personalized approaches.
- Cultivating capabilities to understand, anticipate and predict what is driving employees to leave.

The accelerating pace of change has affected all industries and is changing the nature of work. Shifting demographic patterns, the rapid pace of technological advancements, the shift to knowledge-based economies and increasing pressures for innovation, productivity and cost containment will set the pace for work of the future. As we build a new ecosystem based on relationships and on integrating diverse ideas into services and products, the modern re-creation of something very village-like can be seen. Smaller and flatter organisations will emerge that are much more focused on integrating people and their ideas into collective systems that deliver unique services or products. The urban neighbourhood will re-emerge as the equivalent of the village, augmented by the virtual world (and maybe someday absorbed into it). Those who adapt fast enough and innovate are going to be the once who are out and front with the solutions. Those who

[14] A Web 2.0 site may allow users to interact and collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to websites where people are limited to the passive viewing of content. Examples of Web 2.0 include social networking sites, blogs, wikis, video sharing sites, hosted services, web applications, mashups and folksonomies.

do not adapt fast enough are going to die. Therefore, organisations need to start offering a wide variety of different workplaces at different locations where the knowledge worker can choose from.

Anytime/anyplace computing by knowledge workers (Smart working)

Doing a certain task at the right place and at the right time results in productivity. According to Davis and Naumann (1997), the most productive knowledge workers tend to employ the most efficient work flow and work methods. More important, they tend to be better at managing the use of their time, attention, and motivation. Knowledge work productivity depends on good self-management. The value of unlimited computing access may depend on the knowledge work tasks. Knowledge workers whose tasks involve obtaining data from a variety of locations, activities, and people (such as a scheduler of production activities) are likely to benefit from anytime/anyplace computing and communications facilities.

Four beneficial effects of unlimited access that change the performance of knowledge work are: removal of time and space constraints to communications, removal of time and space constraints for doing knowledge work, improved access to decision makers, and increased ability to receive and process a rich stream of signals about the organisation and its environment.

With anytime/anyplace computing, a knowledge worker is no longer constrained by employment location and employment times in performance of important communications, coordination, and collaboration activities. Communication, coordination, and collaboration access are available 24/7 from anywhere. This is especially important for those whose jobs require communication, coordination, or collaboration with persons in other locations and other time zones.

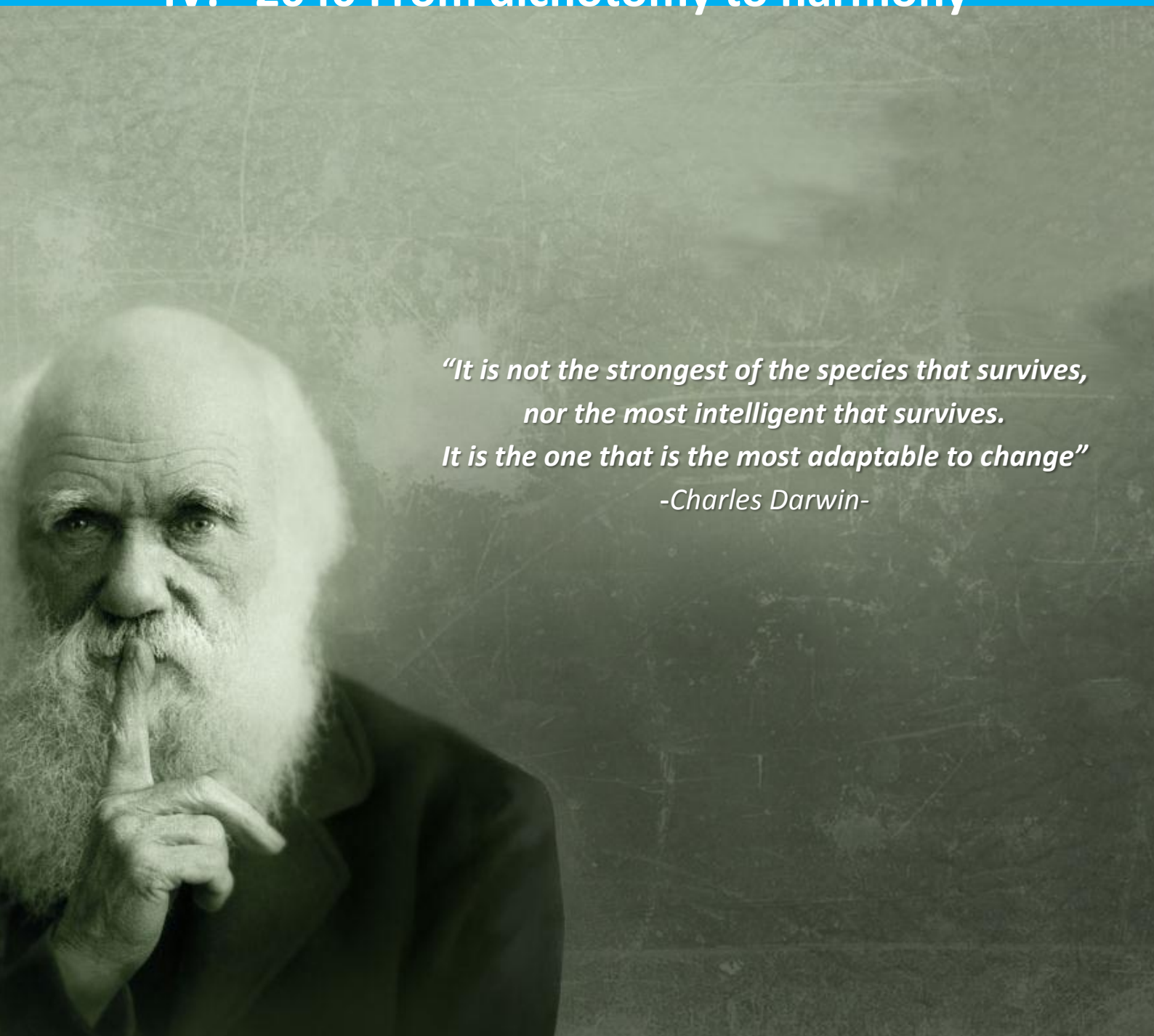
Anytime/anyplace computing allows the office functions to move with the knowledge worker rather than being tied to a physical office. Spread sheets, reports, analyses, and requests for comments and decisions can be sent from any location at any time to relevant stakeholders and decision makers. Anytime/anyplace computing increases the opportunity to get access to critical decision makers at any time.

Smart Work is an act of production performed independent of time and place. In its ultimate form, the “office” no longer exists and traditional work conventions such as work hours are irrelevant. Smart Work is results-oriented: it is often social and collaborative, and the result of a networked way of operating, with exchange, collaboration, and co-creation processes optimising work and its output.

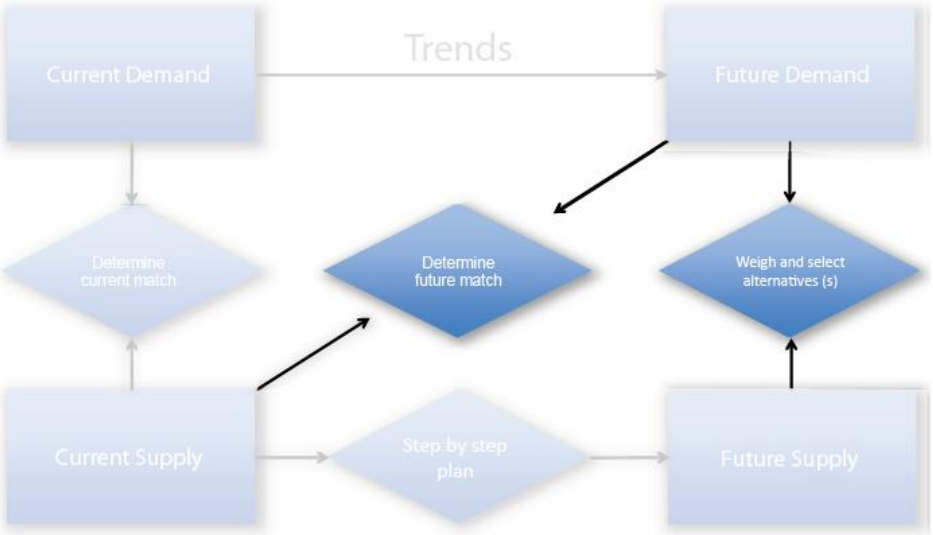
The future of work will be more flexible, more freelance, more collaborative and far less secure. It will be run by a generation with new values.

Knowledge workers will demand facilities to support their desired way of working, if not, they will find a job elsewhere where they can work at different hours during the day at the most convenient location while using the most convenient device for a certain job at a certain time.

IV. 2040 From dichotomy to harmony



7. Matching: future demand with corporate real estate portfolios 2013-2040.



7.1 Introduction

Dichotomy created by the static nature of real estate and the dynamic nature of technological evolution and the use of office space is what needs to be dealt with while creating the workplace of the future. Not as much decommissioning of office sizes, but need to appropriate and giving a new balance to office use. A balance must be created concerning individualism versus collectivism and corporate integration versus fragmentation. It must be clear that the desires of the knowledge workers must be satisfied, just the same as satisfying customers. In the end, office users will be customers. The more they will be supported to do what they need to be better, the more is going to be succeeded and have the desired experience.

Sub question 3

What is the best possible solution for corporations to obtain a real estate portfolio stays aligned with the future demand?

This question will be answered via the DAS-Frame by weighing and selecting alternatives.

7.2 Current 'Assigned' supply mismatches Future 'Freedom & Choice' demand

Before discussing about corporate real estate portfolios themselves, the (mis)matches between the future demand and the current supply must become clear. If the current supply will be maintained as it is now, the current problem with high vacancy rates of 14% and the locked real estate market will become worse. As explained in paragraph 4.2 , the vacancy rate will be doubled within the near future due to hidden vacancy. Vacancy concentrates in buildings with specific physical characteristics. These are buildings in mono-functional office locations or industrial and distribution areas, typically with few facilities and not well accessible by public transportation, with poor external appearance, poor flexibility and less parking places than surrounding properties. Table 16 states the (mis)matches between the current supply and future demand (as discussed in chapter 6) on three different levels, namely on location, object and ICT level.

Table 16 Current supply versus Future demand

Current supply	Matching	Future demand (2040)
Location		
First place offices and Second place offices with focus on First place offices. Assigned locations to work.	Mismatch: Assigned locations	Way of working: time, place, device and organisation independent working. (Choice in places to work)
Object		
Long contracts because of investors' security in cash flows versus.	Mismatch: Long contracts	Short contracts to end, switch or pause
Workplace		
Different per organisation (Assigned, per seat, or assigned flexible workspaces)	Mismatch: assigned workplaces with some flexibility in some cases	Choice in places to work and freedom in ICT to use
ICT		
Computer (BYOD)	Partly match	CYOD, BYOD, Cloud, Video conference

Alternative work strategies, which break the paradigm of an assigned office space for every worker during an assigned period, have been around since at least the early 1990s. For most companies, alternative work strategy is synonymous with telecommuting, an arrangement in which employees regularly work from home. However, as today's businesses face unprecedented challenges, attention is veering to newer work strategies that can radically change office environments, providing opportunities to support work and workers as never before with innovative design approaches and product applications.

From the pressure cooker created by new generations in the workforce, a marketplace gone global and deep economic recession, two facts have emerged:

1) companies need to dramatically cut their two largest expenses, people and real estate;
2) the only way to stay competitive is to accelerate the pace of knowledge work.

Some companies turn to alternative work strategies such as telecommuting as a quick fix, but do not consider how the physical space that remains needs to change in response. By rethinking both the nature of work from today and the physical work environment, there is opportunity to accomplish immediate and long-term goals.

Expanding beyond telecommuting, hoteling, home offices or other typical alternative work strategies, this new approach, which is also called emerging work strategies, is designed around a management philosophy that redefines work to give employees control and choice about where and how they work. At the same time, it supports them with a workplace specifically designed to support the kind of work that happens when people come to the office. It offers maximum flexibility for both individual work and collaborating with others. By untethering workers from assigned workstations or offices, less space is needed overall and workers are supported more fully. It requires considerable time and effort to properly implement and bring such a major change to an organisation. The issues are complex and there are many questions to be answered: what exactly does the organisation do today? What does it aspire to do? What kinds of office space does it need for the kinds of work performed? What is the relevance of the office when work and workers are more and more mobile? If work is more dependent on connections with other workers, how does the office help them collaborate? What are the implications for the four generation workplace? How do leaders plan for the long term while shrinking offices and expenses today? To start with, first an abstract description of existing supply is suitable for the future demand.

Suitable current supply for future demand

Office buildings

Buildings have long life cycles of 50 years or longer especially when renovated. This means that current supply of office buildings will still be present for some decades unless the will be demolished. It is important to have buildings that match not only the current demand, but the demand

throughout their life cycle. As discussed in earlier chapters, the demand for office space changes within a period of 50 years. In the Netherlands most standard office buildings have a rectangular layout that is stacked in different layers with a core centre facilitating vertical and horizontal transportation of people, goods, climate control etc. (see Figure 68). Smaller gridlines provide more flexibility for partitioning. Considering standard measurements of interior elements, furniture and minimal dimensions for different spaces, optimal gridlines are 900m and 1800mm. Gridlines of 3600mm will hinder flexibility. Flexibility in the last years refers to the ability to place separation walls in the desired distance to create a closed or semi closed workplace. Nowadays, the gridlines are less important, because open floor spaces around 5400mm or 7200mm wide and 2700mm high provide enough flexibility to make close, semi-closed and open workplaces. If the grid does not allow a certain division, independent objects can be created inside the open space (see Figure 69).

Figure 68 Conceptual objects for future demand

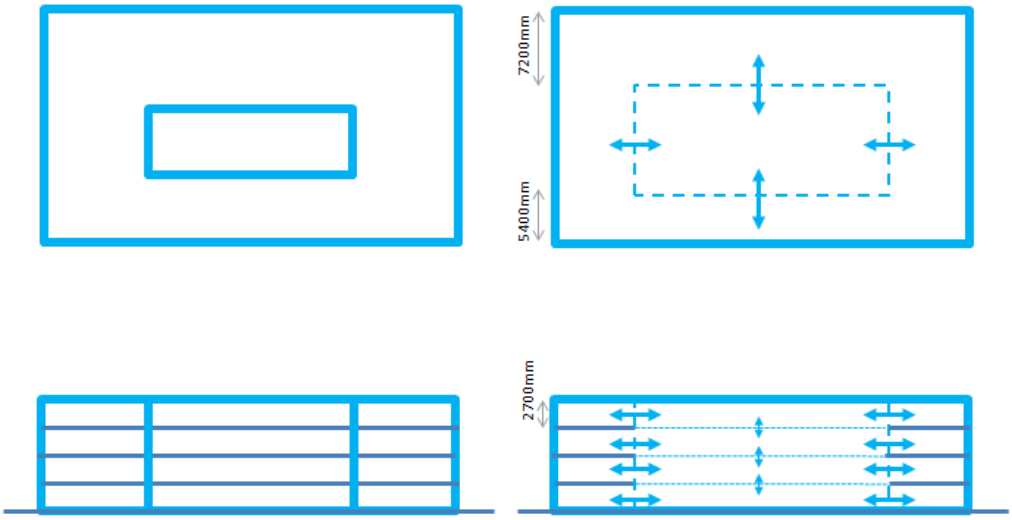


Figure 69 YNNO office layout (source: www.ynno.com)

While the possibilities for redeveloping and adapting existing office building for the same or new use have been revealed, the question that remains unanswered is: which office buildings and locations could and should be reused for new, sustainable offices that meet future demands and can increase the value of the existing, obsolete office building? Although adaptation of existing offices is

a means of reducing the amount of new office developments, not all office buildings can be successfully adapted. If a property is environmentally or locational obsolete, adapting the building to fit new office user demands will not offer any solace. Additionally, some office buildings have unfavourable measurements or inflexible layouts that cannot accommodate the demands of modern office organisations. In some cases, the existing office building is too small and too technically out-dated to be adapted: the costs of interventions that are needed to make the building suitable for new office use will result in a second-best office building that will lose the competition with other buildings and therefore will remain vacant. Moreover, fighting the oversupply in the office market means that some office buildings need to be taken off the market. Departing from the forecasts by DTZ (2011) that if no new office buildings are added to the office stock, 25% of the office supply should be demolished or transformed for other use.

Locations

According to research done by Macke and Hesp (2012) from 'Jones Lang LaSalle' the top 10 Office locations in the Netherlands are ranked in Table 17. In this research 232 office locations have been assessed in relation to three main themes: 'Location', 'Quality' and 'Market & Policy'. These themes have been assessed through an examination of 40 criteria[15] that, together, have resulted in a total score per office location. The colors on the map in Appendix 10 Ranking office locations immediately show the scores achieved by different office locations in particular municipalities.

Table 17 Top 10 office locations the Netherlands (source: (Macke and Hesp, 2012))

2012 Rank	Office Location	Total score
1	Amsterdam - Zuidas	84.50 %
2	The Hague - Beatrixkwartier	81.50 %
3	Amsterdam - Centre	76.00 %
4	Rotterdam - Centre	75.25 %
5	The Hague - Centre	75.00 %
6	The Hague - Adjacent Centre - New Centre	74.75 %
7	Utrecht - Centre	74.50 %
8	Amsterdam - East	73.50 %
9	Den Bosch - Paleiskwartier	73.50 %
10	Rotterdam - Kop Van Zuid	72.75 %

[15] These 40 criteria are not clarified.

Figure 70 Location assessment criteria (source: (Macke and Hesp, 2012))

Beoordelingscriteria

Thema	Onderwerp	Weging	Aantal criteria	Omschrijving
Ligging	Geografie	9%	5	Situering en bereikbaarheid van de stad ten opzichte van het economisch centrum van Nederland. Aanwezigheid kennisinstellingen.
	Demografie en economie	12%	8	Omvang en groei van de bevolking, werkgelegenheid en productiviteit. Opleidingsniveau.
	Infrastructuur	13%	6	Infrastructuur voor auto's en openbaar vervoer, doorstroming en parkeernormen op deellocatieniveau.
Kwaliteit	Voorzieningen	9%	2	Multifunctionaliteit, aanwezigheid van ondersteunende voorzieningen.
	Gebouwkwaliteit	14%	4	Bouwjaar, gebouwkwaliteit, energielabels.
	Imago	10%	3	Leegstandsniveau, architectuur, landscaping en (inter)nationale gebruikers.
Markt & Beleid	Omvang	6%	1	Omvang van de kantorenvoorraad.
	Gebruikersdynamiek	10%	4	Aantrekkelijkheid uitgedrukt in opnamedynamiek, structurele leegstand en mix aan gebruikers.
	Beleggersdynamiek	12%	4	Beleggingsvolume, nieuwbouwvolume en harde planvoorraad.
	Beleid	5%	3	Gemeentelijk beleid in de zin van structuurvisie, restrictieve planvoorraad, duurzaamheidsbeleid.
	TOTAAL	**100%**	**40**	

7.3 Preparing for the future: *Retain by Releasing*

The current office supply is not future ready when it comes to operational aspects that are suitable for so called on-demand offices that provide Shared workplaces, Activity based workplaces. Collaboration tools: (Telepresence facility) and services that are available at different locations and is paid for by use. Most offices are owned or leased by organisations for own use. To obtain a match between the office supply and the future demand it must become clear what must change either on the demand side or on the supply side.

Based on the research results, the changes influenced by ICT trends will be set out looking at the demand and supply. Due to the steadily progress of technologies and processes for information sharing, communication and collaboration, and due to the forces of competition and globalisation, the work environment has changed considerably over the past 20 years. And it will continue to do so in the future, going into the direction of a more virtualised world. The network, the Internet, and the web of people will become the workplace. People will be empowered for seamless dynamic and creative collaboration across teams, organisations and communities through a personalised and mobile collaborative working environment, enabling working from everywhere and at any time. the emergence of "networked workspaces" and the challenge for supporting efficient, intuitive, user-oriented and 'human-centric' work environments where technology is aligned to organisations and human behaviour, enabling people to work together irrespective of constraints in location and time. Information and communication technologies (ICT) supporting mobility, context- and location awareness, networking and ambient interaction will play an important role in implementing this challenge (Brodt et al., 2006). An interesting line is to zoom in on the fit between different ways of working and different personal characteristics (within the context of a particular position and organisation). Here the so-called third places, which are popping up everywhere, are become interesting.

The future office portfolio: the most convenient environment at the most convenient time and place

The future demand for workplaces will be a continues alternating demand happening from task to task during a working day. Instead of a predetermined office portfolio that allows to be adapted at the end of a 5, 10 or more years lease contract or even longer term ownership, organisations must

provide a portfolio in which knowledge workers can find a desired workplace that supports the activities done on a daily basis. They should be able to choose the most convenient workplace is at the most convenient location at the most convenient time to perform their tasks (see Figure 71). See also Table 18 for obtaining a future match.

Figure 71 Users 'choice of workplace and location

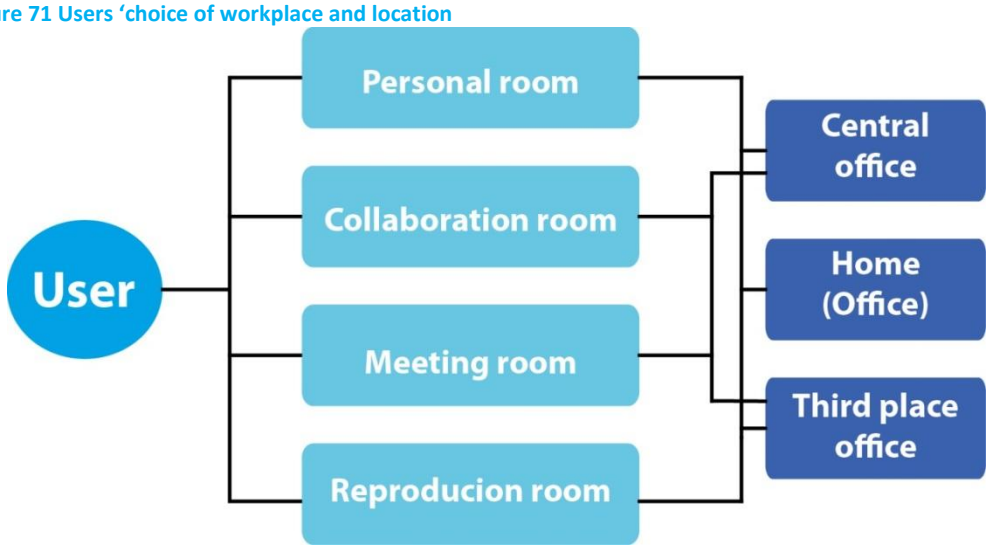


Table 18 Future demand and supply match

Future demand	(Mis)match	Future supply
	ICT	
Freedom in ICT (BYOD/CYOD) Access to information Mobility	Match	Secure and compatible internet network. Cloud computing Mobile devices Virtual communication
	Workplaces	
On-demand workplaces activity supporting workplaces Choice in ICT (BYOD/CYOD)	Match	Shared workplaces Activity based workplaces Collaboration tools: (Telepresence facility)
	Object	
On-demand Short-term contracts	Match	Shared business centres Instant offices Home office Monthly or by usage
	Location	
Choice in location to work	Match	Different office locations

Some assumptions can be made clear. The analysis assumes that as of 2012 the amount of space provided per person is 9m², for an office comprising 200 staff. This equates to an office environment of 1,800 m². So, if we look ahead to 2030, what is the likely scenario, using the table opposite as a basis for calculation. Even though the main office-based population is set to shrink by almost 25%, the increase in the amount of space per person will mitigate against this erosion in office space demand. Overall the message is that we do not necessarily believe there will be a significant change (fall) in the amount of space required for traditional office use, despite a fall in office-based employment. There will, however, be a great deal of change in how office space is used and configured. Given the effect on the bottom line of reducing rental outgoings, there will be increasing pressure to utilise technology and other flexible office solutions to cut the regular rent demand whilst keeping core staff happy, motivated, productive and wanting to come to work. Amidst ever more competitive labour markets, having the right workplace strategy will be key to a company's future success. For developers and landlords, having the right type of space that can accommodate changing layouts and needs and provide the sustainable building solutions which occupiers and investors are now demanding will be paramount to the success of an office portfolio. The right balance between first, second and third work places is crucial.

The future first, second and third office place

The first place office

The first place office is the central office where the organisation's culture brand or image can be expressed as explained in Chapter 4.2 . This is a territorial office assigned to a specific organisation. Management teams, and workers who do not want or need to work elsewhere because they want to be physically close to the management team or happen to live close to the first office will make use of this office. Knowledge workers who work more at second and third place will visit the first place office only for specific meetings, workshops, tactic knowledge sharing or any other interaction where physical presence is needed. The location of the first place office depends on different factors, like residential location of the users, accessibility, image etc.). Any type of office can be the first place offices. This depends on the qualitative and quantitative needs per organisation consisting of a predetermined group of users. The workplace at the central office depends on the organisations culture and activities that they perform at the central office. Mostly these will be personal and flexible workplaces assigned to a specific organisation where image and culture is expressed.

The second office place

The second office place is located at the workers home. Per worker, the home workplace is different. Some will have instant workplace where the open their laptops (or other devices) at the kitchen table while other have a specially reserved and designed office like workplace where distraction is kept at its minimum.

The third office place

At third office place are spaces that are shared, swapped, reserved, rented or simply claimed for a time, versus individually "owned." The most relevant third workplace for this research is a business Centre. A Business Centre is a professionally managed commercial facility that offers end-to-end business infrastructure for short to medium term durations. Customers can choose from a wide range of flexible options that suit their needs. Based on the specific space and infrastructural requirements, clients can take advantage of customised, unbranded serviced offices. Clients can simply list-out their requirements in terms of office size, layout, number of workstations, administration and support facilities, etc. and it is possible for all this to be ready right on day one. Just walk in with teams and commence operations. Business Centres offer an ideal setting for MNCs (multinational corporations) starting off operations in a new location because they allow companies to commence operations immediately, without the hassles of putting together business critical services and infrastructure. Setting up an office cannot be any easier or more cost effective. Most Business Centres are located at prominent addresses, so that clients can benefit from excellent connectivity and derive maximum business benefits from the physical proximity to other major business houses.

Business Centres are best known for their serviced office spaces, all types of businesses, from international organisations to start-ups, require support infrastructure like meeting rooms, voice and video-conferencing facilities, reception services, hospitality services, facilities management and IT support. Business Centres offer all these and more. In addition, most business centres also offer virtual offices which allow you to have a professional business address along with all the services but without having a physical office. State-of-the-art infrastructure, fully furnished offices, end-to-end technical support and utmost flexibility are the mark of an excellent Business Centre. However, a decision to shortlist a Business Centre should also be based on factors like:

- **Location** - centrally located offices - proximity to financial hubs, business services, travel, entertainment and recreation facilities are desirable
- **Executive Offices** - excellent quality business infrastructure, well-maintained, unbranded and fully equipped offices translate into peace of mind – the ideal office atmosphere

- **Technological Support** - absolutely essential – Wi-Fi, business support services, voice and video facilities, AC temperature control, printing and copying facilities, UPS, and server rooms
- **Hospitality** - professional reception, meeting and guest handling procedures, facilities for snacks and refreshments, housekeeping facilities and round-the-clock maintenance support
- **Meeting Rooms** - with flexible facilities for scaling up and down, organizing training sessions, conferences and consulting sessions that require innovative layouts, video conferencing facilities and LCD projectors, etc.

A growing number of organisations now recognise that non-traditional workplace strategies and spaces can contribute to their overall business effectiveness and efficiency. Various places can be categorised where work gets done, and focused on alternative workspaces that extend a company's real estate or are within existing facilities.

- **Coworking facilities** are an alternative to working at home with an emphasis on creating community, usually for self-employed individuals and small start-ups
- **Serviced offices** provide convening spaces for groups that need to work together for a specific number of days; used concurrently or sequentially by multiple groups or companies; also sometimes called collaboration hubs.
- **Co-owned/leased facilities** put multiple companies into one workplace on a long-term basis, usually with separate spaces assigned to each company and some shared.
- **Satellite offices** provide corporate hoteling options for a company's mobile employees.
- **Hybrid facilities** combine resident and mobile employees in a single corporate space.
- **In-house third spaces** provide a casual, coffee-shop atmosphere for work within a corporate space.

In 2040, ICT will be facilitating office workers to work remotely from anyplace with a connection to the internet. Comfort in workplaces is obtained activity based workplaces. In Figure 72 the impact of the selected trends is stated resulting in a strong declination of the first office use where those office users are moved to third place workplaces leaving the second workplace almost unchanged (see Figure 72).

Figure 72 Distribution of workplace use

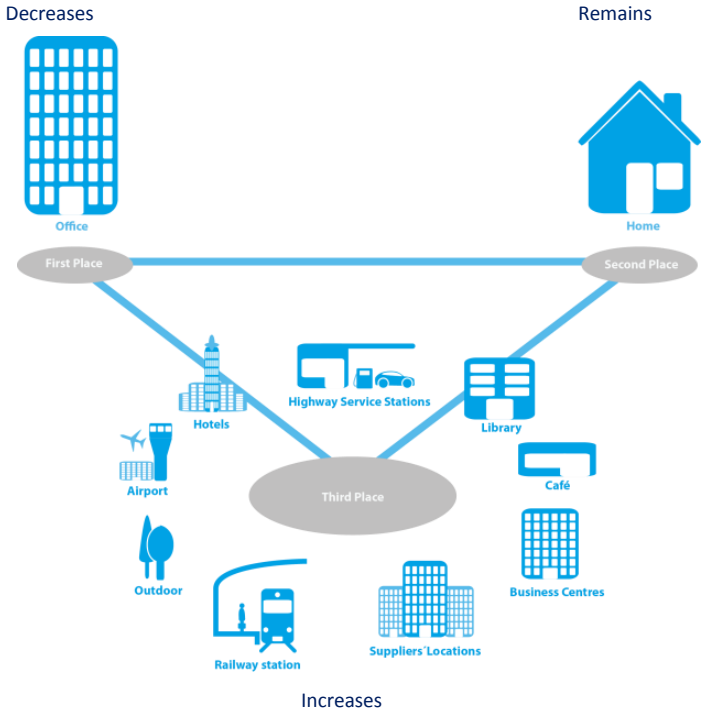
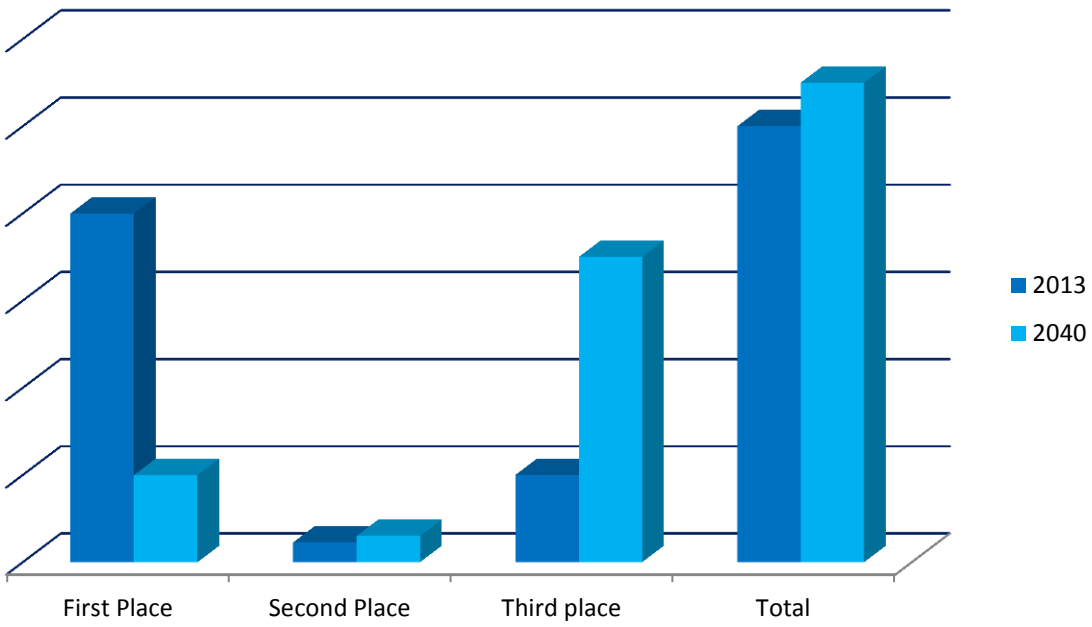


Figure 73 1st, 2nd and 3rd Place workplaces 2013-2040



The shifts are derived from the maximum possibility of working 100% at third and second workplaces. It does not necessary mean that workers and management teams really want to work this way. Taking into account the different generation's willingness to work away from the central office with their colleagues, only working at third and second places is not an option. People demand social cohesion. Other than the social part, starters or less independent workers need guidance by the management team to perform their task within time and quality. Assuming that 50% per cent of all workers are able to work independently with (except for entrepreneurs) guidance of their management team. Nowadays 20% of worker in the Netherlands are able to work remotely. With the help of ICT and some training in time management, in 2040 it must be possible for 60% to 70% of

workers to be able to work at third place offices. However, working at third places should be an option instead of a must. Users should be able to manage their activities and plan which workplaces are needed at a certain time. After deciding on the type of (activity based workplace) they should be able to choose whether they will go to a first, third or stay at the second workplace. Having the option of choosing a place in combination of freedom the technology they will use provide the users of much flexibility and comfort in their work. Besides choice between a first, third or second workplace, it is important for third place workplace provide a variety of cultures, designs and ambiance to comfort different workers with different personalities as much as possible. For example, Regus provides more corporate environments while Spaces brings in a more homey/hotel sphere (see Figure 74 & Figure 75).

Figure 74 Regus interior

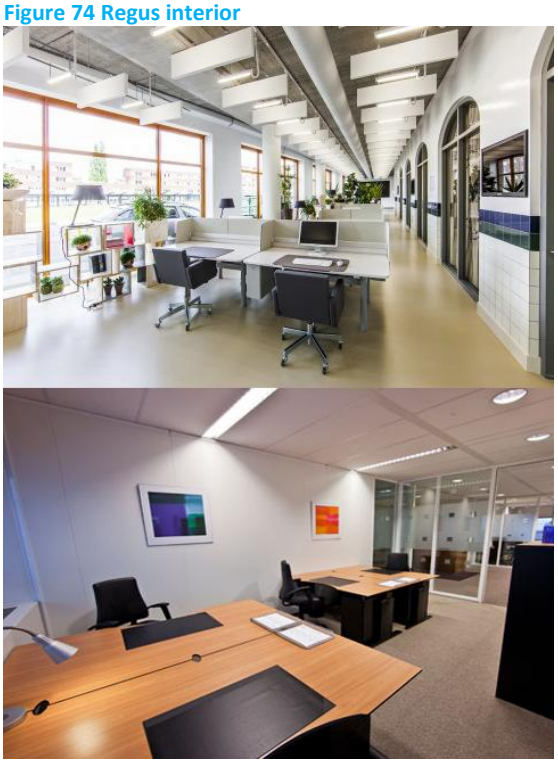


Figure 75 Spaces interior

7.4 Weighing and selecting alternative solutions for a future match

Because the current supply mismatches with the future demand, it is not an option to leave the current supply as it is. This paragraph discusses four alternative solutions to create a future match. An interesting solution would be offering a wide variety of different workplaces at different locations where the knowledge worker can choose from on an ad hoc basis. However, not all companies are either financially or organisationally able to lease or own these different workplaces at different locations. This can be accomplished by using third place offices that are shared with other users from outside the organisation.

To satisfy each different demand per knowledge worker, the diversity in types, styles and locations of these workplaces is of great importance. Nowadays third workplaces are provided by parties of which each is offering a quite monotone in image and culture. For instance, Regus provides workplaces with a corporate image and all locations are designed in the same style. Spaces has a more modern and hotel-like design while the type of workplaces are aligned to the local members.

Mutually there is some diversity, but then a membership for each provider is needed separately. For the third place office to work successfully, the accessibility or collaboration between different providers is required to grant access to a wide variety of workplaces. Therefore four alternative

solutions have been designed that might offer a solution to matching the supply with the demand until 2040.

Alternative 1: Owning, leasing or renting the first place office

This alternative is similar to current real estate portfolios of organisation. The complete real estate portfolio of one organisation is owned and/or leased by one organisation. Organisations own, lease or rent only central office(s) as their first place office for the entire work force leaving the second workplace up to the workforce. This means that the organisation is financial and organisational responsible for all workplaces for their workforce at first places and not providing third places. The variety of different workplaces at different locations is limited to the central office(s). However, for this alternative, future requirements must be expressed in ranges (minimum and maximum) on before acquiring or diminishing space. Due to long term contracts, changes are that the future outcome is different from those on which predetermination is based on forming mismatch between the changed demand and supply.

Alternative 2: Owning, leasing or renting the first and third place office

The complete real estate portfolio of one organisation is owned and/or leased by one organisation. Organisations own, lease or rent a central office as the first place and other offices/buildings as third place office leaving the second workplace up to the workforce. This means that the organisation is financial and organisational responsible for all workplaces for their workforce at first and third places. The variety of different workplaces at different locations is limited to the budged the organisation has to spend of accommodation. However, for this alternative, future requirements must be expressed in ranges (minimum and maximum) on before acquiring or diminishing space. Due to long term contracts, changes are that the future outcome is different from those on which predetermination is based on forming mismatch between the changed demand and supply. To obtain some flexibility, the third place office can be (temporary) shared with other users from outside the organisation when there is an oversupply of office space within the owned portfolio. This can be done in return for either rent per workplace, knowledge provided per user or any other compensation for using the space and facilities This might require extra management.

Alternative 3: Owning, leasing or renting the first place office + access to third place office

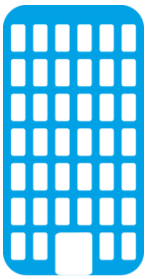
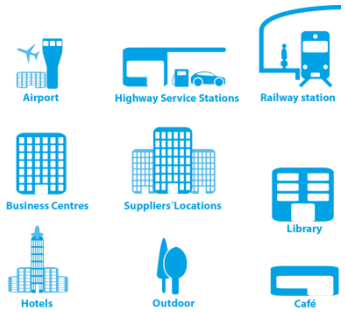
The real estate portfolio of one organisation is owned and/or leased by different organisations. Organisations can own, lease or rent their own central office as the first place while providing the workforce a budget to acquire access to third place offices that are shared with other organisations. The second workplace is up to the workforce. The organisation is solely financial and organisational responsible for the central office(s). Only for this office a minimum and maximum range must be predetermined leaving the chance of future mismatches solely to the central office. Third parties will be organisational and financial responsible for the third place offices and will provide workplaces and facilities as a service comparable to hotels. These services are paid for by to organisations via subscription per worker per month or per year or based on use. This provides each knowledge worker to choose from a wide variety of work environments that they find most convenient at the time and place that they find more convenient. Due to competition between third place offices, the user demands will be constantly matched.

Alternative 4: Access to third place office

The real estate portfolio of one organisation is owned and/or leased by different organisations Organisations can provide the workforce a budget to acquire access to third place offices that are shared with other organisations. The second workplace is up to the workforce. The organisation does not have a central office. Workplace qualities and quantities are on-demand and therefor constantly matching demand per task. Third parties will be organisational and financial responsible for the third

place offices and will provide workplaces and facilities as a service comparable to hotels. These services are paid for by to organisations via subscription per worker per month or per year or based on use. This provides each knowledge worker to choose from a wide variety of work environments that they find most convenient at the time and place that they find more convenient. Due to competition between third place offices, the user demands will be constantly matched.

Table 19 Four alternative strategies

	First Place Office		Third Place Office		Second Place Office
					
	Contract type	**Responsibility**	**Contract type**	**Responsibility**	**Responsibility**
A1	Own, lease or rent	Organisation	-	-	Worker
A2	Own, lease or rent	Organisation	Own, lease or rent	Organisation	Worker
A3	Own, lease or rent	Organisation	Membership	Third party	Worker
A4	-	-	Membership	Third party	Worker

The goal is to obtain a possible solution that provides an optimal future supply for all stakeholders on the long run. Some examples of business objectives include minimising expenses, expanding internationally, or making a profit. Real estate decision making should always incorporate the interests of the different stakeholders involved and weigh these interests over time as a result of the ever changing demand (accommodation requirements) and obsolescence of supply (existing accommodation). Different organisations and branches have different cultures. Different cultured organisations vary in adopting change. For example, juridical organisations are more traditional than IT organisations and are likely to keep on using first place offices as long as possible. The implementation of each alternative solution can have unforeseen consequences. Therefore, all four alternatives are tested in four possible scenarios of the Netherlands until 2040.

7.5 Consequences in four scenarios of the Netherlands

Technological change in the long run (i.e., in the period of thirty years up to 2040) is best described in terms of general-purpose technologies (GPTs). The arrival of these GPTs is unknown, but when they arrive society will change fundamentally (Weel et al., 2010). Scenarios should not be seen as an end in itself but as a management tool to improve the quality of decision-making improve. However, this skill requires considerable refinement and takes time to obtain results. Companies need an explanation for the use of scenarios to strategic decisions take (Ringland and Young, 2007).

Four scenarios of the Netherlands 2040

First, a GPT is pervasive, because it can be found in a large variety of applications in many different parts of the economy. This characteristic explains why electricity is a GPT and a light bulb is not. Both can be found at many places, but only electricity has a large variety of applications. Second, a GPT improves substantially over time, which lowers its costs and contributes to its pervasiveness. The increase in computing power of the microchip is a prominent example. And thirdly, a GPT spawns many complementary technological and organisational innovations, as the evolution of the Internet shows.(Weel et al., 2010). What are the main characteristics of each of the four scenarios,

and what are the main differences that are relevant for policymaking? The table 'Main scenario characteristics' presents a summary.

Figure 76 Four scenarios of the Netherlands 2040 (source: (Weel et al., 2010))

Main scenario characteristics				
	Talent Towns	Cosmopolitan Centres	Egalitarian Ecologies	Metropolitan Markets
				
City size, in population	100k – 200k	2 – 8 m	100k – 500k	> 10 m
Technology, knowledge				
Direction ICT	Communication	Communication	Information	Information
New GPT	None	Research-oriented	None	Application-oriented
Innovation	Direct applications, strong competition	Radical, firm – university links	Applied and incremental	Fundamental and applied, within firms
World economy				
BRICs	Manufacturing	Manufacturing hubs	Inward orientation	Some metropolises
United States	Top-end innovation and design	GPT, services	IT products and local varieties	Many metropolises
EU (including the Netherlands)	Business services	High-end services	Local varieties	Few, autonomous metropolises
Trade	Global market, high trust, strong trade agreements	Global market, trade in intermediaries	In final products	Limited
Place of business				
Agglomeration	Scattered	Concentrated	Medium city size, local varieties	Highly concentrated
Infrastructure	Virtual + air connections	Between and within cities, high quality	Regional	Locally, high quality
People				
High-skilled workers	Talent is rewarded	Talent is highly rewarded and benefits from interactions	Moderate wages	High wages due to benefits from interactions
Income inequality	High due to specialisation	Very high due to size and specialisation	Low due to absence size of specialisation	High due to size
Vulnerability to shocks	High – specific human capital and city output	High – specific human capital and large city output	Limited	Low

Scenario 1: Talent Towns

The Talent Town scenario is referred to a world with relatively small cities (100,000 - 200,000 inhabitants) and specialized workers and firms. Communication technology (CT) enables specialist workers to co-operate in virtual teams, particularly in service industries. People do not have to meet in person all of the time in order to successfully design new products, improve upon production

processes or devise marketing campaigns. Consequently, firms employ specialists from all over the world. Specialist workers gain from personal interaction with their fellow specialists, which determines their location choice. Meeting in person provides the opportunity to monitor the developments in their field, exchange ideas or discuss reputations. In addition, they select their place of residence on the basis of the attractiveness of the living environment and the availability and quality of consumption amenities such as restaurants, theatres, childcare centres, schools and so forth.

The comparative advantage of the Netherlands and other European countries lies with business services. In the coming years, manufacturing activities move for the most part to Asia, because manufacturing knowledge increasingly becomes generally available and because trade facilitates the global transfer of final goods and intermediates. Knowledge of business services becomes the distinctive comparative advantage of the Netherlands. Dutch consultants, financial specialists, designers and publicity experts operate worldwide. In this highly competitive world, exports of business services enable the Netherlands to increase imports of manufacturing products. Since intense competition perpetually creates new winners and losers, there always is a chance that interest groups lobby for protectionism. If some government gives in, then a cascade of retaliation may undermine the sources of wealth.

TT is a very dynamic world with excellent opportunities, but also major challenges. The strongly competitive environment enables high-skilled specialists to earn high incomes. However, the rising top performer of tomorrow can overtake the top performer of today, and when a certain specialisation becomes obsolete, an entire TT may lose its livelihood. Moreover, the wages of low-skilled workers suffer downward pressure due to global competition. The TT world faces the paradox of high demand for protection and redistribution, but limited supply. The high mobility of labour, capital and tasks puts bounds on redistribution. An elaborate social insurance system would urge high-skilled people with a small risk of becoming unemployed to move abroad, thereby eroding the premium base. Hence, substantial vulnerability and inequality together with low solidarity characterise TT.

Scenario 2: Cosmopolitan Centers

Envision a world of large cities (each of 2 to 8 million inhabitants) with global connections hosting specialised workers and firms. In a CC city, many specialists from all over the world combine their efforts in the design and production of toys and cars, games and business software, but also a range of new products and services. Some firms and workers specialise in design, financial services or transport, others in electrical engineering or packaging. Companies acquire intermediary products and support services from all over the world. This global division of tasks relies above all on efficient and relatively cheap communication technologies, which facilitate intensive coordination between all steps in the production process. The second characteristic of this piecemeal production process is just-in-time trade in intermediate products and services, for which a stable international environment is crucial.

Cities develop into clusters of these specialised activities. The largely science-driven expansion of bio- and nanotechnology demands close cooperation between researchers in universities and firms. Also in other fields specialist workers substantially benefit from grouping together. Working on complex tasks in a common location, specialists disseminate knowledge, exchange ideas, share common facilities and establish a reputation among their peers. A cosmopolitan centre of biotech R&D arises at one location, another location develops into a logistics centre, and so on.

The Netherlands may host a few of these clusters in which it has a comparative advantage (stemming from our location and connections with the major economic regions in Europe and the rest of the world, from the educational level of the population and from our international orientation). In addition, our strength in the past may develop in the future, and the Dutch CC cities may specialise in, for instance, company headquarters, water management and engineering, biomass technology, medical engineering, creative activities or logistics services. The prosperity of these cities might be threatened if other cities contest or take over that comparative advantage. Therefore,

income levels may differ substantially between centres and between a particular centre and its hinterland. Substantial income inequality also exists within cities, because the large CCs attract a broad range of supporting tasks.

Scenario 3: Egalitarian Ecologies

Variety and dispersion characterise egalitarian ecologies. Economic activity spreads out over medium-sized cities (100,000 - 500,000 inhabitants) that host medium-sized firms. Mediumsized cities in the east and south of the Netherlands flourish, building on their strengths in fields such as creative industries, agricultural services, healthcare products, fashion and design. Economic activity in the Randstad keeps pace, because the Netherlands retains its position in the transport of final goods all over Europe. Knowledge resides largely in the minds of the country's generalist employees in combination with the databases and other IT-applications of firms. The IT systems enable firms to produce differentiated products that cater to differences in local demand.

Living and working activities spread out over space. Due to in-house production and meager inter-firm knowledge flows, firms benefit little from being located near each other. Firms turn away from large cities and settle in medium-sized cities, which offer high-quality non-tradable private and public services, and which provide agreeable living conditions for their employees. Successful cities are hotbeds of high-quality production, and offer opportunities for creative cooperation on a small scale. However, in the longer term cities also face the risk of stagnation. Workers and plants can become locked-in, with limited opportunities inside the city, limited opportunities for learning from outside companies and limited outside options. EE represents a world with little income growth and modest income differentials. Because technological progress levels off and considerable wealth flows to suppliers of raw materials, disposable income grows only moderately. The relatively equal income distribution fits with the preference for equity in the Dutch society. However, social relations may come under pressure from the considerable migration of low- and medium-skilled workers, which also poses a challenge to the Dutch education- and vocational training system.

Scenario 4: Metropolitan Markets

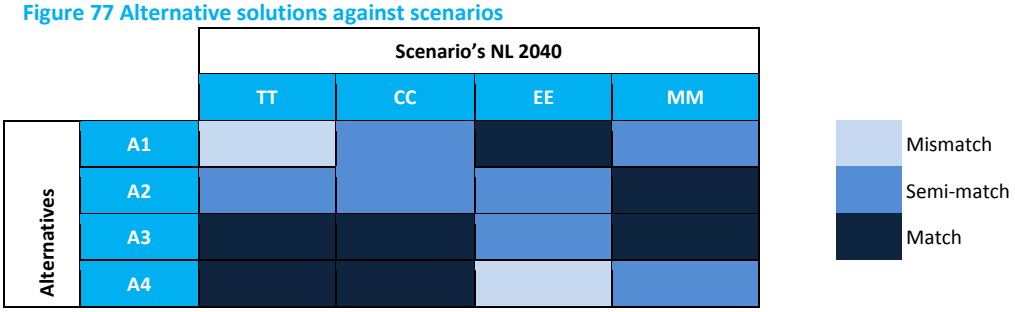
Metropolitan Markets can be seen as a few very large metropolises with more than 10 million inhabitants dominating the world. Large factories, huge office buildings and sky-high apartment blocks characterise these cities. Economic activity is concentrated in dense areas, where economies of scale and scope are optimally exploited. The hinterland and smaller cities face bleak prospects, talented workers leave and sufficient production size may never be reached. Metropolitan Markets is a world in which the winning cities take all.

In MM, bio- and nanotechnology break through. Their sheer complexity requires extensive research facilities and a high degree of tacit knowledge exchange within large firms to create sufficient potential for developing marketable applications. IT expert systems enable managers to delegate decision-making power. Still, managers need face-to-face contacts with experts in order to assess the technological potential of the firm's product portfolio. Hence, managers have the potential to run a large firm, as long as the various departments of the firm are situated in close vicinity to each other.

Metropolises attract firms and people. In metropolises, firms find trusted business partners, knowledge centres, a large supply of generalist workers and many consumers. People move to a MM city to select the best job, to build interesting relationships and to benefit from an appealing supply of cultural and recreational services. In addition, the scale of the community reduces uncertainty. Thus, if one's job doesn't satisfy, many other job options can be found. Where the metropolis thrives, the hinterland lags behind. The metropolis attracts all of the highly productive firms and higher-qualified people. Income inequality is large—both within the metropolis and between the metropolis and the hinterland. This may pose serious social problems for a country with a preference for equity, such as the Netherlands. An even deeper problem arises if the Netherlands fails to host a local metropolis; given the scale and scope of MM cities there is a chance that this is impossible. In that

case, the Netherlands as a whole becomes a hinterland. Neighbouring European metropolises would attract all company headquarters, research centres and talented people.

Figure 77 Alternative solutions against scenarios



Alternative 1 might work in CC, and will work in EE and MM, TT will cause a mismatch. Alternative 2 might work in TT and CC, it will work in EE and MM. Alternative 3 holds best in all four scenarios. Alternative 4 will not work in MM. Therefore, Alternative 3 will be selected as solution. No matter what scenario will come out, the flexibility of Alternative 3 allows a match to the demand.

7.6 Conclusion

After testing the possible solutions in the four scenarios, the fourth sub question will be answered:

What is the best possible solution for corporations to obtain a real estate portfolio stays aligned with the future demand?

This question is answered by input retrieved from trend watchers and real estate developers/consultants and via the DAS-Frame by weighing and selecting alternatives. Alternative 3: Owning, leasing or renting the first place office + access to third place office came out as best solution concerning flexibility and in most of the possible scenarios of the Netherlands until 2040.

The demand for corporate real estate portfolios can be summarised as freedom and choice. When comparing this future demand with the current corporate real estate portfolio it can be concluded that there is a mismatch. This mismatch resulted in a current vacancy rate of 27% in the Dutch office market of which 13% is still hidden. This mismatch needs to be turned into a match in order to lower the vacant and unused office space that is costing the owners and the government money while pauperising the spatial quality in the surrounding area. Innovated and further developed ICT that will used by generation X, Y & Z during the next two decades cause another demand for office use. More flexible. The current corporate real estate portfolios need to be restructured in order to be able meet this demand. Considering the four possible scenarios for the Netherlands towards 2040, four alternative solutions have been discussed. They have been weighed and tested against the four different scenarios.

Table 20states the (mis)matches between the current supply and future demand on three different levels, namely on location, object and ICT level.

Table 21 Current supply versus Future demand

Current supply	Matching	Future demand
Location		
First place offices and Second place offices with focus on First place offices. Assigned locations to work.	Mismatch: Assigned locations	Way of working: time, place, device and organisation independent working. (Choice in places to work)
Object		
Long contracts because of investors security in cash flows versus.	Mismatch: Long contracts	Short contracts to end, switch or pause
Workplace		
Different per organisation (Assigned, per seat, or assigned flexible workspaces)	Mismatch: assigned workplaces with some flexibility in some cases	Choice in places to work and freedom in ICT to use
ICT		
Computer (BYOD)	Partly match	CYOD, BYOD, Cloud, Video conference

Alternative work strategies, which break the paradigm of an assigned office space for every worker during an assigned period, have been around since at least the early 1990s. For most companies, alternative work strategy is synonymous with telecommuting, an arrangement in which employees regularly work from home. However, as today's businesses face unprecedented challenges, attention is veering to newer work strategies that can radically change office environments, providing opportunities to support work and workers as never before with innovative design approaches and product applications.

From the pressure cooker created by new generations in the workforce, a marketplace gone global and deep economic recession, two facts have emerged:

1) companies need to dramatically cut their two largest expenses, people and real estate;

2) the only way to stay competitive is to accelerate the pace of knowledge work.

Some companies turn to alternative work strategies such as telecommuting as a quick fix, but do not consider how the physical space that remains needs to change in response. By rethinking both the nature of work from today and the physical work environment, there is opportunity to accomplish immediate and long-term goals.

Expanding beyond telecommuting, hoteling, home offices or other typical alternative work strategies, this new approach, which is also called emerging work strategies, is designed around a management philosophy that redefines work to give employees control and choice about where and how they work. At the same time, it supports them with a workplace specifically designed to support the kind of work that happens when people come to the office. It offers maximum flexibility for both individual work and collaborating with others. By untethering workers from assigned workstations or offices, less space is needed overall and workers are supported more fully.

Suitable current supply for future demand

Buildings have long life cycles of 50 years or longer especially when renovated. This means that current supply of office buildings will still be present for some decades unless the will be demolished

It is important to have buildings that match not only the current demand, but the demand throughout their life cycle.

Office buildings

Considering standard measurements of interior elements, furniture and minimal dimensions for different spaces, optimal gridlines are 900m and 1800mm. Gridlines of 3600mm will hinder flexibility. Flexibility in the last years refers to the ability to place separation walls in the desired distance to create a closed or semi closed workplace. Nowadays, the gridlines are less important, because open floor spaces around 5400mm or 7200mm wide and 2700mm high provide enough flexibility to make close, semi-closed and open workplaces. If the grid does not allow a certain division, independent objects can be created inside the open space.

Locations

According to research done by Macke and Hesp (2012) from 'Jones Lang LaSalle' the top 10 Office locations in the Netherlands are ranked in Table 17. In this research 232 office locations have been assessed in relation to three main themes: 'Location', 'Quality' and 'Market & Policy'.

Table 22 Top 10 office locations the Netherlands (source: (Macke and Hesp, 2012))

2012 Rank	Office Location	Total score
1	Amsterdam - Zuidas	84.50 %
2	The Hague - Beatrixkwartier	81.50 %
3	Amsterdam - Centre	76.00 %
4	Rotterdam - Centre	75.25 %
5	The Hague - Centre	75.00 %
6	The Hague - Adjacent Centre - New Centre	74.75 %
7	Utrecht - Centre	74.50 %
8	Amsterdam - East	73.50 %
9	Den Bosch - Paleiskwartier	73.50 %
10	Rotterdam - Kop Van Zuid	72.75 %

Preparing for the future: *Retain by Releasing*

The current office supply is not future ready when it comes to operational aspects that are suitable for so called on-demand offices that provide Shared workplaces, Activity based workplaces. Collaboration tools: (Telepresence facility) and services that are available at different locations and is paid for by use. Most offices are owned or leased by organisations for own use. To obtain a match between the office supply and the future demand it must become clear what must change either on the demand side or on the supply side.

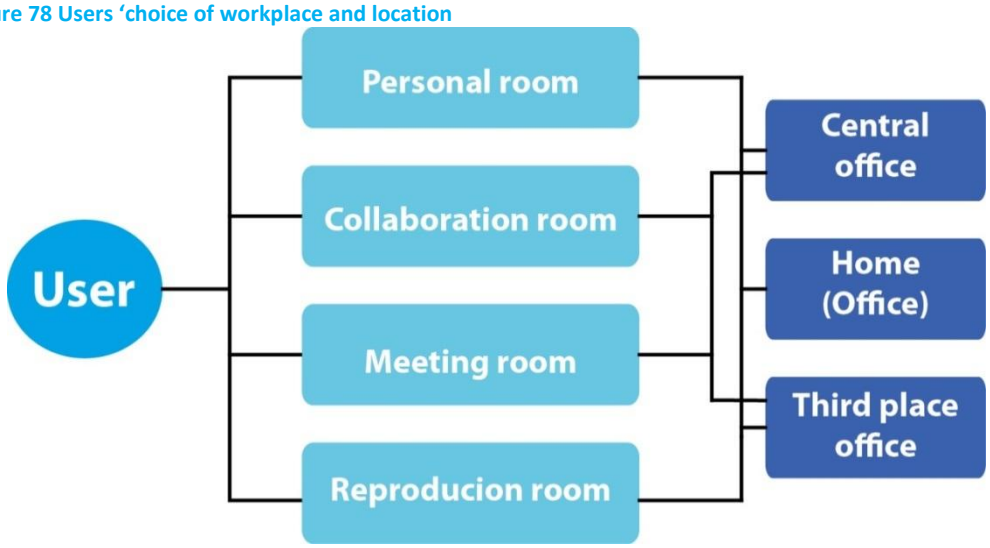
The network, the Internet, and the web of people will become the workplace. People will be empowered for seamless dynamic and creative collaboration across teams, organisations and communities through a personalised and mobile collaborative working environment, enabling working from everywhere and at any time. the emergence of "networked workspaces" and the challenge for supporting efficient, intuitive, user-oriented and 'human-centric' work environments where technology is aligned to organisations and human behaviour, enabling people to work together irrespective of constraints in location and time

An interesting line is to zoom in on the fit between different ways of working and different personal characteristics (within the context of a particular position and organisation). Here the so-called third places, which are popping up everywhere, are become interesting.

The future first, second and third office place

The future demand for workplaces will be a continues alternating demand happening from task to task during a working day. They should be able to choose the most convenient workplace is at the most convenient location at the most convenient time to perform their tasks (see Figure 71)

Figure 78 Users 'choice of workplace and location



See also Table 18 for obtaining a future match.

Table 23 Future demand and supply match

Future demand	(Mis)match	Future supply
	ICT	
Freedom in ICT (BYOD/CYOD) Access to information Mobility	Match	Secure and compatible internet network. Cloud computing Mobile devices Virtual communication
	Workplaces	
On-demand workplaces activity supporting workplaces Choice in ICT (BYOD/CYOD)	Match	Shared workplaces Activity based workplaces Collaboration tools: (Telepresence facility)
	Object	
On-demand Short-term contracts	Match	Shared business centres Instant offices Home office Monthly or by usage
	Location	
Choice in location to work	Match	Different office locations

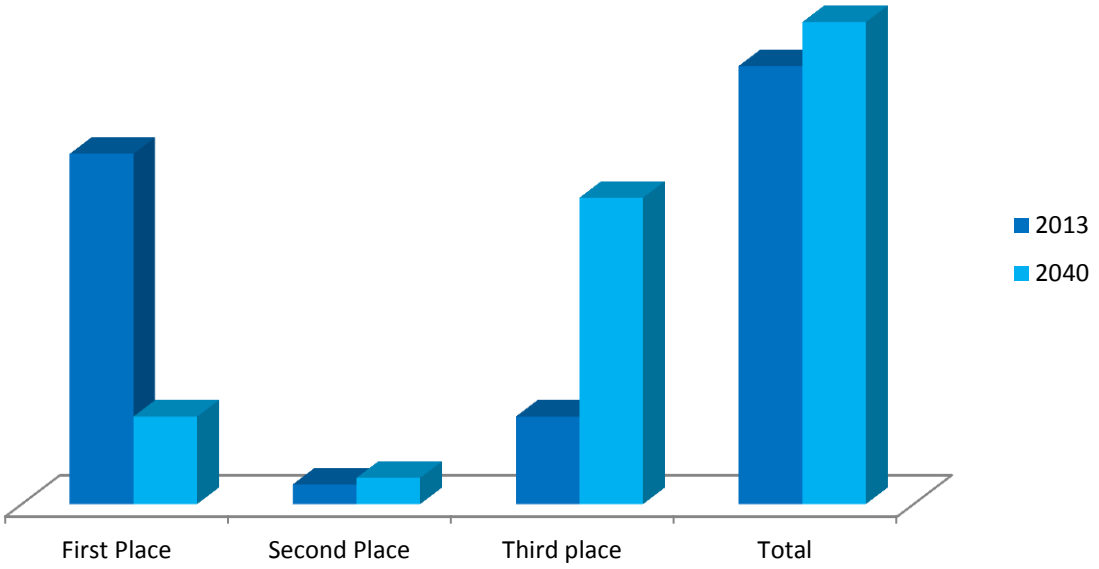
Overall the message is that we do not necessarily believe there will be a significant change (fall) in the amount of space required for traditional office use, despite a fall in office-based employment. There will, however, be a great deal of change in how office space is used and configured. Given the effect on the bottom line of reducing rental outgoings, there will be increasing pressure to utilise technology and other flexible office solutions to cut the regular rent demand whilst keeping core staff happy, motivated, productive and wanting to come to work. Amidst ever more competitive labour markets, having the right workplace strategy will be key to a company's future success. For developers and landlords, having the right type of space that can accommodate changing layouts and needs and provide the sustainable building solutions which occupiers and investors are now demanding will be paramount to the success of an office portfolio. The right balance between first,

second and third work places is crucial. The first place office, the second office place and the the third office place.

Various places can be categorised where work gets done, and focused on alternative workspaces that extend a company's real estate or are within existing facilities: Coworking facilities, Serviced offices**,** Co-owned/leased facilities, Satellite offices**,** Hybrid facilities and In-house third spaces

In 2040, ICT will be facilitating office workers to work remotely from anyplace with a connection to the internet. Comfort in workplaces is obtained activity based workplaces. In Figure 72 the impact of the selected trends is stated resulting in a strong declination of the first office use where those office users are moved to third place workplaces leaving the second workplace almost unchanged (see Figure 72).

Figure 79 1st, 2nd and 3rd Place workplaces 2013-2040



It does not necessary mean that workers and management teams really want to work this way. Taking into account the different generation's willingness to work away from the central office with their colleagues, only working at third and second places is not an option. People demand social cohesion. Other than the social part, starters or less independent workers need guidance by the management team to perform their task within time and quality. With the help of ICT and some training in time management, in 2040 it must be possible for 60% to 70% of workers to be able to work at third place offices. However, working at third places should be an option instead of a must. Users should be able to manage their activities and plan which workplaces are needed at a certain time. Having the option of choosing a place in combination of freedom the technology they will use provide the users of much flexibility and comfort in their work.

Weighing and selecting alternative solutions for a future match

This paragraph discusses four alternative solutions to create a future match. An interesting solution would be offering a wide variety of different workplaces at different locations where the knowledge worker can choose from on an ad hoc basis. However, not all companies are either financially or organisationally able to lease or own these different workplaces at different locations. This can be accomplished by using third place offices that are shared with other users from outside the organisation. Nowadays third place workplaces is provide by different parties with their own culture. Mutually there is some diversity, but each membership is bond to only one provider's portfolio. For the third place office to work successfully, the accessibility or collaboration between

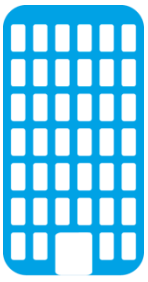
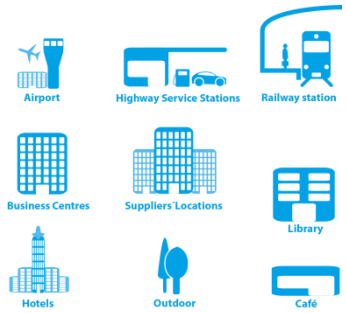
different providers is required to grant access to a wide variety of workplaces. Therefore four alternative solutions have been designed that might offer a solution to matching the supply with the demand until 2040.

Four alternative solutions

- Alternative 1: Owning, leasing or renting the first place office
- Alternative 2: Owning, leasing or renting the first and third place office
- Alternative 3: Owning, leasing or renting the first place office + access to third place office
- Alternative 4: Access to third place office

These alternatives have been set out in table 17 stating per alternative what Contract type is possible, the party who is responsible for office(s). For example, at alternative 2 the first place office could be rented by the organisation who is exploiting the office space, but also rents office space at third places while the worker can as well decide to work from home.

Table 24 Four alternative strategies

	First Place Office		Third Place Office		Second Place Office
					
	Contract type	**Responsibility**	**Contract type**	**Responsibility**	**Responsibility**
A1	Own, lease or rent	Organisation	-	-	Worker
A2	Own, lease or rent	Organisation	Own, lease or rent	Organisation	Worker
A3	Own, lease or rent	Organisation	Membership	Third party	Worker
A4	-	-	Membership	Third party	Worker

Real estate decision making should always incorporate the interests of the different stakeholders involved and weigh these interests over time as a result of the ever changing demand (accommodation requirements) and obsolescence of supply (existing accommodation). Different organisations and branches have different cultures. Different cultured organisations vary in adopting change. For example, juridical organisations are more traditional than IT organisations and are likely to keep on using first place offices as long as possible. The implementation of each alternative solution can have unforeseen consequences. Therefore, all four alternatives are tested in four possible scenarios of the Netherlands until 2040.

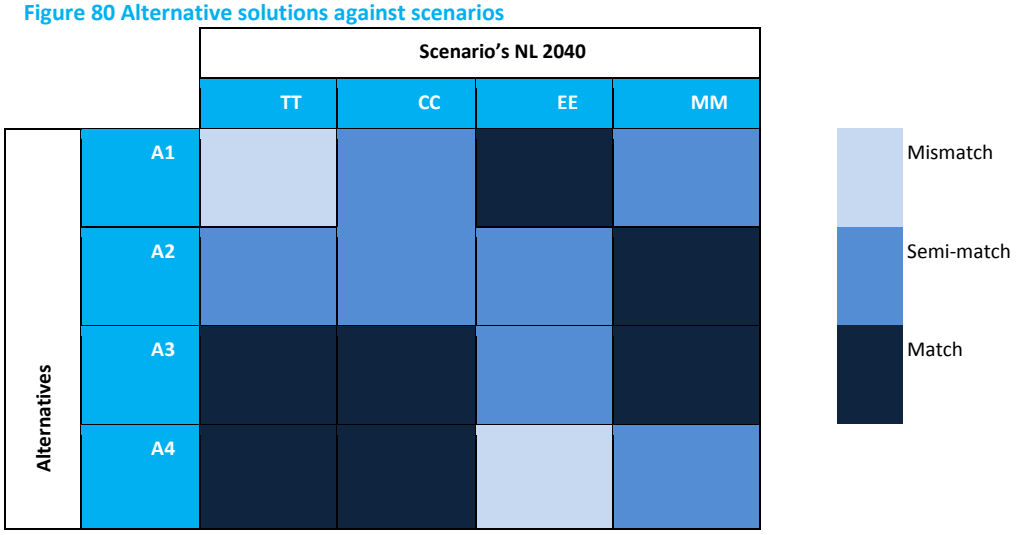
Consequences in four scenarios of the Netherlands

Alternative 3 holds best in all four scenarios. Alternative 4 will not work in MM. Therefore, Alternative 3 has been selected as solution. No matter what scenario will come out, the flexibility of Alternative 3 allows a match to the demand. Depending on the size, goals and objectives of an organisation, there are four possible alternative solutions provided to match the future demand. The differences between the three solutions are whether or not the organisation allows their workforce to work from third place offices and if so, whether or not the third place office is under the responsibility of the organisation itself or that the it is paid for, for example via membership, to third parties who provide third work places as a service.

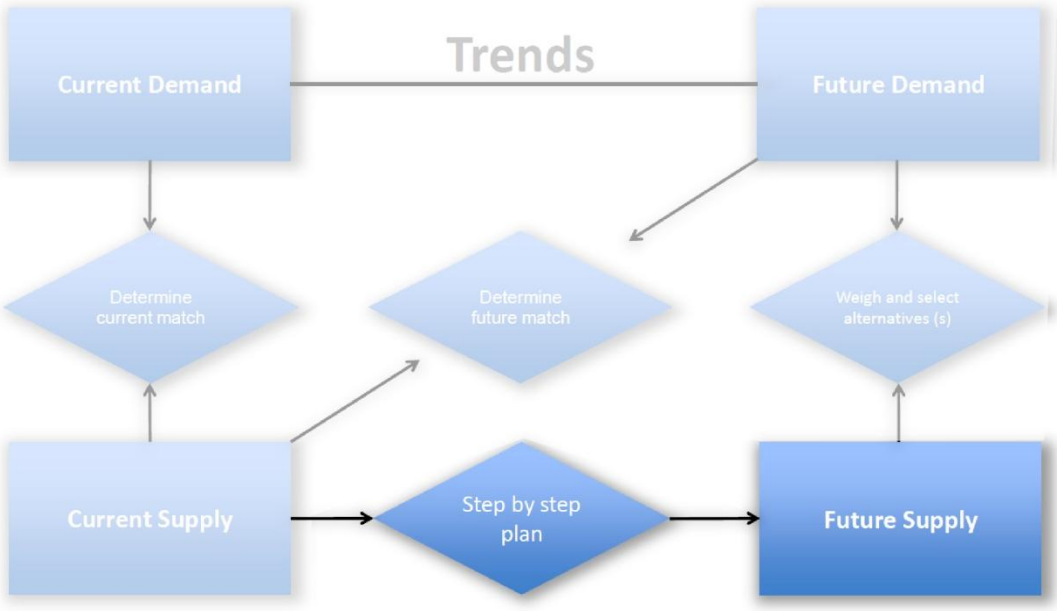
Figure 80 illustrates the matching of each alternative solution in each of the four scenarios of the Netherlands 2040. Considering the most matches in with the four scenarios, alternative 3 performs best compared to Alternative 1, 2 and 4. Concerning this alternative, the organisation owns, lease or rents their own central office as the first place while providing the workforce a budget to acquire access to third place offices that are shared with other organisations. The second workplace is up to the workforce.

While the best solution is selected, the implementation of will be discussed in the next chapter.

Figure 80 Alternative solutions against scenarios



8. Step by step plan: First place, second place welcome third place



8.1 Introduction

The New Way of Working is already quite established and the interest is still increasing. With this increasing interest the following question frequently arises: where do you start? What is the best approach route? Do you start with the accommodation (bricks) and ICT (bits) or take the behaviour of the people as a starting point? In this paragraph an overview is given of the main changes to a current office portfolio. There is no doubt that joined-up thinking between Human Resources (HR), Information Technology (IT) and Corporate Real Estate (CRE) functions within the organisation will drive cultural change. To understand how to make the transition towards the selected alterative (Owning, leasing or renting the first place office + access to third place office), the last sub question will be answered.

In this chapter the transition of the current supply to the future supply is specified in a step by step plan. This plan describes the main changes to the portfolio and to the different buildings (places). Also a time schedule has been created for the different steps, which is based on the adoption rate of the most influential ICT trends (i.e. cloud computing and BYOD/CYOD).

Sub question 4

How can the selected solution be implemented?

This question will be answered by creating a step by step plan and time scheduled.

8.2 Towards 2040 in five steps

Chapter 7 clarified that the current supply does not match with the future demand as discussed in chapter 6. The current situation with assigned workplaces at assigned locations partly needs to be transformed into a situation in which knowledge workers are provided with access to different workplaces at different locations. According to the analysis of the different generations (i.e. Baby Boomers, X, Pragmatic generation, Y & Z) entering the work floor as described in paragraph 6.2 , it can be concluded that around the year 2020 the Baby Boomers have left the work floor while

Generation X starts to leave the work floor. In the mean while the 45 year younger generation Z will enter the work floor. Generation Z will have another demand for ways of working, namely having the ability to choose their place to work (first, second or third place) and have freedom in technology (BYOD/CYOD) needed to get the job done.

Considering the 'War for talent', organisations need to respond to the generations demands as much as possible in order to maintain a competitive position. Therefor the real estate portfolios need to be adapted before generation Z joins the work floor in 2021. Depending on the size of the organisation, the current workforce (Baby Boomers, X, Pragmatic generation & Y) can continue to work the way they are accustomed. Those who can manage to change should be introduced to the transition to third place workplaces as a pilot. Of course, this depends on the duration of on-going lease contracts for first place offices.

The time schedule of the transition is based on the moment generation Z enters the work floor in 2021 and the most important trends will reach the plateau of the Hype Cycle which are mobile devices (<2014) in combination with BYOD/CYOD (2014-2017) and Cloud computing (2014-2017). This transition is needs to be prepared prior to execution. Therefore the transition is divided in two different phases with five steps in total.

- **Phase 1 2013-2020:** Preparation phase
- **Phase 2 2020-2025:** Execution phase

The preparation phase 2013-2020

An organisation should be prepared to change its accommodation strategy at any given time. In this phase each organisation can make a tailored business plan in which the organisation's goals and objectives are clarified and the needed workforce is analysed to achieve these goals and objectives. This phase also allows the opportunity to better prepare for Generation Z and the changes they will inspire. Partnering with universities allows to a better understanding of the specific demand of potential future employees for your business. This is not only for greater employment branding, but to recruit top talent. Partnering can be done by providing case studies to these students allowing for practical application and an arena for recruiting. This allows both parties to understand each other. Once their demand has been defined, the needed accommodation and facilities for the workforce need to be re-determined.

It must become clear what each worker costs in the current situation and what third workplace costs (e.g. rent, membership) per worker. Therefore data will be needed about the costs of running the office on a per-workplace basis (includes accommodation costs, facility costs etc.). The costs and environmental impacts of travel – both business travel and commute travel – should also be calculated. Costings will also be needed for investments in new ICT, any alterations to premises, and for training. A cost/benefit analysis must be made in which a financial comparison between the current situation and the future situation indicates the best solution.

After the result of the cost/benefit analysis has been obtained, a business plan can be put together. In this phase three steps (doing an inventory, evaluate findings and develop a strategic plan) need to be taken to obtain a complete preparation.

1. Inventory

Establish goals

A good portfolio management strategy starts with consensus on organizational goals and how real property can help achieve them. Beyond functional imperatives you should consider financial and interagency impacts, desired ownership position, level of risk, importance of timing and sustainability objectives

Analyse the portfolio

Once goals have been established, identify the strategic operating requirements necessary to meet those objectives. Also, inventory all facilities within the portfolio for:

- Size
- Ownership status
- Occupancy
- Density and utilisation ratio
- Unused space
- Mission criticality
- Energy efficiency and related energy mandates
- Executive Orders
- Key drivers of ICT and enablers of change.
- Other important factors affecting usage and cost

Many organisations, especially those with multiple sites throughout the country, discover that the findings differ from what was assumed.

2. Evaluate findings

After you have inventoried the facilities, compile a report so it is easy to evaluate your findings in context and identify opportunities.

This report should include:

- Defined strategic operating requirements
- Potential regulatory impacts
- Current portfolio management framework
- Identification of strategic operating properties and non-essential properties or parcels
- Opportunities for operational improvement and/or financial gain

3. Develop a strategic plan

Armed with this information, real estate leaders can then develop a comprehensive, strategic plan for both essential and non-essential properties with defined steps for achieving organizational goals. An effective strategic plan should include:

- Defined stakeholder roles and responsibilities
- Metrics for measuring success and how results will be communicated
- Information technology gaps and needed upgrades
- Cost for executing the overall plan
- New approach to commuting and mobility, and the adoption of polycentric thinking

Align technology to the real estate strategy and introduce the appropriate tools for new work styles. Review workplace strategy and introduce activity based working and mobility. Create an aspirational vision for new work styles. Understand demographics and profile the workforce to identify the needs of different groups by age, job function and psychometric analysis. Engage with the workforce to develop opportunities for change.

Execution phase 2014-2020

Once the preparation phase is finished organisations introduce change management to prepare people for new work styles. They can move from management by supervision to a results based approach. Champions can be identified for innovation and change. Once the workforce is prepared a pilot project can be started to already evaluate its success and make adjustments. The pilot consists of creating a pool with different kind of workers who will work at third place workplaces as much as possible for e predetermined time (e.g. They are allowed to come to the first place office when it is necessary (e.g. important meetings).

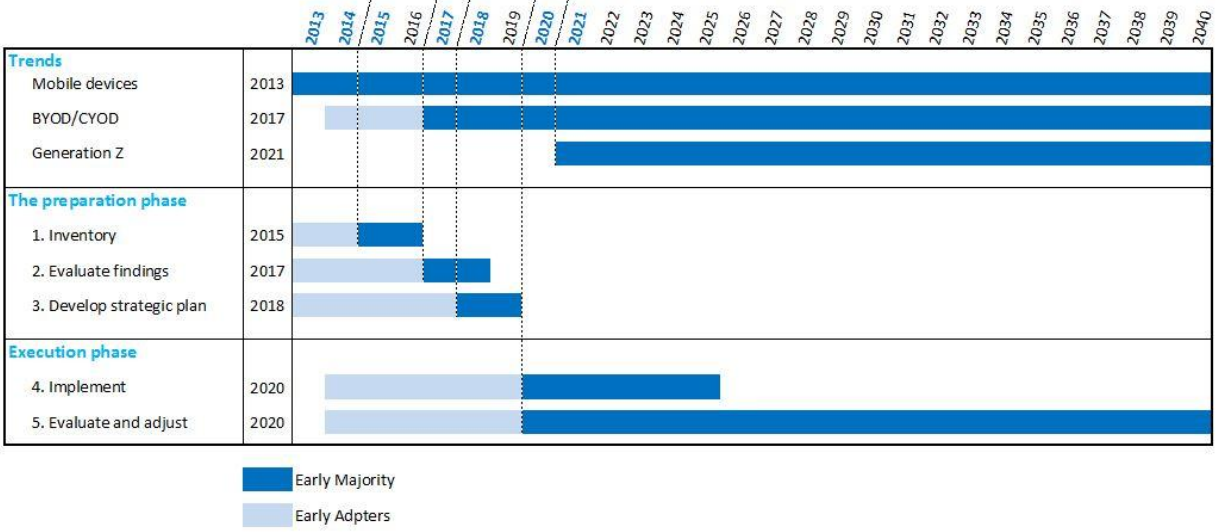
4. Implement 2020-2025

After having done a pilot project and adjustments have been done, the learned lessons can be applied and the third work places can be implemented.

5. Evaluate and adjust 2020-2040

After successfully implementing the third workplaces, the new situation must be constantly evaluated and adjusted.

Figure 81 Step by step time-line 2013-2040



Organisations with long lease contracts (beyond 2025) should make a business case to study the different possibilities while being stuck with a contract. First examination must be done on whether or not the contract should be terminated at an earlier time. If earlier termination is desired, several options must be analysed. An option can be to sub-lease the surplus space. Another option can be early termination of the contract. This might implicate a ransom as a penalty for not completing the agreed term. Organisations with property must weigh alternative solution, like selling the object or rent unneeded space. Vacant space can be transformed into workplaces for other workers from outside the organisation making it their third place office (third place).

Investors are looking for certainties when it comes to investing. For an investor, the mantra is ‘Location, location, location’, and preferably in combination with a unique object, investing in third place offices becomes attractive.

Designing the workplace of the future

An organisation’s ability to design and implement the workplace of the future hinges on how effectively it can restructure its cost profile, streamline business practices, interface with complementary in-flight initiatives, and more effectively utilise limited resources to manage the three pivotal components of the workplace: Workforce (people); Technology (audio-visual/data infrastructure and workplace management solutions), and Workspace (physical facilities).

Enabling the workplace of the future with virtual and mobile technologies will require an organisation to re-examine its real estate and workplace strategy with the objectives of improving space utilisation. By proliferating mobile technologies and migrating towards shared workspace environments, the workplace of the future will “de-link” physical space consumption from employee headcount. In other words, the addition of 100 new employees will not necessarily require 100 new workspaces. The primary goals of the initiative are three-fold:

1. to reduce (superfluous) real estate occupancy costs;
2. to improve employee productivity, retention, and commitment; and
3. to enhance customer relations and business continuity.

Key project activities included conducting an employee profile analysis to identify target user groups that would embrace AWS, as well as performing analysis on the company's global real estate portfolio to identify potential opportunities for cost savings.

A collaborative space brings together people and their ideas, which creates collisions, connection and catalysation. A co-working place is a space to create that leaves all the rules behind to provide the power of choice and the freedom to create to the users their fullest potential. How do you create a collaborative space? First, people and space need to be brought together. A space needs to be designed to respond to the needs of the community. This also creates a sense of ownership. Create a space that reflects the unique personality that gives the space an identity. Appendix 8 states critical success factors for designing and implementing the workplace of the future.

Location

In the early part of the 20th century, the workplace of the future shifted from a noisy, dirty factory to a spacious centralised room with desks lined up in orderly rows that would later become cubicles. In this century, the workplace is shifting again. But this time there is no uniform structure for where American workers will perform their job duties. It could be at the kitchen table, or perhaps a café, or at a cooperative space like 'The Hub', which started in London and is now on four continents and plays host to hundreds of ambitious entrepreneurs.

In the past, work was tied to a physical location. Now, it is not. Why? Information technology has turned the assumptions of where work should happen and the role of centralised office buildings inside out. Since documents and files are exchanged and monitored electronically, it is less essential for all of a company's workers to be located in the same place to get their jobs done. With high-speed Internet connections, laptops, PDAs, tablets and Software-as-a-Service (SaaS), people can now work as effectively when they're on the move as they can when sitting at their office desks.

This is the whole idea of the mobile and distributed workforce. There has been telecommuting for a really long time, but telecommuting has always been a very tethered experience. Virtual companies are more and more commonplace. Flexibility means boomers have to give up their philosophy of face time. Face time being, 'If you are not at work and I don't see you at work doing work, then you must not be working.' That is a big boomer belief. Boomers have to stop focusing on people's presence – meaning where they are – and focus on their outcomes, what they are achieving. As a result of this kind of flexibility, a number of things unfold that end up mutually benefiting the employee and the company. The worker can save time commuting, find a better balance between work and personal obligations, and generally be more productive.

How do the trends influence location choices? Mobility, work from anywhere, short/easy traveling to a desired workplace as close as possible. The best suited workplace for a certain or number of activities with the easiest access (time, accessibility (parking etc.)

First place offices and third place offices can best be located in central locations because of the liveliness and often good access by public transport. Formal locations are more suitable for first place offices because of the good accessibility by car and good parking. Despite of the good accessibility and parking at formal locations, for third place offices the location will lack liveliness which is one of the important factors for the target group. Other locations are well suitable for third place offices because of the scattered concentrations, which provide variety in choice and because they are located nearby residential areas or at the country side, which reduces commuting time. The diverse building types and amenities are attractive for third place workers.

In the future the different subjects will have different weighing due to different priorities per first and third place offices.

Figure 82 Changing location rankings

Theme	Subject	Weighing First place	Weighing Third place	Description
Location	Geography	>%9	<%9	
	Demography and economy	<%12	>%12	
	Infrastructure	>%13	>%13	
Quality	Facilities	%9	>%9	
	building quality	>%14	<%14	
	Image	>%10	<%10	
Market & policy	Size	%6	%6	
	User dynamics	<%10	>%10	
	Investor dynamics	<%12	>%12	
	Policy	%5	%5	
	Total	100%		

Workplaces

The technology-based workplaces will change the way that people interact with each other to accomplish core business objectives. It will require new skills to perform certain processes that are dependent on the new technologies. The workplaces will impact the organisational culture by promoting certain values and behavioural expectations such as collaboration, communication, distance management, trust, etc. In addition to the changes described above, the workplaces will require organisations to assess and revise existing processes, policies, and regulations that govern human resources, the use of workspace, and the use of technology. Employees and human resource departments will be key drivers of workforce demands, and need to be involved throughout the design and implementation process. The objective is to improve an organisation's ability to support different work groupings and agility to effectively respond to changing workforce trends and demands when necessary.

The workplace of the future equips the workforce with information just the way they need it. It will include a well-run desktop and introduces virtual desktops and virtual applications, enabling mobility and tablet technology. This is paired with unified communications and collaboration that securely enables business agility and workforce empowerment while remaining economically responsible. It changes the way employees, partners and customers engage. The use of smartphones and mobile tablets allows business to take advantage of a fully connected society and hundreds of thousands of mini applications for virtually every need. New businesses and products now become household names in the matter of weeks, not years. People are forming social crowds, exert networks and supply chain micro economies. Not just socially, but in our workplaces too.

The workplace is more attuned to personal talents and a comforting environment improves performance.

Traditional office spaces are not going to disappear. Face-to-face communication can sometimes speed up decision-making and information flow in ways that virtual work environments cannot. But the notion that mobility develops a more flexible work force better equipped to meet the needs of a changing economy is also here to stay. So, many companies are redesigning the enclosed office spaces that remain to be more flexible environments that provide a mix of open and closed areas for workers to use as needed. Benefits of these modern hybrid office spaces include more creativity, information sharing, teamwork and coordination.

According to Pieter van der Laan (interview March 8, 2013) students have a vision about how to work, but in most cases they are in search for their workplace in the office. They search a place in the organisation. Paul Somers (interview March 29, 2013) explained during his interview how Spaces approaches the design and implementation of third place offices (see appendix

Translating Corporate goals and culture into the workplaces.

The hardest part of workplace change is not the physical environment or technology, it is the people, their culturally conditioned attitudes about how they should be managed, how and when

they should work, and their attachments to the traditional, centralized workplace (or rather the values they associate with it). The key to success is to understand that people know best how, when and where to work. The best way to help them perform to their highest levels is to give them choices. However, it is important to make the space social:

- Social capital between co-creators is crucial for innovation to occur. It builds trust, especially important when teams are doing intense work. Open and relaxed areas for informal conversations are critical components for successful innovation spaces.
- Provide convenient access to food and beverages
- Provide comfortable lounge seating, café tables, and other furniture that invites mingling
- Locate casual collaboration areas in close proximity to work areas so it's easy to take a break, swap stories, etc.
- Provide welcoming areas for guests with appropriate views into the space and work in progress

Combine or connect the principle as much possible with the Users, Together they can collaborate with the designers who then again work closely with the specialist to get the best result satisfying the demand of the users. On-off implementation of workplaces, it is a constant monitoring process. For efficiency measure quantitative activities, when each workplace is used and by how many different users. There are several measurement tools to understand. For example, this can be done by sensors measuring seat occupation or simple analysis conducted by a group of people who do a check round several times a day. Employees can work individually in a quiet space or with colleagues in open, collaborative team areas or rooms. Combined with technological advances, teams can work together in the same physical location or virtually.

The way the workplace is evolving and how individual patterns of work are changing in an organisation is getting more important to understand and consider. This paragraph provides insight into the types of work activities that predominate within an organisation and therefore the workplaces that should be dedicated to different kinds of activities. Creative processes done by workers are becoming more important while paternalistic and routine work will be taken over by software. Increased creativity benefits the innovative capacity of an organisation, which can strengthen the competition position of companies. Stimulating creativity among workers will become a focus point in the work environment. Whether or not 'furnishing otherwise' of the work environment leads to more creativity and better innovation still is not clear. Indications are found that design aspects do have influences creativity (Vink, 2009b).

Creativity is promoted by an unusual and surprising place. More indirect effect on creativity is obtained in a domiciled environment more relaxed and comfortable compared to sterile environment. Also the esthetic quality of the space influences the state of mind.

Different studies show that physical work environments that are specially designed to stimulate cognition, contribute to creativity. But who knows best what is best for the workers? According to Veger (interview, 04 March 2013) workers are stuck in traditional structure and prefer doing things the way they have always done. To obtain creative thinking, these workers need to be taken out of their structure.

Effectively designing and implementing a new Workplace of Tomorrow should help improve an organisation's ability to respond to these changes in a cost-effective manner by enabling them to:

- Delink physical workspace consumption from headcount and in the process, improve workspace utilization and reduce fixed costs to operate and maintain physical workspace and facilities
- Align in-flight and planned technology investments with business demands and workforce patterns in a way that increases efficiencies and leverages economies of scale

To be successful, this initiative must focus on transforming “where and how” work gets done rather than “what” type of work gets done. The initiative also requires close coordination with the HR, Real Estate, and IT organisations to align workspace and technology solutions with workforce patterns. Changes in workforce demographics, the shrinking pool of skilled labour, and the increase in employee demands on workplace flexibility present a unique and urgent opportunity for organisations to develop innovative workplace solutions that can improve workspace utilization, improve the ROI of technology investments, and accommodate the employees at a significantly lower cost. Additionally, as organisations hire new employees at all levels, these employees can be introduced to a new, flexible, and mobile workplace that addresses the realities of today’s workforce in a cost-effective manner. YNNO provides different spaces for meetings:

1 Finding solutions

New ideas will really come to life as they are visualised. The ideal space for the third phase in a result-oriented meeting is the multimedia lab, which is a design space where solutions (project) plans and (housing) strategies are made. Standing consultation and the use of latest technology leads to surprising results. How about making a podcast[16] instead of a written report. By the colour yellow, which predominates in this space, participants are encouraged in their ideation and creativity. The ideas are further developed here and visualised.

2 Reflecting

To actually achieve a result out of the meeting it is good to occasionally take distance, to think about the ideas that have formed, to oversee the whole, to think about yourself, your behaviour or activity. This way, the plans are evaluated prior to taking decisions. The living room atmosphere/ambiance invites you to put your feet on the table, lean back in the couch, and to answer the question: 'are we on the right track? The area is also very suitable to evaluate. The space exudes tranquillity with its blue colour.

3 Making decisions.

Concrete agreements belong to result-oriented meetings. No decision, no result! Because this is the only way to actually get a sequel in the form of actions or plans out of a meeting.

In the middle of the room is a round table. As a result, members equivalent to each other. It is a formal setting, for example, board meetings, partner or consult multidisciplinary meetings. The decision is stimulated by the colour red in the interior.

4 Meetings

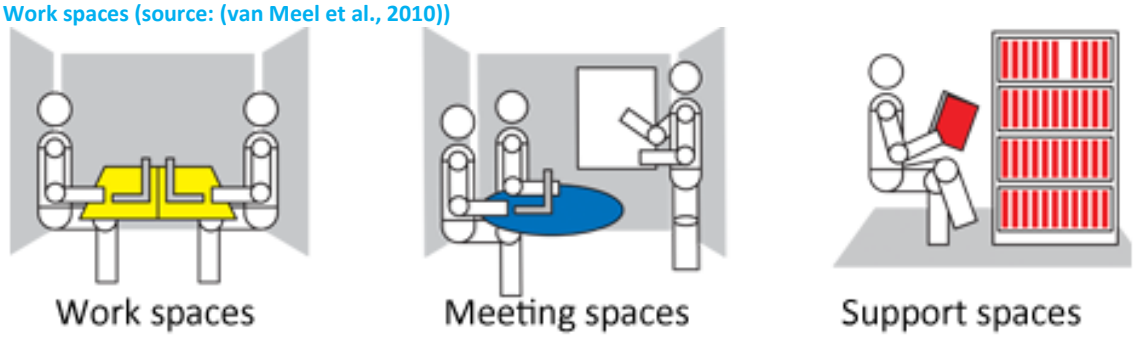
Varying types of meetings (more involvement with content). Round or oval table with chairs
Short and brain storming (solutions and expedient). High tables with bar stools or standing.

“The effects of meeting format (standing or sitting) on meeting length and the quality of group decision making were investigated by comparing meeting outcomes for 56 five-member groups that conducted meetings in a standing format with 55 five-member groups that conducted meetings in a seated format. Sit-down meetings were 34% longer than stand-up meetings, but they produced no better decisions than stand-up meetings. Significant differences were also obtained for satisfaction with the meeting and task information use during the meeting but not for synergy or commitment to the group’s decision. The findings were generally congruent with meeting-management recommendations in the time-management literature, although the lack of a significant difference for decision quality was contrary to theoretical expectations. This contrary finding may have been due to differences between the temporal context in which this study was conducted and those in which other time constraint research has been conducted, thereby revealing a potentially important

[16] A podcast is a type of digital media consisting of an episodic series of audio radio, video, PDF, or ePub files subscribed to and downloaded through web syndication or streamed online to a computer or mobile device.

contingency—temporal context." (Bluedorn et al., 1999). This paper provides valuable evidence with respect to the efficacy of stand-up meetings: they are significantly shorter than sit-down meetings, and the decisions taken in them are just as good. Their only downside in the experiment is that participants were less satisfied with the meeting than those in sit-down meetings. The authors warn: "…additional research is needed to determine whether the stand-up meeting can be used for longer meetings dealing with problems that vary in their structure." Based on the target group, offices should provide a combination of three types of workspaces (see Figure 83)

Figure 83 Work spaces (source: (van Meel et al., 2010))



8.3 Future supply: Bits, Bricks & Brains

Having analysed ICT trends, their influence on the future demand via the workforce, checking different solutions against the four different scenarios results in a future supply that organisations might need to provide freedom in ICT, grand access to the desired workplaces, in order to obtain and retain talented knowledge workers. In other words, the basis to have the complete combination of Bits, Bricks & Brains to achieve the organisations goals.

Future workplaces in an office

Colvin (2012) sets out the Future of Work by illustrating the composition of an office a few years from now, which can be seen as a result from all the important trends. As Colvin states: "The office a few years from now will in most ways physically resembles the office of today. People will still sit at desks and meet in conference rooms and get food from the cafeteria. There will be some new gadgets: more tablet computers, for example, and 3D printers capable of spot-manufacturing small three-dimensional objects. The big changes to the way we work will be in the gadgets they will be as powerful as mainframes, allowing workers to do heavy computing work, like product design, on the go. Tiny sensors will monitor your movements and, based on the departments you visit, recommend potential co-workers to meet and work with". Colvin assumes that even the office 10 years from now will not be much different. Most futurists predict the demise of a central office, replaced by telecommuters and contractors working from satellite locations. Colvin is sceptical: "If anything, the fast-paced global nature of business is going to call for more collaboration and face-to-face teamwork. And if we're wrong, we can all work remotely using our amped-up smartphones".

Peter Vink (2009a), a professor of Applied Ergonomics & Design at the TUDelft, published a book with many results: "Aangetoondeeffecten van het kantoorinterieur" (Proven effects of office interior). From the department of curious facts: white light increases alertness. At a temperature increase from 21 to 27 degrees centigrade productivity will lower by thirty per cent. Plants have a beneficial effect on creativity. (Note that the effect of a large plant is stronger than the effect of multiple plants and the plant can be kept in sight Even the projection of a plant makes all creative...)

Perhaps more important facts: informal meeting places to promote the exchange of information and thus the innovation (85 per cent of the conversations appear to be about work and not about soccer, the weather or the kids), and office employees prefer a 'combi office'. That means that the office offers a choice of different types of workstations, which are suitable for different types of work

(consulting, think, write, call, and brainstorming). Research among thousand employees of ICT service provider 'Logica' showed that the combined office scored particularly well compared to the previous situation, where everyone permanently was seated in an office landscape. The options had a positive influence on both communication and concentration.

Companies are often reluctant to apply new knowledge. TNO did experiments with four different setups for meeting rooms: square table, oval table, lounge sofa's, bar stools. It became clear that the arrangement with square tables, which is the most prevalent, is the least suitable. (Vink, 2009a): "If you then ask why a company cannot switch to another arrangement, you get the argument that it is convenient to displace the loose tables. How often do they move those tables? Well, anyway twice a year. That's not the real reason. The actual reason is a blockage in our heads: habit.

Design and Build the Workplace of Tomorrow Support Business Performance

An approach to designing and implementing a new work environment with the objective of reducing real estate costs, optimizing investments in modern technologies, and improving organisational flexibility and agility to respond to current and future workforce demands

The Workplace of Tomorrow: An Overview

The Workplace of Tomorrow (WPoT) is a modern work environment that supports an organisation's current and future business requirements and the realities of today's evolving workforce in a cost-effective manner. At the same time, the WPoT should demonstrate the flexibility and agility to evolve in response to changing demands. More specifically, the WPoT should:

- Improve overall employee productivity and mission performance by leveraging modern technologies to help address business demands and differences in generational expectations for the work environment
- Make effective in-flight and planned investments in technology by adopting a holistic approach to outfitting the modern worker, taking into consideration workforce patterns, enterprise-wide impacts on the supporting infrastructure, technology advances, and opportunities for efficiency/economies of scale
- Reduce costs to maintain the physical workplace by "delinking" space consumption from headcount. This can be achieved by enabling increased mobility and moving away from the concept of dedicated workspace as an entitlement
- Focus on creating a culture that encourages employees to work in shared workspace environments where physical workspace is always utilized and never empty
- Redirect resources from technology optimization and facilities cost reduction to improve core mission performance and fund innovation
- Support enterprise sustainability and compliance with legislative mandates by reducing the organisation's carbon footprint and enhancing "green" attributes of the workplace

The office of the future will implicate different activity based workplaces at different locations. A future office can be like the following (see also Appendix 13) :

Figure 84 Office of the future

The office of the future will be a digital, data-driven place. For many workers the productivity gained by having a computer assistant tell you exactly whom you should team up with on your next project far outweighs the big-brother nature of how the software arrived at its conclusion. Most futurists predict the demise of a central office, replaced by telecommuters and contractors working from satellite locations around the world. The fast-paced global nature of business is going to call for more collaboration and face-to-face teamwork. Many companies are now working to define the systems, technology and processes for effective remote collaboration. These tools will not necessarily change work in the future, but it will change how work gets done. More "work product" will be recorded and stored; teleconferences will be instantly transcribed and the text saved, for example. Privacy experts say companies will have to give employees full control over their privacy. For instance, workers will need to grant permission to be recorded in a videoconference, for example, and they should be able to maintain their online computer through customized settings. The trend of fewer and fewer (human) workers producing more and more may reach the point where the work of a tiny fraction of us can produce all of the goods and services required by the population as a whole. When that happens we will either be forced to re-evaluate our basic assumptions regarding the traditional distribution of wealth.

Actually the above illustrate Future of Work by Colvin (2012) is a very close description of workplaces in the near future. However, the illustration focuses on different workplaces in one building. To be more precise, all workplaces seem to be placed on the same floor. It would be nice to have these floors in all buildings, but considering costs, types of workplaces can be grouped and spread among other third place office. More expensive workplace (e.g. telepresence and holographic facilities) could be grouped in central locations while less fancy workplaces can be placed at more different locations. This will tend to activity based offices providing a few activity specific workplaces.

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete".
-Buckminster Fuller-

8.4 Conclusion

In this chapter an overview is given of the main changes to a current office portfolio. There is no doubt that joined-up thinking between Human Resources (HR), Information Technology (IT) and Corporate Real Estate (CRE) functions within the organisation will drive cultural change. To

understand how to make the transition towards the selected alterative (Owning, leasing or renting the first place office + access to third place office), the last sub question will be answered.

Sub question 4

How can the selected solution be implemented?

Organisation do not need to take action immediately to match their Real Estate portfolio to the future demand. Approximately six to seven years are left to prepare and phase the transition to Alternative 3 and own, lease or rent First Place Office(s) and organize access to Third Place Offices provided an managed by third parties. Depending on the size of the organisation, the current workforce can be left working the way they are accustomed, but those who can manage change and those who prefer should be introduced to the transition to third place workplaces as a pilot. Of course this depends on the duration of on-going lease or rent contracts. Considering the technological trends (mobile devices (<2014) in combination with Bring/Choose Your Own Device (2014-2017) and Cloud computing (2014-2017) and generational changes (2021) a step by step plan has been created for 2013 till 2040. This step by step plan is divided over two phases (see Figure 81):

- **Phase 1 2013-2020:** Preparation phase
- **Phase 2 2020-2025:** Execution phase

In perpetration phase each organisation can make a tailored business plan where the organisation's goals, objectives are clarified and the needed workforce is analysed to achieve these goals and objectives. In this phase three steps (doing an inventory, evaluate findings and develop a strategic plan) need to be taken to obtain a complete preparation.

- **Phase 1 2013-2020:** Preparation phase

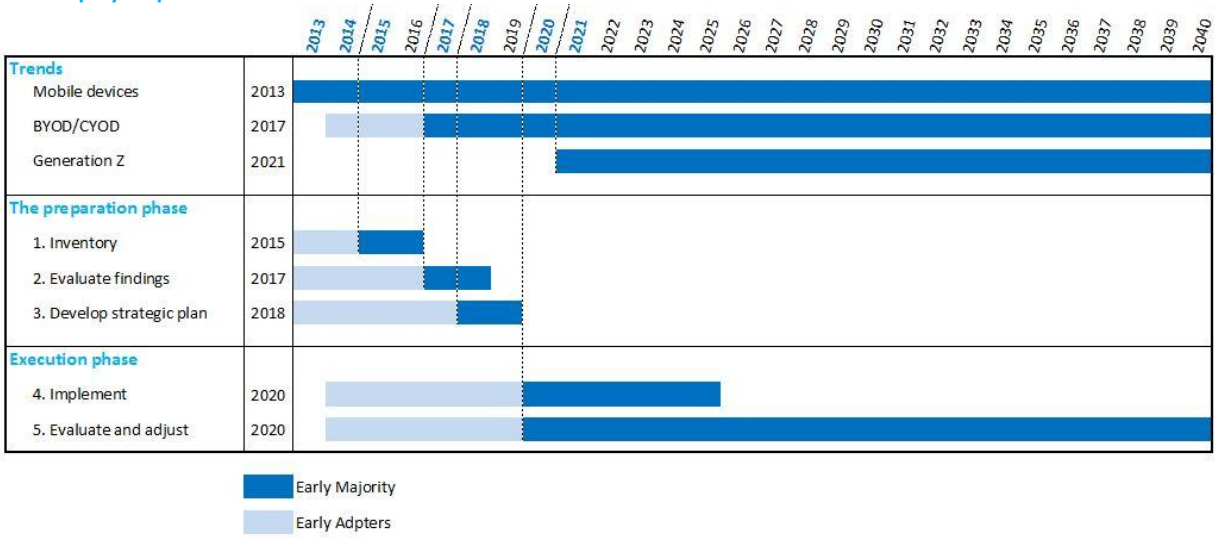
1. Inventory: Establish goals and analyze the portfolio
2. Evaluate findings
3. Develop a strategic plan

Once these three steps have been taken the execution phase can begin. In this phase the workforce needs to be prepared for change. Once the organization is 'ready' for the transition the last two steps can be made.

- **Phase 2 2020-2025:** Execution phase

4. Implement: run a pilot project around 2020-2025
5. Evaluate and adjust 2020-2040

Figure 85 Step by step time-line 2013-2040



Organisations with long lease contracts (beyond 2025) should make a business case to study the different possibilities while being stuck with a contract. Organisations with property must weigh alternative solution, like selling the object or rent unneeded space. Vacant space can be transformed into workplaces for other workers from outside the organisation making it their third place office (third place). Investors are looking for certainties when it comes to investing. For an investor, the mantra is 'Location, location, location', and preferably in combination with a unique object, investing in third place offices becomes attractive.

Designing the third place environment

An organisation's ability to design and implement the workplace of the future hinges on how effectively it can restructure its cost profile, streamline business practices, interface with complementary in-flight initiatives, and more effectively utilise limited resources to manage the three pivotal components of the workplace: Workforce (people); Technology (audio-visual/data infrastructure and workplace management solutions), and Workspace (physical facilities). By proliferating mobile technologies and migrating towards shared workspace environments, the workplace of the future will "de-link" physical space consumption from employee headcount. An organisation's ability to successfully implement the workplace of the future hinges on a number of key factors including: Cross-Functional Integration, Strong Stakeholder Engagement, Commitment to Invest in Mobile Technologies, Web 2.0 Tools and Workspace Management Solutions, Effective Workforce Analysis.

Location

In the past, work was tied to a physical location. Now, it is not. Why? Information technology has turned the assumptions of where work should happen and the role of centralised office buildings inside out. Since documents and files are exchanged and monitored electronically, it is less essential for all of a company's workers to be located in the same place to get their jobs done. With high-speed Internet connections, laptops, PDAs, tablets and Software-as-a-Service (SaaS), people can now work as effectively when they're on the move as they can when sitting at their office desks.

First place offices and third place offices can best be located in central locations because of the liveliness and often good access by public transport. Formal locations are more suitable for first place offices because of the good accessibility by car and good parking. Despite of the good accessibility and parking at formal locations, for third place offices the location will lack liveliness which is one of the important factors for the target group. Other locations are well suitable for third place offices because of the scattered concentrations, which provide variety in choice and because they are located nearby residential areas or at the country side, which reduces commuting time. The diverse building types and amenities are attractive for third place workers.

Workplaces

The workplace of the future equips the workforce with information just the way they need it. It will include a well-run desktop and introduces virtual desktops and virtual applications, enabling mobility and tablet technology. This is paired with unified communications and collaboration that securely enables business agility and workforce empowerment while remaining economically responsible. It changes the way employees, partners and customers engage. The use of smartphones and mobile tablets allows business to take advantage of a fully connected society and hundreds of thousands of mini applications for virtually every need. New businesses and products now become household names in the matter of weeks, not years. People are forming social crowds, exert networks and supply chain micro economies. Not just socially, but in our workplaces too.

The workplace is more attuned to personal talents and a comforting environment improves performance.

Traditional office spaces are not going to disappear. Face-to-face communication can sometimes speed up decision-making and information flow in ways that virtual work environments cannot. But the notion that mobility develops a more flexible work force better equipped to meet the needs of a changing economy is also here to stay. So, many companies are redesigning the enclosed office

spaces that remain to be more flexible environments that provide a mix of open and closed areas for workers to use as needed. Benefits of these modern hybrid office spaces include more creativity, information sharing, teamwork and coordination.

There are no universal solutions for creating high performing workplaces. Nothing goes without a plan, but not everything goes as planned. Organisations need to stay focused, question their selves and adjust. Each challenge needs to be met with an approach unique to your organisational needs, their culture, their market drivers. The overall organisation supports your best people by feeding them innovation and opportunities, and in turn, you expect high-performance. Nowadays, workplaces are there to connect people with information and other people. With an (interior) architect the workplaces should be designed with a new philosophy, paperless, transparent, connecting people and information and an inspiring theme. The physical workplace is far more than just furnishings and real estate; it is also about how people work and are managed, the technologies that enable the work, and how the organisation employs the workplace for its own ends. Going further, the workplace even reflects forces of the larger social and economic environment.

A workplace strategy is a clear statement of how an organisation will support the work being done by employees and contractors wherever and whenever it takes place. The specific activities within each of these four phases varies from organisation to organisation, depending on organisational capabilities, the current state of the workplace, and the ambitions of the executive sponsor.

9. Conclusion

9.1 The changing world of office work

Changes in offices due to ICT innovations started with the first office that originated with the (IT) invention of the printing press around 1450 that mainly took place at home. The office layout was influenced by the organisational culture based on Taylorism in the late 19th century. Gentleman clubs existed for the elite group to meet, exchange ideas, and share resources, which was not done in the office. The clubs were equipped in a way one could not afford solely. These changes influenced by technology and organisational culture can be seen in later periods as well but in other forms. Nowadays up to 2040, the workplaces might not change drastically. What is going to change is the access to activity based workplaces spread over different office buildings in different locations.

Technology nowadays is the backbone of all businesses. The 21st century belongs to the knowledge worker and the nature of work is changing. The idea is that work can be done anywhere at any time, without physically having to inside the central office. The 21st century for the knowledge worker is very team based. People need spaces to gather, to socialise, to network as well as to really to get to work done. Space must not be designed around a location for every employee. A space must be designed to accelerate work. Organisations really need to take a look at their operation, culture as well as the industry that they are to see which workplaces best fits their needs. Workplaces in the future are about taking that space that used to be personal private space and giving it over to more collaborative and public locations. Employees will not have an assigned work station where they come in to work, they find a space for what is appropriate for what they are doing for that moment. Individuals need to give up their "I" space so they have more "We" space. This way, people have a choice between a variety of workplaces.

9.2 Answering the research questions

What is the demand of office workers for corporate real estate portfolios in the Netherlands in the year 2040 as a result of current ICT trends and how can the supply be matched with this demand?

In the future there is no specific and constant demand. An attempt to define a demand in the future is doomed to fail. There will be different alternating demands for different workplaces, locations and ICT. The future demand for corporate real estate portfolios will be a continues alternating demand happening from task to task during a working day. Instead of a predetermined office portfolio that allows to be adapted at the end of a 5, 10 or more years lease contract or even longer term ownership, an alternative needs to be found to match the supply with the demand.

In this research, by using Gartners Hype Cycle and in-depth interviews, the current ICT trends have been studied that have influence on the activities knowledge workers perform. Therefore the first sub question will be answered.

What are the current trends in ICT that influence the future demand for corporate real estate portfolios in the Netherlands?

The current ICT trends derived from literature and the in-depth interviews are summarised in Table 25. The most important trends are Media tablets (mobile devises), Cloud computing and BYOD, because these allow office workers to be more mobile by having the ability to access and process information from any location where there is internet available. In combination, mobile devices with access to the 'Cloud' and having the opportunity to Bring Your Own Device and Choose Your Own Device gives workers the choice of working anywhere and at any time. The other selected trends must not be underestimated. They contribute to a more seamless control of ICT and mobilisation of

workers. Dividing the trends allows to focus on ways and means workers perform their primary activities in workplaces separately form the time and place where the activities take place.

Table 25 Theoretical and Empirical ICT trends

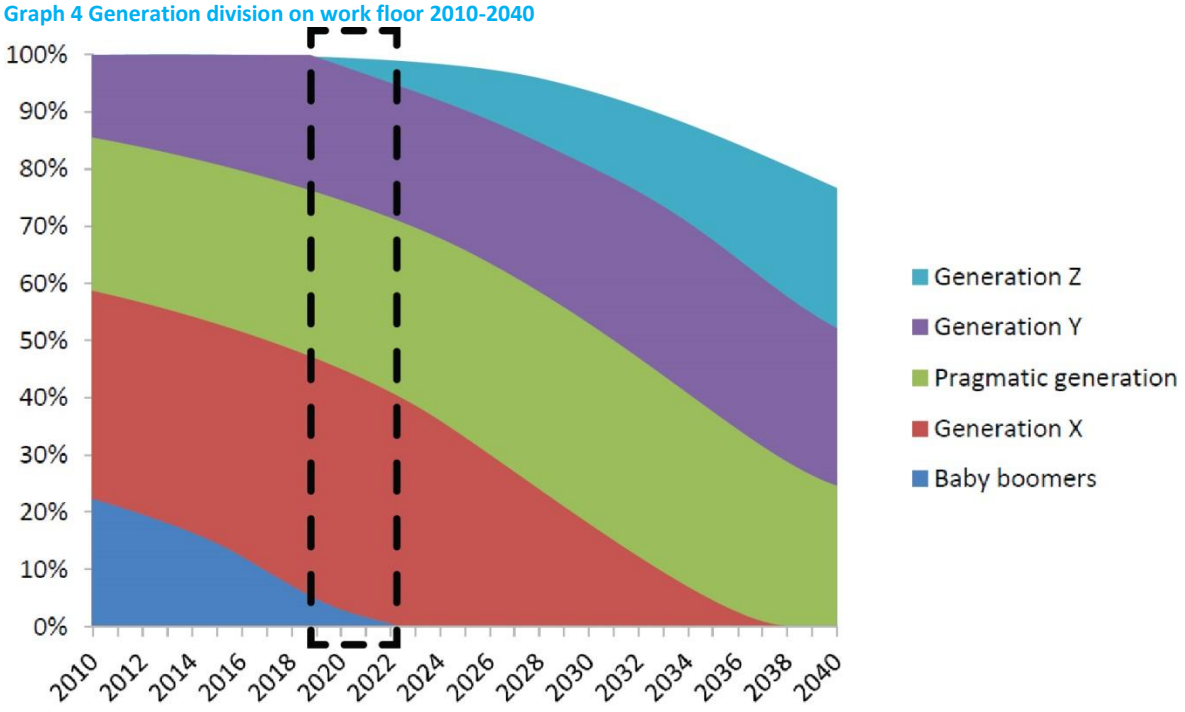
Trends		Control and input:	Mobilisation:
1	Speech Recognition		
2	Media Tablets		
3	Virtual Worlds		
4	Gesture Control		
5	Cloud Computing		
6	Augmented Reality		
7	BYOD (Bring Your Own Device)		
8	3D Printing		
9	Gamification		
10	Mobile Robots		
11	Autonomous Vehicles		
12	Volumetric and Holographic Displays		
13	Screens		
14	Software for routine work		
15	Crowdsourcing		

As can be concluded from this study, ICT in the coming decades allow the worker to work location independent using mobile devices with which all information can be accessed and processed as long there is an internet connection. Also does virtual communication allow workers to work remotely. ICT allows workers no necessity to physically meet colleagues or clients and work from the second workplace which is home. However, ICT trends do not form a future demand on their own. Innovations can provide far reaching possibilities, but this does not mean that the people (the soft factors) are willing go along with ICT innovation. Therefor the new work force has been analysed who are grown up with innovation after innovation.

To what future demand do current ICT trends lead?

The workforce divided in 'the professional' and 'the employee' in combination with different personalities forms a wide variety in demand for a work environment. Beside these differences, the flow of generations (Protest Generation, Generation X, Pragmatic Generation, Generation Y, Generation Z) over the coming decades bring significant change in the demand. A crucial period starts around 2022 when generation Y will join the workforce. Generations X and Y and the millennials do not look to be following in the baby boomers' footsteps. At this period the pragmatic generation will be in charge and they will and need to make some big changes.

Graph 4 Generation division on work floor 2010-2040



This diversity of the office workers who will be on the work floor for the coming decades has been discussed. Not does this diversity alone play a role in the demand for office use, but also the demographic changes will.

In the future, demand for accommodation will be decided by the knowledge worker. The slower working force growth results in scarcity of talented knowledge workers will end in a 'War for Talent'. In the competitive knowledge economy organisations must do what it takes to attract and retain talent to survive. For organisations this means satisfying the diversifying workforce with 'Choice' in place they desire to perform their activities while giving them 'Freedom' in using the device(s) they find best to do the job. Organisations must provide a portfolio in which knowledge workers can find a desired workplace that supports the activities done on a daily basis. They should be able to choose the most convenient workplace at the most convenient location at the most convenient time to perform their tasks. To understand the effects of this estimate future demand needs to be compared with the current supply. This brings us to the third sub question:

What is the best possible solution for corporations to obtain a real estate portfolio stays aligned with the future demand?

The current supply is focused on assigned places where employees of one organisation work during assigned hours. Never the less, some organisations have adopted the 'New Way of Working' which in fact still is working within an assigned building or portfolio but then at shared desks. Freedom of Place is limited to the first place offices and the second place office. It is mainly the contractual and organisational situation that mismatches the future demand.

The solution for this is offering a wide variety of different workplaces at different locations where the knowledge worker can choose from. Because the vast amount of different workplaces at different locations not all companies are either financially or organisationally able to lease or own such a portfolio. This can be accomplished by using third place offices that are shared with other users from outside the organisation. Four different strategies have been designed and tested against four scenarios of the Netherlands 2040:

- **Alternative 1: Owning the first place office**

- **Alternative 2: Owning the first and third place office**
- **Alternative 3: Owning the first place office + access to third place office**
- **Alternative 4: Access to third place office**

The difference between the three solutions is whether or not the organisation allows their workforce to work from third place offices and if so, whether or not the third place office is under the responsibility of the organisation itself or that the it is paid for, for example via membership, to third parties who provide third work places as a service.

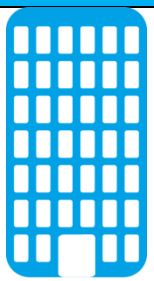
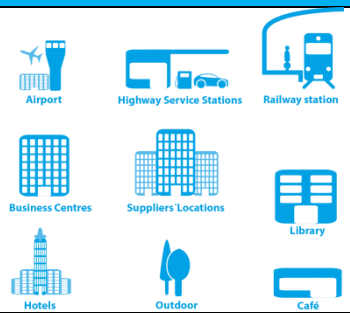
The four scenarios are:

- **Talent Towns**
- **Cosmopolitan Centres**
- **Egalitarian Ecologies**
- **Metropolitan Markets**

As a result, the third alternative 'Owning the first place office + access to third place office' is the most robust strategy in all four scenarios see Table 26. Off Corse, this strategy must be tailored per organisation, but this means that organisations should redefine their real estate portfolio to a reduced central office as the first place office and providing knowledge workers access to third place office of their desire. This allows the first place office to better fit a smaller selection of users. Because third place offices are paid for per worker and according to use, flexibility is added to the office portfolio.

Because of distraction and possible isolation at the second work place, the home office will be used for maximum of two day a week, while most time is spend at third place offices.

Table 26 Four alternative strategies

	First Place Office		Third Place Office		Second Place Office
					
	Contract type	**Responsibility**	**Contract type**	**Responsibility**	**Responsibility**
A1	Own, lease or rent	Organisation	-	-	Worker
A2	Own, lease or rent	Organisation	Own, lease or rent	Organisation	Worker
A3	**Own, lease or rent**	**Organisation**	**Membership**	**Third party**	**Worker**
A4	-	-	Membership	Third party	Worker

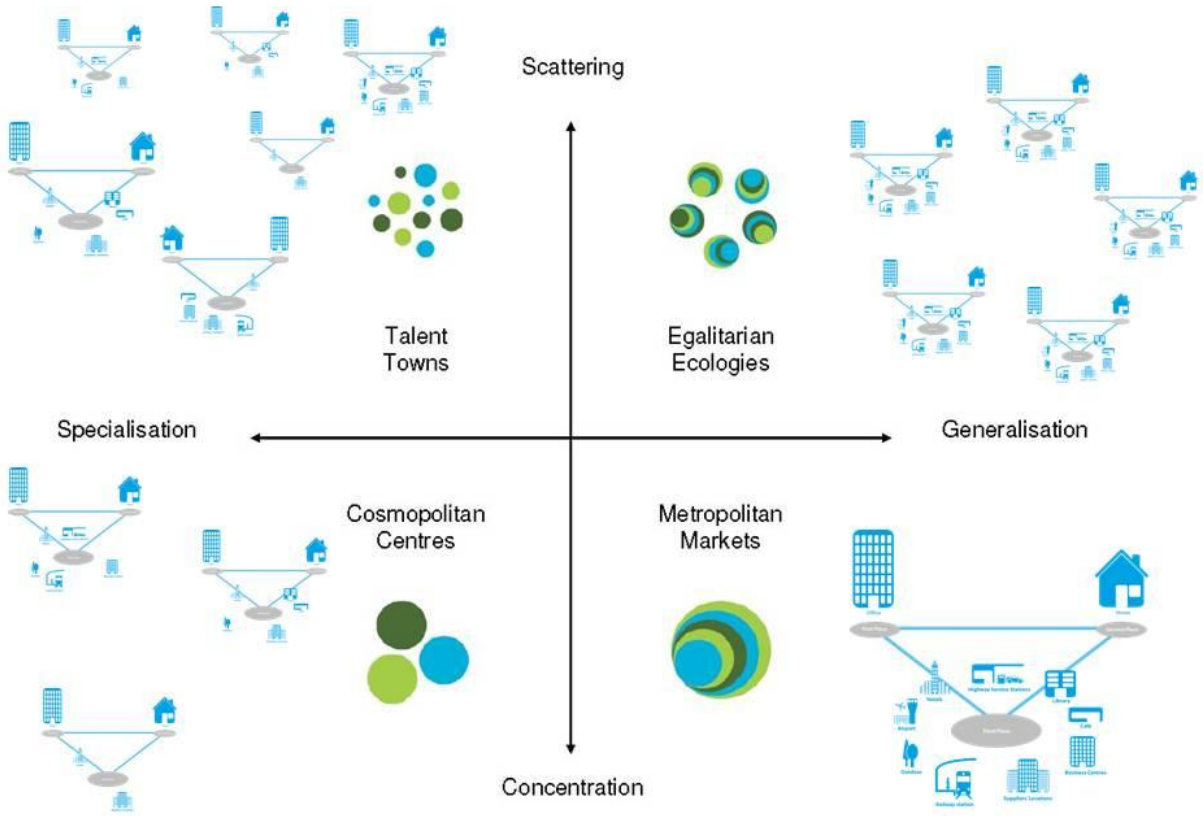
Taking the four scenarios in to account, the way first and third place offices are spread can be seen in Figure 86. In talented towns, workplace portfolios are aligned to the demand per region with a certain talent and are scattered over the Netherlands. In egalitarian ecologies, complete portfolios with all kinds of workplaces need to be present in all different regions. In cosmopolitan centres, the portfolios are aligned to the specific demand of a region, like talent towns but will be more concentrated. In the last scenario, metropolitan markets, over the Netherlands or even over the whole world, users should have access to all kinds of workplaces.

First place offices and third place offices can best be located in central locations because of the liveliness and often good access by public transport. Formal locations are more suitable for first place

offices because of the good accessibility by car and good parking. Third place offices will lack the liveliness which is one of the important factors for the target group. Other locations are well suitable for third place offices because of the scattered concentrations, located nearby residential areas or at the country side. The diverse building types and amenities are attractive for third place workers.

Despite the demand of office users, companies rely on economic changes. These economic changes are studied by using four futures of the Netherlands in 2040.

Figure 86 Workplaces in four scenarios



While the workplaces at the first place office will be more based on the individual office worker, Workplaces at the third place office need to be activity based workplaces to provide a best fit for the task.

How can the selected solution be implemented?

Alternative 3 can be implemented via a step by step plan in four phases, namely the preparation phase, the pilot phase, the implementation phase and the continuous phase where the implementation is evaluated and adjusted to obtain a constant match between the workers' demands and the facilities they have access to. Creating third place offices can be done by co-creation with users, experts and owners. According to the target group, activity based workplaces can be selected from three types of spaces, namely works spaces, meeting spaces and support spaces.

Organisation do not need to take action immediately to match their Real Estate portfolio to the future demand. Approximately six to seven years are left to prepare and phase the transition to Alternative 3 and own, lease or rent First Place Office(s) and organize access to Third Place Offices

provided an managed by third parties. Depending on the size of the organisation, the current workforce can be left working the way they are accustomed, but those who can manage change and those who prefer should be introduced to the transition to third place workplaces as a pilot. Of course this depends on the duration of on-going lease or rent contracts. Considering the technological trends (mobile devices (<2014) in combination with Bring/Choose Your Own Device (2014-2017) and Cloud computing (2014-2017) and generational changes (2021) a step by step plan has been created for 2013 till 2040. This step by step plan is divided over two phases (see Figure 87):

- **Phase 1 2013-2020:** Preparation phase
- **Phase 2 2020-2025:** Execution phase

In perpetration phase each organisation can make a tailored business plan where the organisation's goals, objectives are clarified and the needed workforce is analysed to achieve these goals and objectives. In this phase three steps (doing an inventory, evaluate findings and develop a strategic plan) need to be taken to obtain a complete preparation.

- **Phase 1 2013-2020:** Preparation phase

1. ***Inventory:*** *Establish goals and analyze the portfolio*
2. ***Evaluate findings***
3. ***Develop a strategic plan***

Once these three steps have been taken the execution phase can begin. In this phase the workforce needs to be prepared for change. Once the organization is 'ready' for the transition the last two steps can be made.

- **Phase 2 2020-2025:** Execution phase

4. ***Implement: run a pilot project around 2020-2025***
5. ***Evaluate and adjust 2020-2040***

Figure 87 Step by step time-line 2013-2040

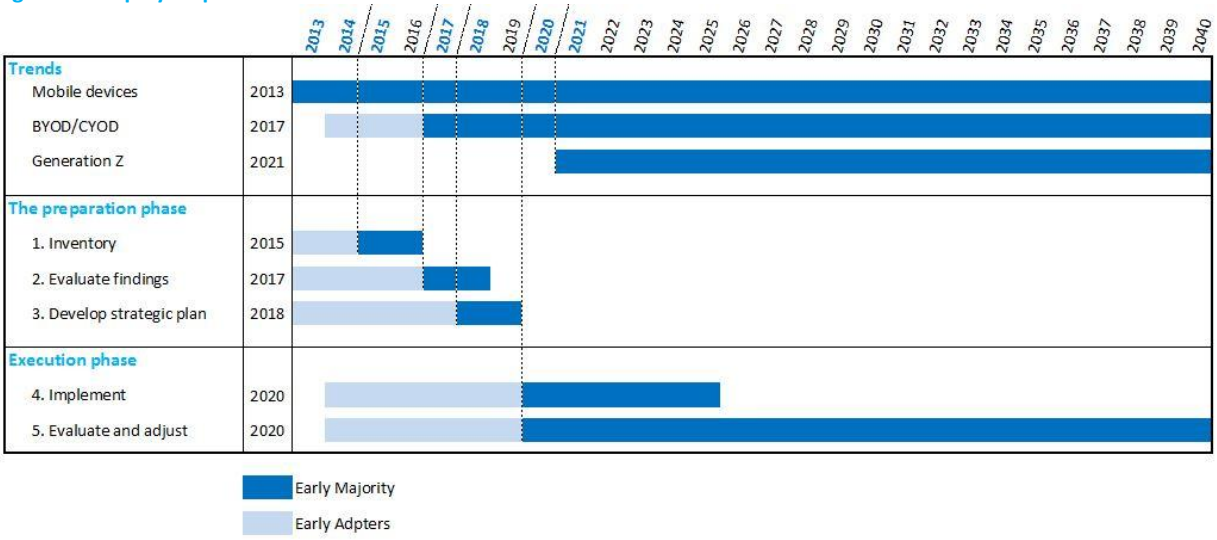
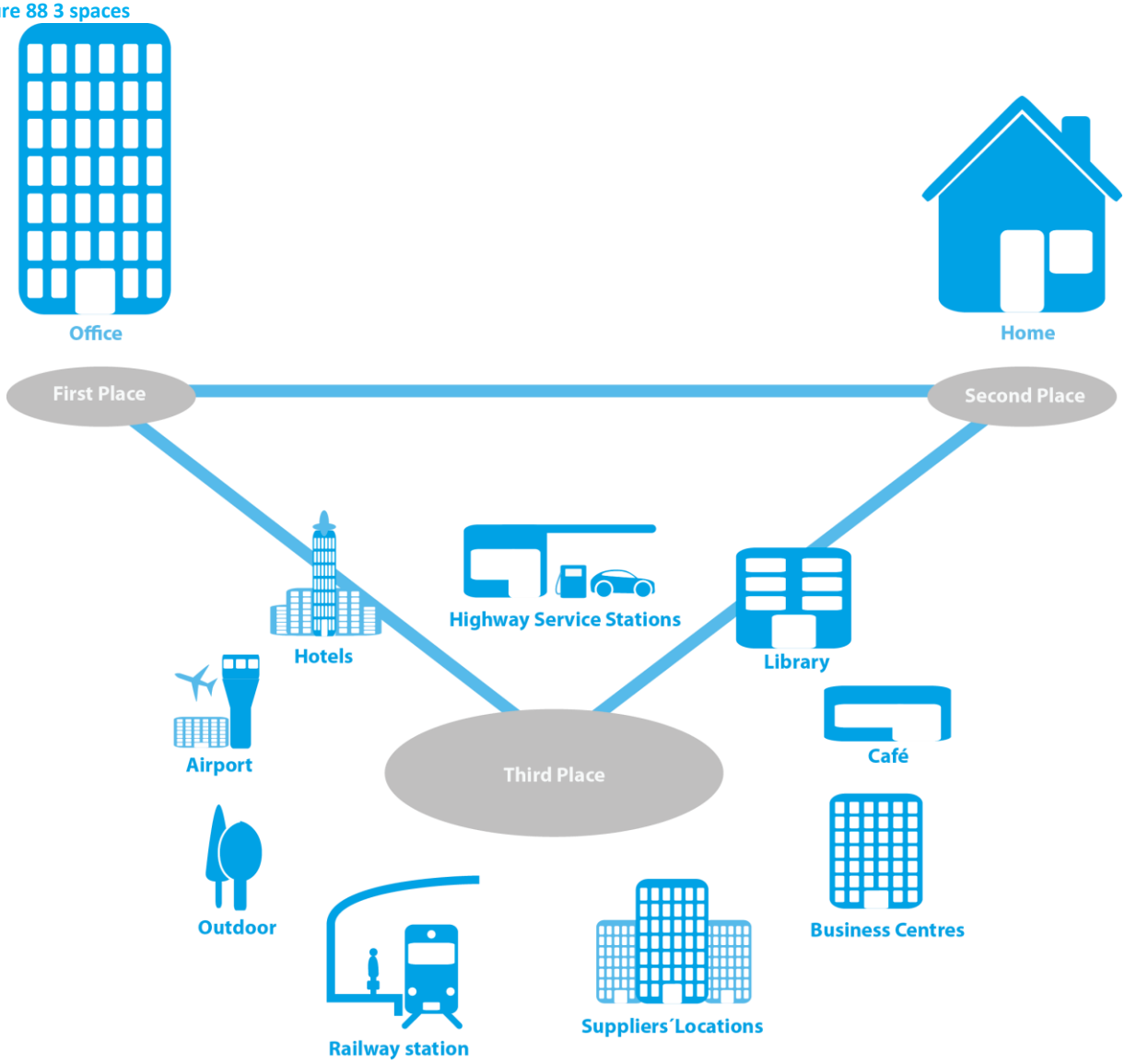


Figure 88 3 spaces

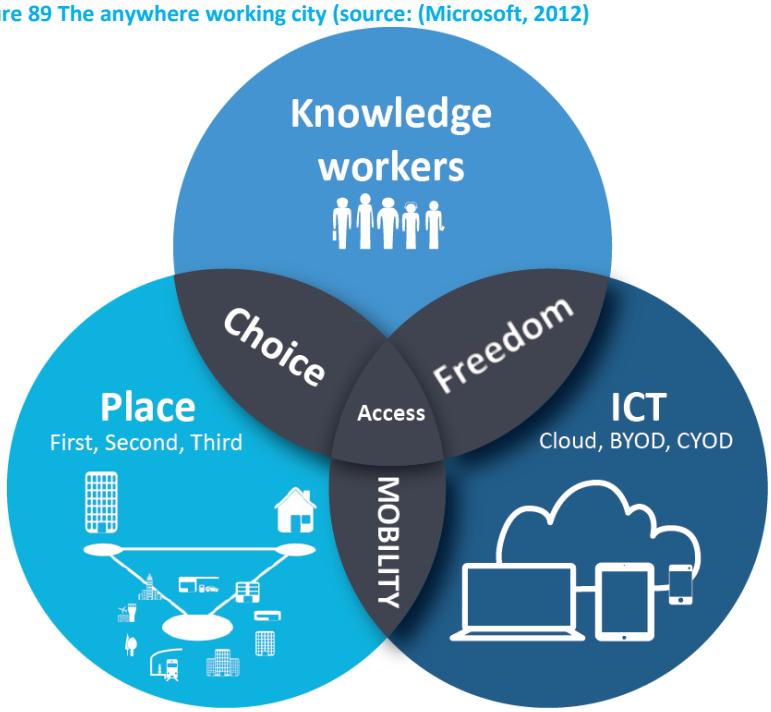


Answering the main research question.

What is the demand of office workers for corporate real estate portfolios in the Netherlands in the year 2040 as a result of current ICT trends and how can the supply be matched with this demand?

The future demand of office workers for corporate real estate portfolios in the Netherlands between 2020 and 2040 will be to have the ability to have a choice in the place to work and the freedom in technology to get the job done (see Figure 89). To match this demand, the supply must be on-demand, in other words, knowledge workers must have access to different activity based workplaces at different locations and time. In combination with a comforting and inspiring environment, continues productivity and innovation will be at its max.

Figure 89 The anywhere working city (source: (Microsoft, 2012)



Pitfalls

To cope with diversity and flexibility of companies, a variety of workplaces at different location (central district, on-route and near neighbourhoods). In short, near to people's homes and near or in transportation means. Reducing the use of Central offices on a daily basis makes accessibility to the office location less important while giving more importance to the quality of the location surroundings. Third place office need bee well accessible and on portfolio level need to provide a variety of workplaces facilitating all different activities. Activity-based workplace on portfolio level. Preferably one office building with all facilities, second different building next to each other providing activity based workplaces.

Instead of companies having a tailor made office portfolio, companies need to have access to a variety of workplaces spread around the country and for international companies even in other countries. Workers will become more self-sustaining considering project based contracts.

Many times third workplaces are developed in existing structures. Implemented in existing buildings at existing locations. Mostly due to the fact that space is not leased. Third workplaces should be planned on beforehand rather than a space filling solution afterwards. A program of requirements needs to be made independently from the supply. First we need to know what we need then how and where.

Context of ICT support for place independent working

ICT develops faster than real estate portfolios developed. So there is a problem between shifting from the fast ICT developments on the one hand and the slower office developments on the other hand. Another problem is that organisations cannot shift very fast and adapt as fast to the latest ICT. However, there can be concluded that this will demand a different approach organizing workplaces and thus also requires different management and competences. Another problem is that will exist for many years to come. Flexibility is needed to be able to shift between the online world and the offline world.

Management of workers and workplaces outside the central workplace.

Self-management, freedom in ICT and choice in workplaces. The management of organisations lack believe for ICT to bring added value to their activities, because they are often stuck in old traditions.

The management of organisations whether or not under the direction of the head of the department or chief executive and others alike want to have profitable Return On Investments. They have to see the necessity for keeping up to date with ICT and ways of working. The management of organisations after all determine how much resources can be made available. In addition they also determine the direction or course the organisation has to follow, thereby directly and indirectly influencing the course of communicating and use of workplaces. The cases show that the management of organisations and the teams that want to setup manage and maintain the Social Media initiative can substantially differ in their opinion. And in some cases the management fills in both roles.

The task of the management of organisations is, and will always be the case regarding Social Media, to steer on the broad lines. Involvement of the management of organisations is strongly recommended and desirable. However, it is the team that will have to do all the work and give account to the management of the organisation. The latter can judge on the broad lines whether the initiative is still on the planned course and is relevant. Problems and chances that are seen should be communicated with the management of organisations after which there can be decided which path is to be taken. In reality there is expected that the larger part of this process will still lay with the Social Media team. The management of organisation shall only be consulted when it concerns chances and problems of large extent.

9.3 Recommendations for further research

There are two main recommendations for further research which build directly upon this thesis. Because the missing link between ICT trends and Corporate Real Este, this research has been done with an exploratory setting. Knowledge has been gained how to monitor ICT Trends and how they influence future demand. With this future demand several solutions can be designed and tested that end up in a quite general statement about what organisations must do to survive the future business environment. What can be recommended for further research is the creation of a practical tool that guides organisations to collect relevant data and generate a tailored plant to adjust the real estate portfolio. The DAS-Frame can be used as the basic framework, while input and output generators need to be designed. Important is that crucial questions are asked to generate a thorough analysis of the organisation.

10.Reflection on the research process

Overall I believe that the chosen research method has resulted in valuable insights. This research has not been a linear set-up of consecutive research steps, but rather a constant reflection and iteration between both theoretical and empirical research. While this means that one has to deal with a greater level of complexity this also simplifies the identification of patterns and relations, which I believe may be less apparent in a clear separation of theory and empirical research. In addition this thesis had set out to provide a framework which provide guidance for practitioners. In practice, processes and interactions are not as neat as we tend to make them in academics; instead a process is simultaneously exposed to multiple influences. In this sense I believe the chosen research set-up may have resulted in conclusions which are in consensus to the complexity also found in practice.

This research builds on qualitative methods, nonetheless of the specific approaches used provide solely opinion based results. While in the case studies use was made of in-depth interviews. While such methods are necessary for both “multiple critical factors” (Groat and Wang, 2002) and “the meaning of actions” (Miles and Huberman, 1994) to be understood, results will always be based on a collection of opinions. Although these insights have been triangulated against preceding literature study and documents research, there has to be awareness for response bias and thus possible limitations to the truth-value of results. As such, results should not be generalised beyond what they are: the triangulated opinions of a selected group of individuals.

There also has to be critical awareness for the possibility of researcher bias. While the attempt has been to remain as objective as possible with the analysis of results, the same has been conducted by only one researcher. The chances of bias could have been minimised by having two or more researchers analyse the interviews independently to identify mentioned factors. The final list would have then been made on the basis of the comparison of lists. However, given the limited resources, this research being a master thesis, this option could not be realised. As a consequence the aim has however been to make the analysis as transparent as possible and checking the interpretation of results through member checks with the interviewees.

At the beginning of the research a common misunderstanding that many people make has been made by me as well. In quantitative as well as qualitative analysis, in a vain effort to remain "perfectly objective," is to present a large volume of unassimilated and uncategorised data for the reader's consumption. The analyst, the author of this thesis, decides which data are to be singled out for description according to principles of selectivity. This usually involves some combination of deductive and inductive analysis. While initial categorisations are shaped by pre-established study questions, the qualitative analyst should remain open to inducing new meanings from the data available. Data reduction should be guided primarily by the need to address the salient evaluation questions. This selective winnowing is difficult, both because qualitative data can be very rich, and because the person who analyses the data also often played a direct, personal role in collecting them. The words that make up qualitative analysis represent real people, places, and events far more concretely than the numbers in quantitative data sets, a reality that can make cutting any of it quite painful. But the acid test has to be the relevance of the particular data for answering particular questions.

Epilogue

Predictions about the future of offices are often wrong. Office concepts have a life cycle of their own: they emerge, they become popular, and then they are replaced by other ideas – a pattern similar to that of management theory. Just remember what people have been saying over the past dozen years or so about the prospects of the office. When, for example, e-mail was invented, people predicted the advent of the paperless office. But since the invention of email the use of paper has

tripled. Another illustrative example of the coming and going of concepts is the office landscape. In the 1960s, this concept was hailed as the perfect solution. To promote it, exactly the same arguments were used as today: organisations had to deal with an ever changing world, organisational structures were becoming 'flatter' and information technology would radically alter our worldview. Yet, ten years later the initial euphoria about the office landscape had vanished as the concept became associated with employee complaints and the Sick Building Syndrome.

The difficulty with assessing new concepts is a lack of knowledge. Innovative projects get a lot of media exposure, but this exposure hardly results in real information. Clients and designers seem willing to accept new concepts as much for their novelty, aesthetics (glamorous packaging) and prestige (the glitter of the designer or organisation involved) as for the real reasons (does it actually do the job?). In the end, however, success depends on the way the concept affects employee performance.

And, the only real way to found this out (on time) is to evaluate ideas in reality. These evaluations should focus on the human factor. Fashion may be fun for architects and consultants, but it is deadly for users. They are the ones who spend their lives in offices and have to be productive. Therefore, we should pay close attention to how technology affects human behaviour. When we want to say something sensible about future offices we should look at tomorrow's employees: kids growing up on the virtual playground. How will they respond to new office concepts? Some clues can already be found by looking at today's geeks, nerds, and whizzkids. These groups prove, for example, to be much better in multitasking than we are. Reading a book can be a hard for them, but listening to music, surfing on the web and watching television at the same time is not much of problem. This is likely to affect their perception of visual and acoustical privacy. Likewise they tend to be much better in electronic communication. To them 'chatting' on the Internet is not a novelty, but natural. From that perspective, they are much more likely to feel at ease with the concept of teleworking and virtual offices than older employees.

On the other hand it is not very likely that deeply rooted human needs such as the need for social interaction, trust, status and privacy will disappear because of the advent of the Internet. Humans are born with a toolkit at least 15,000 years old. We are equipped with bodies and brains evolved for hunting, gathering, and gratuitous violence. Not for information-age tasks such as sitting behind desks, staring at screens and clicking a mouse. This idea is supported by the fact that, for example, more than 50% of the Dutch office population has computer-related health problems with their eyes, back, wrists and so on. In office design we should take such issues into account. For future offices, we should find a balance between deeply rooted human needs and new technologies. In other words: we must create an office in which the mammoth hunter goes virtual.

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http://www.cisco.com/web/strategy/trec/index.html (April 4, 2012)
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Workplace Innovations and Employee Outcomes: Evidence from Finland
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http://www.corenetglobal.org/ (March 1, 2012)

Microsoft Corporation
http://www.microsoft.com/en/us/sitemap.aspx (April 5 2012)

Cisco
http://www.cisco.com/en/US/products/index.html (April 5 2012)
http://www.cisco.com/en/US/netsol/ns1120/index.html (June 5 2012)

Appendix 1 Four groups of office work activities

Source: The office: Procedures and technology (Oliverio et al., 2006)

Word Processing

Communicating information effectively is important in all types of organisations. Much information is communicated using written documents. Word processing is the producing of written documents such as letters or reports by using software programs and computers. Usually these documents are shared in printed form. Increasingly, however, written documents are shared and read online. Electronic mail messages, for example, are often used to communicate within a company. Some word processing programs allow the user to save documents in HTML format. These documents can be posted on the company intranet, for example, and viewed in browser software. Desktop publishing is closely related to word processing and requires many of the same skills.

Desktop publishing is the producing of documents that include both text and graphics. Examples of these documents include newsletters, brochures, and forms. Basic desktop publishing can be done using word processing software such as Microsoft Word. Desktop publishing software programs, such as Adobe PageMaker, are used for advanced desktop publishing.

Basic Competencies

The proper and efficient use of a personal computer in composing, revising, and preparing many types of documents is the goal of skill development in this category. The essential skills include:

- Keyboarding with speed and accuracy
- Knowledge and skill in use of software programs
- Skill in formatting and proofreading documents
- A large vocabulary
- Proficiency with grammar, punctuation, and spelling
- Ability to learn special vocabularies
- Ability to follow instructions
- Skill in preparing copy from audio recordings, if employed as a
- Transcriptionist
- Skill in dictating text and commands if using speech recognition software

Workers Who Need These Competencies

Word processing skills are needed by many workers. Executives and managers, both general and technical, spend much time composing written communications. Technical personnel, such as engineers, advertising designers, architects, and public relations specialists, are employees likely to use word processing and basic desktop publishing skills in their work.

Data Processing

Data processing is the collecting, organising, analysing, and summarising of data, generally in numeric form. Many positions require competency in such skills. This type of activity is usually done at a computer, using spread sheet and statistical software programs. Though we think of data processing as primarily dealing with numerical data and word processing as dealing with text, the two processes often blend with one another. This blending process is made easier by the integration capabilities of software programs. Data processing and word processing are often collectively referred to as information processing. Many workers do this type of office activity.

Basic Competencies

Among the skills important for workers who handle data processing activities are the following:

- Proficiency with spread sheet, database, and related software programs
- Knowledge of arithmetic processes and statistical methods

- Ability to be consistently accurate
- Knowledge of methods of organising and analysing data
- Ability to interpret data
- Ability to prepare reports that communicate information in a meaningful way
- Ability to maintain an organized workstation

Workers Who Need These Competencies

Accountants, budget analysts, brokers, insurance salespersons, and many other types of personnel found in all kinds of organisations deal with data and prepare reports. As new software programs make processing data faster and easier, these workers must continually learn to use new programs and methods in their work.

Information Management and Transmission

Information management refers to the organising, maintaining, and accessing of data. Transmission refers to the communicating of information both within and outside the organisation.

Basic Competencies

The skills considered basic in this category include considerable variety:

- Identification of information needed in the situation
- Ability to maintain or develop an information system
- Ability to give attention to details
- Ability to use established procedures
- Knowledge of records management principles and basic filing rules
- Good keyboarding skills
- Proficiency in working with databases
- Ability to meet deadlines and solve problems
- Ability to work with others

Workers Who Need These Skills

A wide range of workers is likely to need the skills for information management and transmission. Personnel such as buyers, real estate brokers, and property managers must have well-organized information systems. The details they need to make decisions often require them to design their own systems. Often their information must be available to others, too. Following a well-designed system is the key to easy use of information.

General Managing and Communicating

General managing and communicating are broad areas that involve handling work time and tasks efficiently and interacting with other employees and customers. Setting up schedules, meeting deadlines, and tracking the progress of tasks are aspects of general managing. Communicating with customers and co-workers is a common activity for many types of workers in a company. Reporting on the progress of tasks, projects, or budgets are also aspects of general managing. Often, these reports are given orally and delivered with the use of a multimedia presentation.

Basic Competencies

The skills and knowledge needed to handle the activities in this category are varied. In general, they include the ability to:

- Establish priorities
- Establish schedules and meet deadlines
- Work in teams
- Motivate others to complete work
- Use a personal computer and manage files

- Handle telephone calls effectively
- Give attention to several tasks at the same time
- Determine the time required for completion of tasks
- Communicate effectively both orally and in writing
- Interact with many types of people at all levels of an organisation or outside the organisation

Workers Who Need These Competencies

General management and communication skills are critical for a wide range of employees, from executives to salespeople to office support staff. Office employees must be good managers of their own time. In addition, they must be skilful in guiding the work of any employees who report to them. They must be able to establish priorities and follow schedules for the completion of tasks. They must communicate clearly and effectively to co-workers and customers.

Appendix 2 Flex Offices Concepts

A generic office concept is the flex-office concept. This real estate concept involves furnished workplaces that are rented per Hour/ half day / day / week. In the Netherlands there are a number of providers of this type of flexible workplaces. One of these providers is Regus, the largest provider. The offices are usually located along main roads and major infrastructure hubs such as airports and highways. Next to the equipped workstations, they offer, meeting rooms, IT facilities, secretarial support and reproduction facilities. An important criterion is the flexibility, in which the specific requirements of the users stand central. Regus is an international chain that focuses on full-service housing office organisations.

Business Facility Point's

Facilium develops Business Point Facility in the Netherlands. This form was first presented in 1997. They focus on the growing need for supporting services (park management) at the Dutch office and business terrains. Often the individual companies are not large enough to have all of these functions in-house. In the following municipalities these initiatives have found an entrée both to the government and to businesses: Arnhem, Apeldoorn, Heerenveen, Hoogeveen, Roosendaal, Zwolle and Deventer. Source: facilium.nl

Innovative office (combi office)

There can be spoken of an innovative office if the place where is being worked offer possibilities of teleworking (using ICT). The layout of the office is that of a combined office (presence of different activity-related workplaces). The workplaces are shared or flexible workplaces. Much can be varied with by the constituent parts: accommodation, organisation, work processes and ICT. Many assume that with innovative accommodation there is much profit to gain by saving on accommodation costs. However, the available studies do not provide a conclusive image to cheaper or more expensive. The idea does strongly live that innovative work has an effect on image: shorter lines of communication, more knowledge exchange and shorter turnaround for changes (Wagenberg et al., 2001).

Community Technology Centres (CTC's)

A generic office concept is the Community Technology Centres. In the 80s there are many of such centres in the United States, the United Kingdom and Scandinavia established. CTC's come in many forms, but typically is that ICT has a prominent place. Also, the different office concepts have in common that they are created to socially or economically bring the location in development. Access to the Internet and ICT-courses are standard services in these centres. The centres are primarily intended for use by the lower socioeconomic strata. In addition, self-employed, satellite offices of organisations and teleworkers are also welcome. These CTCs are located both in cities and in rural areas and are often subsidised several years to continue independently after this initial phase.

Office condominium, Phoenix (USA)

An example of an office concept from America is the "Office Condominium. These are units in an office or in a business premise which are sold to the user rather than leased. Just like with apartments, the common facilities are controlled by an association of owners. Two of the tree times it is a new building, the rest it is about renovation and re-developed office and business centres that turn out to be vacant for a long time. The real estate concept is interesting for a real estate developer because there is little risk with presale.

Non-organisation bound offices (neighbourhood offices)

work at this office is concept is unravelled in different types of tasks so they can be performed in different locations and thus in sustainable way (Limonard, 2005). Office workers no longer have to come daily to a central office to do their work. What is sufficient is an office within walking or cycling

distance of the house. At any time of the day, people can walk in here and teleworking. Such 'non-organisation bound office' is a collective workplace for people from the neighbourhood who perform their daily office work. Such offices are called ‘neighbourhood’ offices.

Home teleworking

A related office concept is teleworking from home, office in the home environment. Much research has been done by TNO with the project Domotion. Surveys indicate which functions are suitable for telework and which are not. In the function, there must be information or communication activities that can be performed independently.

Telecommuting is therefore ideally suited for knowledge workers. But research also shows that not everyone wants to telework. This working method allows quite a lot of demands of the employee. Research shows that the employee must be able to separate work from private-time. There must be sufficient support from the home front and there must be a good connection with the department/organisation. All this requires more self-discipline, something that not every employee can do. Source; domotion.nl

Appendix 3 Understanding the Hype Cycle

Interpreting Technology Hype

When new technologies make bold promises, how do you discern the hype from what's commercially viable? And when will such claims pay off, if at all? Gartner Hype Cycles provide a graphic representation of the maturity and adoption of technologies and applications, and how they are potentially relevant to solving real business problems and exploiting new opportunities. Gartner Hype Cycle methodology gives you a view of how a technology or application will evolve over time, providing a sound source of insight to manage its deployment within the context of your specific business goals.

Each Hype Cycle drills down into the five key phases of a technology's life cycle. Roll over the phases in the graphic above for more information.

How Do You Use Hype Cycles?

Clients use Hype Cycles to get educated about the promise of an emerging technology within the context of their industry and individual appetite for risk.

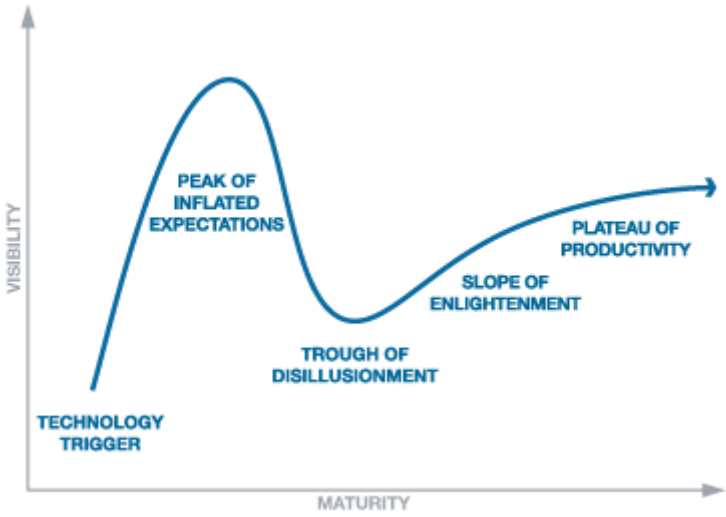
Should you make an early move? If you're willing to combine risk taking with an understanding that risky investments don't always pay off, you could reap the rewards of early adoption.

Is a moderate approach appropriate? Executives who are more moderate understand the argument for an early investment but will also insist on a sound cost/benefit analysis when new ways of doing things are not yet fully proven.

Should you wait for further maturation? If there are too many unanswered questions around the commercial viability of an emerging technology, it may be better to wait until others have been able to deliver tangible value.

How Do Hype Cycles Work?

Each Hype Cycle drills down into the five key phases of a technology's life cycle.



Technology Trigger: A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist and commercial viability is unproven.

Peak of Inflated Expectations: Early publicity produces a number of success stories—often accompanied by scores of failures. Some companies take action; many do not.

Trough of Disillusionment: Interest wanes as experiments and implementations fail to deliver. Producers of the technology shake out or fail. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters.

Slope of Enlightenment: More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious.

Plateau of Productivity: Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broad market applicability and relevance are clearly paying off.

Source: http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp (retrieved: 08-01-2013)

Adopter category	Definition
Innovators	Innovators are the first individuals to adopt an innovation. Innovators are willing to take risks, youngest in age, have the highest social class, have great financial liquidity, are very social and have closest contact to scientific sources and interaction with other innovators. Risk tolerance has them adopting technologies which may ultimately fail. Financial resources help absorb these failures. (Rogers 1962 5th ed, p. 282)
Early adopters	This is the second fastest category of individuals who adopt an innovation. These individuals have the highest degree of opinion leadership among the other adopter categories. Early adopters are typically younger in age, have a higher social status, have more financial lucidity, advanced education, and are more socially forward than late adopters. More discrete in adoption choices than innovators. Realize judicious choice of adoption will help them maintain central communication position (Rogers 1962 5th ed, p. 283).
Early Majority	Individuals in this category adopt an innovation after a varying degree of time. This time of adoption is significantly longer than the innovators and early adopters. Early Majority tend to be slower in the adoption process, have above average social status, contact with early adopters, and seldom hold positions of opinion leadership in a system (Rogers 1962 5th ed, p. 283)
Late Majority	Individuals in this category will adopt an innovation after the average member of the society. These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. Late Majority are typically skeptical about an innovation, have below average social status, very little financial lucidity, in contact with others in late majority and early majority, very little opinion leadership.
Laggards	Individuals in this category are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change-agents and tend to be advanced in age. Laggards typically tend to be focused on "traditions", likely to have lowest social status, lowest financial fluidity, be oldest of all other adopters, in contact with only family and close friends.

Appendix 4 Relevant ICT Trends

Table 27 Current ICT trends defined

Trends (Fenn, 2010)	Definition
1. Predictive analytics	any approach to data mining with three attributes: rapid analysis measured in hours or days (rather than the stereotypical months of "traditional" data mining), an emphasis on the business relevance of the resulting insights (no "ivory tower" analyses) and (increasingly) an emphasis on ease of use, thus making the tools accessible to business users (no more "Ph.D.'s with lab coats").
2. Speech Recognition	interpret human speech and translate it into text or commands
3. Consumer telematics	end-user-targeted vehicle-centric information and communication technologies (vehicle ICTs) and services. Network-enabled cars for consumers provide in-vehicle services, such as emergency assistance, Global Positioning System (GPS) navigation, traffic information, local search (for example, for charging stations or restaurants) and concierge services.
4. Idea management	a structured process of generating, capturing, discussing and improving, organizing, evaluating and prioritizing valuable insight or alternative thinking that would otherwise not have emerged through normal processes.
5. Biometric Authentication Methods	Biometric authentication methods use biometric traits to verify users' claimed identities when accessing devices, networks, networked applications or Web applications
6. Consumerisation	the specific impact that consumer-originated technologies can have on enterprises. It reflects how enterprises will be affected by, and can take advantage of, new technologies and models that originate and develop in the consumer space, rather than in the enterprise IT sector. Consumerisation is not a strategy or something to be "adopted."
7. Media Tablets	a device based on a touchscreen display (typically with a multi-touch interface) whose primary focus is the consumption of media.
8. Mobile OTA payment	transactions conducted using a mobile phone and payment instruments that include: Banking instruments such as cash, bank account or debit/credit card, and Stored value accounts (SVAs) such as transport card, gift card, Paypal or mobile wallet and exclude transactions that use: Carrier billing using the telecom's billing system with no integration of the bank's payment infrastructure, or Telebanking by using the mobile phone to call the service centre via an interactive voice response (IVR) system. However, IVR used in combination with other mobile channels such as Short Message Service (SMS) or Unstructured Structured Service Data (USSD) is included.
9. Virtual Worlds	an online networked virtual environment — hosted on an infrastructure — in which participants are immersed in a 3D representation of a virtual space and interact with other participants and the environment through an avatar (a representation of themselves in the virtual space).
10. Hosted virtual desktops	a full, thick-client user environment, which is run as a virtual machine (VM) on a server and accessed remotely.
11. Home health monitoring	the use of IT and telecommunications to monitor the health of patients in their homes and to help ensure that appropriate action is taken.
12. Text analytics	the process of deriving information from text sources. It is used for several purposes, such as: summarization (trying to find the key content across a larger body of information or a single document), sentiment analysis (what is the nature of commentary on an issue), explicative (what is driving that commentary), investigative (what are the particular cases of a specific issue) and classification (what subject or what key content pieces does the text talk about).
13. In-memory analytics	
14. Gesture Control	the ability to recognize and interpret movements of the human body in order to interact with and control a computer system without direct physical contact.
15. Mesh Networks: sensors	A mesh network has no centralized access points but uses wireless nodes to create a virtual wireless backbone.

16. Machine-to-Machine communication Services	used for automated data transmission and measurement between mechanical or electronic devices.
17. Cloud Computing	a style of computing where scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies.
18. Audio mining/ Speech Analytics	embrace keyword, phonetic or transcription technologies to extract insights from pre-recorded voice streams.
19. Internet TV	video streaming of licensed professional content (typically, TV shows, live events and movies) over the public Internet for viewing on a PC, handset or Internet-connected TV set.
20. NFC Payment	Contactless payment technology enables payment transactions via a contactless chip embedded in payment cards, tags, key fobs and mobile phones. The chip communicates with a reader device that uses radio frequency or Near Field Communication (NFC) standards. It includes radio frequency identification (RFID) as part of a machine-to-machine communications trend.
21. Activity streams	a publish/subscribe notification mechanism that provides frequent updates to subscribers about the activities or events that relate to another individual.
22. In-memory Database Management Systems	
23. Augmented Reality	Augmented reality (AR) is a technology that superimposes graphics, audio and other virtual enhancements over a live view of the real world. It is this "real world" element that differentiates AR from virtual reality.
24. Applications stores	offer downloadable applications to mobile users via a storefront that is either embedded in the device or found on the Web. Application categories in public application stores include games, travel, productivity, entertainment, books, utilities, education, travel and search, and can be free or charged-for. Private application stores can be created by enterprises for mobile workers.
25. Private Cloud Computing	a form of cloud computing in which service access is limited, and/or the customer has some control/ownership of the service implementation
26. Social Analytics	Describes the process of measuring, analysing and interpreting the results of interactions and associations among people, topics and ideas.
27. Complex-Event Processes	
28. BYOD	Bring your own device (BYOD) is an alternative strategy allowing employees, business partners and other users to utilize a personally selected and purchased client device to execute enterprise applications and access data. Typically, it spans smartphones and tablets, but the strategy may also be used for PCs. It may include a subsidy.
29. 3D Printing	3D fabricating technologies have been available since the late 1980s and have primarily been used in the field of prototyping for industrial design. More recently, the 3D printing quality has increased, and printer and supply costs have decreased to a level that broadens the appeal of 3D printing to consumers and marketers.
30. Wireless power	A wireless power supply facilitates the charging or direct powering of electrical and electronic equipment using inductive or radio frequency (RF) energy transfer.
31. Hybrid Cloud Computing	policy-based and coordinated service provisioning, use and management across a mixture of internal and external cloud services.
32. HTML5	HTML5 is a collection of proposed specifications for the next generation of HTML. Beyond this, HTML5 is used as a short-hand label for all that's new with the Web, including CSS3 and changes to HTTP.
33. Gamification	the use of game mechanics to drive engagement in non-game business scenarios and to change behaviours in a target audience to achieve business outcomes. Many types of games include game mechanics such as points, challenges, leaderboards, rules and incentives that make game-play enjoyable. Gamification applies these to motivate the audience to higher and more meaningful levels of engagement. Humans are "hard-wired" to enjoy games and have a natural tendency to interact more deeply in activities that are framed in a game construct.
34. Big Data	Big data is high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information

	processing for enhanced insight and decision making.
35. Crowdsourcing	the processes for sourcing a task or challenge to a broad, distributed set of contributors using the Web and social collaboration techniques.
36. Speech-to-speech translation	Speech-to-speech translation involves translating one spoken language into another. It combines speech recognition, machine translation and text-to-speech technology.
37. Silicon Anode batteries	an extension of widely used lithium ion (Li-Ion) batteries. This will result in significantly higher energy storage and longer battery life.
38. Natural Language Question Answering	the comprehension by computers of the structure and meaning of human language (e.g., English, Spanish, Japanese), allowing users to interact with the computer using natural sentences.
39. Internet of Things	the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.
40. Mobile Robots	Mobile robots move and navigate in an autonomous or semiautonomous (that is, via remote control) manner and have the ability to sense or influence their local environments. Mobile robots may be purely functional, such as vacuum-cleaning or lawn-mowing robots, or may be humanlike in their appearance and capabilities.
41. Autonomous Vehicles	An autonomous vehicle is one that can drive itself from a starting point to a predetermined destination in "autopilot" mode using various in-vehicle technologies and sensors, including adaptive cruise control, active steering (steer by wire), anti-lock braking systems (brake by wire), GPS navigation technology and lasers.
42. 3D scanning	A three-dimensional scanner is a device that captures data about the shape and appearance of real-world objects to create 3D models of them.
43. Automatic content recognition	the ability of a client application (typically a smartphone or media tablet app) to identify a content element within its proximity _ audio, video or digital image _ based on sampling a portion of the audio or video (or image), processing the sample and comparing it with a source service that identifies content by its unique characteristics such as audio or video fingerprints or watermarks.
44. Volumetric / Holographic Displays	visual representations of objects in three dimensions, with an almost 360-degree spherical viewing angle in which the image changes as the viewer moves around. True volumetric displays fall into two categories: swept volume displays and static volume displays. Swept volume displays use the persistence of human vision to re-create volumetric images from rapidly projected 2D “slices.” Static volume displays use no major moving parts to display images, but rather rely on a 3D volume of active elements (Volumetric Picture Elements, or voxels) changing colour (or transparency) to display a solid option.
45. 3D bioprinting	a medical application of 3D printers. It is a system directed by medical imaging data and software that specifies the design of living tissue and organs, plus the printing device to create a functioning human organ from an individual’s own or other cells.
46. Quantum Computing	A quantum computer uses atomic quantum states to effect computation. Data is held in qubits (quantum bits), which have the ability to hold all possible states simultaneously. This property, known as “superposition,” gives quantum computers the ability to operate exponentially faster than conventional computers as word length is increased. Data held in qubits is affected by data held in other qubits, even when physically separated. This effect is known as “entanglement.” Achieving both superposition and entanglement is extremely challenging.
47. Human Augmentation	Human augmentation moves the world of medicine, wearable devices and implants from techniques to restore normal levels of performance and health (such as cochlear implants and eye laser surgery) to techniques that take people beyond levels of human performance currently perceived as "normal." In the broadest sense, technology has long offered the ability for superhuman performance — from a simple torch that helps people see in the dark to a financial workstation that lets a trader make split-second decisions about highly complex data. The field of human augmentation (sometimes referred to as "Human 2.0") focuses on creating cognitive and physical improvements as an integral part of the human body. An example is using active control systems to create limb prosthetics with characteristics that can exceed the

	highest natural human performance.
48. Head-Mounted Displays (HMDs) (not listed in Hype Cycle 2012!)	small displays or projection technology integrated into eyeglasses or mounted on a helmet or hat. Heads-up displays are a type of HMD that does not block the user's vision, but superimposes the image on the user's view of the real world. An emerging form of heads-up display is a retinal display that "paints" a picture directly on the sensitive part of the user's retina. Although the image appears to be on a screen at the user's ideal viewing distance, there is no actual screen in front of the user, just special optics (for example, modified eyeglasses) that reflect the image back into the eye. Other heads-up displays that are not worn by the user but are projected on a surface (for example, on a car or plane windshield) are not covered in this discussion. Some HMDs incorporate motion sensors to determine direction and movement (for example, to provide context-sensitive geographic information) or as the interface to an immersive virtual reality application.

Table 28 Filtering relevant ICT trends

Trends	Reading	Listening	Watching	Writing/ drawing	Operate computer applications	(CMC) Computer mediated Communication	Natural communication	Commuting	Not relevant
1. Predictive analytics									■
2. Speech Recognition				■	■	■			
3. Consumer telematics									■
4. Idea management									■
5. Biometric Authentication Methods									■
6. Consumerisation									■
7. Media Tablets	■	■	■	■	■	■			
8. Mobile OTA payment									■
9. Virtual Worlds		■	■	■		■			
10. Hosted virtual desktops									■
11. Home health monitoring									■
12. Text analytics									■
13. In-memory analytics									■
14. Gesture Control				■	■				
15. Mesh Networks: sensors									■
16. Machine-to-Machine communication Services									■
17. Cloud Computing	■	■	■	■	■	■			
18. Audio mining/ Speech Analytics									■
19. Internet TV									■
20. NFC Payment									■
21. Activity streams									■
22. In-memory Database Management Systems									■
23. Augmented Reality	■	■	■	■	■	■			
24. Applications stores									■
25. Private Cloud Computing	■	■	■	■	■	■			
26. Social Analytics									■
27. Complex-Event Processes									■
28. BYOD	■	■	■	■	■	■			
29. 3D Printing				■			■		
30. Wireless power					■				
31. Hybrid Cloud Computing	■	■	■	■	■	■	■		
32. HTML5	■	■	■	■	■	■	■		

33. Gamification									
34. Big Data									
35. Crowdsourcing									
36. Speech-to-speech translation									
37. Silicon Anode batteries									
38. Naturals Language Question Answering									
39. Internet of Things									
40. Mobile Robots									
41. Autonomous Vehicles									
42. 3D scanning									
43. Automatic content recognition									
44. Volumetric / Holographic Displays									
45. 3D bioprinting									
46. Quantum Computing									
47. Human Augmentation									
48. Head-Mounted Displays (HMDs) (not listed in Hype Cycle 2012!)									

Cloud computing is one of the important pillars for people to access, share and process this information from anywhere where there is connectivity with the cloud or even just the internet. Also does cloud computing allow a team to co-work on information remotely.

Control/ input:

Speech Recognition (analysed by*:* Jackie Fenn)

Speech recognition systems interpret human speech and translate it into text or commands. Primary applications are self-service and call routing for call centre applications, converting speech to text for desktop text entry, form-filling or voice-mail transcription, and user interface control and content navigation for use on mobile devices and in-car systems. Control of consumer appliances (such as TVs) and toys is also commercially available but not widely used. Phone applications such as call routing or content navigation (for example, obtaining a weather report) often use various techniques, ranging from directed dialogue, in which the system walks the caller through a series of questions, to natural-language phrase recognition, in which the user can respond freely to an open-ended question. Depending on the application, the speech recognition may be performed on the device or on a server in the network (which offers superior accuracy but slower response times) — or as a combination of both.

Accuracy can be highly variable depending on background noise, size of the recognized vocabulary, level of natural-language understanding attempted, clarity of the speaker's voice, quality of the microphone and processing power available. For text entry in a quiet environment, where some users can achieve impressive accuracy, speech recognition still has not been widely adopted outside medical and legal dictation, possibly due to the need to learn a new skill (dictation) for most general office workers.

Business Impact:

Speech recognition for telephony and contact centre applications enables enterprises to automate call centre functions such as travel reservations, order status, ticketing, stock trading, call routing, directory services, auto-attendants and name dialling. Additionally, it is used to enable workers to access and control communication systems, such as telephony, voice mail, e-mail and calendaring applications, using their voice.

For some users, speech input can provide faster text entry for office, medical and legal dictation, particularly in applications where speech shortcuts can be used to insert commonly repeated text segments (for example, standard contract clauses).

For mobile devices, applications include name dialling, controlling personal productivity tools, and accessing content (such as MP3 files) and voice-mail-to-text services. These applications are strongly motivated to use speech to support in-car use and for unified communications among voice, text and e-mail services.

For speech recognition to work properly, a quite environment is needed influencing the acoustic requirements for of the workplace where this feature is used.

Gesture Control/recognition

Gesture recognition and control involves determining and interpret the movement of a user's fingers, hands, arms, head or body in three dimensions through the use of a camera; or via a device with embedded sensors that may be worn, held or body-mounted in order to interact with and control a computer system without direct physical contact. The term “natural user interface” is becoming commonly used to describe these interface systems, reflecting the general lack of any intermediate devices between the user and the system.

One of the most visible examples is the newly launched Microsoft Kinect (previously known as Project Natal) gaming controller. In some cases (for example gaming controllers such as the Nintendo Wii Balance Board or the Microsoft Skateboard controller), weight distribution is being added to supplement the data available.

A more limited subset of gesture recognition (in 2D only) has become common with the recent development of multi-touch interfaces (such as the Apple iPhone or Microsoft Surface) where multiple finger touches — pinch and squeeze, flicks and swipe-type gestures — are used to provide a richer and more intuitive touch-based interface.

The primary application for gestural interfaces at present is in the gaming and home entertainment market. However, the potential of hands-free control of devices, and the ability for several people to interact with large datasets, opens up a wide range of business applications — including data visualisation and analytics, design, retail, teaching, and medical investigation and therapy.

As computing power moves from a single device to an "on-demand" resource, the ability to interact and control without physical contact frees the user and opens up a range of intuitive interaction opportunities, including the ability to control devices and large screens from a distance.

Virtual Worlds ***Analysis By:*** Steve Prentice

A public virtual world is an online networked virtual environment — hosted on a publicly accessible infrastructure — in which participants are immersed in a 3D representation of a virtual space and interact with other participants and the environment through an avatar (a representation of themselves in the virtual space).

In the short term, public virtual worlds remain a "sandbox" environment for experimentation in training, community outreach and collaboration, but the "buzz" has died and enterprise interest remains static. In the longer term, virtual environments still represent useful media channels to support and engage with communities in an immersive fashion but appear unlikely to induce transformational change.

Video Telepresence: *Analysis By:* Scott Morrison; Robert Mason

Video telepresence is a form of immersive video communication that creates the impression of being in the same room as other conference participants. Most telepresence suites run high-definition (HD) video resolution at 720p (progressive scan) or 1,080p lines. Conference participants appear as life-size individuals on large plasma, LCD or projection screens. Multiple cameras and microphones pick up individuals or pairs of individuals, so that all audio-visual information becomes directional, with good eye contact and spatial sound aligned with the location of the person speaking.

Telepresence suites are designed and assembled by the system supplier to provide layout, acoustics, colour tones and lighting that maximize the perception of realism. Vendors have recognized a need for more adaptive solutions, which fit into established environments and cost considerably less than fully immersive suites. In addition, some providers offer "lite" solutions, which have multiscreen capabilities that are basically a step up from regular HD room videoconferencing. Operational simplicity and high availability are other key factors for telepresence. The systems are designed to enable anyone to use them to their full potential with little or no prior training, without the connectivity problems associated with traditional room videoconferencing solutions.

Telepresence systems make high demands on the network, with low-compression, three-screen, HD rooms taking anything from 8 Mbps to 45 Mbps of dedicated bandwidth for video and content. They are typically deployed across Multiprotocol Label Switching (MPLS) networks, often dedicated to and designed for video traffic, with minimal latency, so that users can retain natural levels of spontaneity during interactions with other participants.

Vendors are now moving quickly toward telepresence interoperability with each other and with traditional, room-based videoconferencing systems, desktop video and unified communications solutions. In particular, the relatively wide adoption of the Cisco-developed Telepresence Interoperability Protocol (TIP) will offer a mechanism to deal with multiscreen environments, as products which use the TIP protocol come onto the market during 2010/2011. Commercial negotiations among service providers are currently slowing the progress of wide inter-carrier telepresence, although even these are expected to be resolved over the next 18 months, paving the way for wider adoption of the technology. But it may take two to three years for all providers to implement the inter-carrier agreements based on the bilateral approach the major players have adopted.

For regular telepresence users, travel cost reductions and improved productivity will provide a business case with a relatively short payback period, often less than 18 months. Telepresence typically demands a utilization rate in excess of three hours per day — three to four times what most organisations achieve with traditional videoconferencing — to justify the investment, which can range from $180,000 to $400,000 or more per endpoint, and an additional $8,000 to $18,000 per month for managed services and network connectivity. Early adopters do indicate that telepresence has boosted usage rates into the 30% to 40% range for organisations, based on a 10-hour business day, compared with less than an hour per day for unmanaged videoconferencing systems. Increased usage is key to cost justification and customer success with telepresence. Public utility services have yet to live up to their promise — there are simply not enough rooms available yet to provide access to significant volumes of potential users.

Augmented Reality

Analysis By: Tuong Nguyen; Jackie Fenn; CK Lu

Augmented reality (AR) is a technology that superimposes graphics, audio and other virtual enhancements over a live view of the real world. It is this "real world" element that differentiates AR from virtual reality. AR aims to enhance users' interaction with the environment, rather than separating them from it. The term has existed since the early 1990s, when it originated in aerospace manufacturing.

AR can be used to add extra information on top of existing objects or areas. Augmented reality can for example be useful for way finding outside and inside buildings. Also can AR be used to experience virtual objects in a physical environment for a better understanding. AR integrated in lenses or glasses allows one to see images or read while not making use of screens or other image projecting devices fixed to a certain location. These wearable devices provide freedom of movement and location while still being able to observe visual information effortless.

Electronic Paper

Analysis By: Jim Tully

Definition: Electronic paper refers to several reflective display technologies that do not require a backlight and can be viewed in conditions of moderate to good ambient illumination. They can be made very thin, producing a nearly paper-thin rewritable display that gives a similar user experience to that of printed paper.

Electronic paper typically utilizes organic plastics rather than glass, giving physical characteristics that are surprisingly rugged.

Most of these technologies involve physical movement of (or within) the pixel to facilitate a change from light to dark or to change color. The performance achieved is, therefore, slower than other electronic displays, such as LCDs. The most common example is E Ink, which is based on pixels composed of charged particles suspended in a fluid. Other solutions are based around micro-electromechanical systems (MEMS), nano chemical changes and rotation of spherical-shaped pixels. The displays consume power only while images are changing and therefore use virtually no power for static images. There is much interest in the development of the flexible versions of these displays, such as those produced by Polymer Vision (now acquired by Wistron) and Plastic Logic. Faster versions are also being developed with the ultimate aim of full video speeds.

Touch sensitivity can be added to electronic paper by adding a touch layer over the front or back of the display. Addition to the rear of the display offers the added benefit of a higher quality (and brighter) image, since reflected light does not need to pass through the touch-sensitive layer. Touch technology allows features such as the highlighting of words or adding handwritten notes in electronic books.

Use of wireless battery-powered signage is likely to bring significant benefits to some classes of business. Electronic paper will also lead to new product and market opportunities for vendors — especially in consumer and remote applications.

Gamification

Volumetric and Holographic Displays

Mobilisation:

Media Tablets

Analysis By: Van Baker; Angela McIntyre; Roberta Cozza

A media tablet is a device based on a touchscreen display (typically with a multitouch interface) whose primary focus is the consumption of media. Examples of media include Web pages, music, video and games. The device can also facilitate content entry via an on-screen keyboard, a hardware-based slide-out keyboard, or one that is part of a clamshell design. The device has a screen with a diagonal dimension that is a minimum of five inches and may include screens that are as large as is practical for handheld use, roughly up to 15 inches. The media tablet runs an operating system that is more limited than, or a subset, of the traditional fully-featured operating systems, such as Windows 7. Alternatively, it may be a closed operating system under the control of the device manufacturer; examples include Android, Chrome and Apple's iOS 4. The media tablet features wireless connectivity with either Wi-Fi, WAN or both, a long battery life and lengthy standby times with instant-on access from a suspended state. Examples of media tablets are the Apple iPad and the Joo Joo tablet.

The adoption and use of multitouch media tablets in addition to smartphones has the potential to disrupt the overall computing industry including product design centers, software, controls and user interface design. If the most commonly used consumer devices are driven by simple user interfaces with touch controls, then there will be pressure on the traditional personal computing market to move away from the mouse and keyboard design center that has been the central control model since the graphical user interface arrived. Media tablets in conjunction with smartphones have the potential to fundamentally change the personal computer use model in the longer term. This impact extends to the user interface and performance expectations such as instant on. Media tablets will also impact handheld devices with applications where small screens are a serious constraint.

Wireless power

A wireless power supply facilitates the charging or direct powering of electrical and electronic equipment using inductive or radio frequency (RF) energy transfer. Inductive systems are preferred for short-range wireless power transfer (a few centimeters) and can provide high levels of power of several hundred watts or more. RF power transfer operates over longer distances (tens or hundreds of meters or more) and provides more modest levels of power (a few milliwatts). Inductive systems are therefore more suited for PCs and the fast charging of mobile devices, while RF power is more applicable to radio frequency identification (RFID), sensor networks and trickle-charging of cell phones.

In its most basic forms, inductive power has been in use for many years — for example, in electric toothbrushes. The focus today is on more flexible, efficient and addressable forms of the technology using resonance techniques. Most users of mobile electronic devices find battery charging to be a real annoyance. It is inconvenient and different chargers are required for different types of equipment. The idea of wireless charging is clearly attractive and several solutions have recently been demonstrated. For example, wireless charging schemes are being designed for use in countertop surfaces and similar environments that will charge a mobile device when it is placed onto the surface.

The technology is applicable to a wide range of business and consumer situations. Some environments require mobile devices to be charged at all times, and wireless charging is particularly suited to those situations.

Cloud Computing

Gartner defines "cloud computing" as a style of computing where scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies.

The cloud-computing model is changing the way the IT industry looks at user and vendor relationships. As service provisions (a critical aspect of cloud computing) grow, vendors must become, or partner with, service providers to deliver technologies indirectly to users. User organisations will watch portfolios of owned technologies decline as service portfolios grow. The key activity will be to determine which cloud services will be viable, and when.

Cloud computing is one of the important pillars for people to access, share and process this information from anywhere where there is connectivity with the cloud or even just the internet. Also does cloud computing allow a team to co-work on information remotely.

Location-Aware Applications

Analysis By: Monica Basso

Definition: Location-aware applications use the geographical position of a mobile worker or an asset to execute a task. Position is detected mainly through satellite technologies, such as a GPS, or through mobile location technologies in the cellular network and mobile devices. Examples include fleet management applications with mapping, navigation and routing functionalities, government inspections and integration with geographic information system applications.

Location-aware applications can be deployed in field force automation, fleet management, logistics and goods transportation in sectors such as government, healthcare, utilities and transportation.

BYOD (Bring Your Own Device)

3D Printing

3D fabricating technologies have been available since the late 1980s and have primarily been used in the field of prototyping for industrial design. More recently, the 3D printing quality has increased, and printer and supply costs have decreased to a level that broadens the appeal of 3D printing to consumers and marketers.

Additive 3D printers deposit resin, plastic or another material, layer by layer, to build up a physical model. Inkjet 3D printers image successive layers of plastic powder, hardening each layer on contact, to build up the piece. The size of the part varies with the specific manufacturer's printer and whether support structures are required.

Uses for 3D printers have expanded as advances in 3D scanners and 3D design tools, as well as the commercial and open-source development of additional design software tools, made 3D printing practical. The cost of creating 3D models has continued to drop, with devices available for an investment of approximately $10,000. Increasing printer shipments will create economies of scale for the manufacturers, and when coupled with price pressure from low-cost 3D printer kits, will continue to drive down 3D printer prices. Similarly, the supplies costs will decrease as use increases and competitive pressures become a factor.

The commercial market for 3D print applications will continue expanding into architectural, engineering, geospatial, medical and short-run manufacturing. In the hobbyist and consumer markets, the technology will be used for artistic endeavors, custom or vanity applications (such as the modeling of children, pets and

gamers' avatars), and "fabbing" (the manufacture of one-off parts). As a result, demand for scarce 3D design skills and easy-to-use consumer software tools will explode in the consumer and business arenas.

When virtual products do not provide the rich interaction as a physical object 3D printing can be used to obtain the product without any the logistical effort.

Mobile Robots

Mobile robots move and navigate in an autonomous or semiautonomous (that is, via remote control) manner and have the ability to sense or influence their local environments. Mobile robots may be purely functional, such as vacuum-cleaning or lawn-mowing robots, or may be humanlike in their appearance and capabilities.

Evaluate mobile robots for cleaning, delivery, security, warehousing and mobile videoconferencing applications. As robots start to reach price levels that are comparable to a person's salary, prepare for mobile robots to appear as new endpoints in corporate IT networks.

Longer term, mobile robots will deliver a broader spectrum of home help and healthcare capabilities, and, as costs fall, they may play a growing role in automating low-wage tasks in activities such as food preparation.

Robots can in the future be replaced by humans doing routine-work.

Autonomous Vehicles

An autonomous vehicle is one that can drive itself from a starting point to a predetermined destination in "autopilot" mode using various in-vehicle technologies and sensors, including adaptive cruise control, active steering (steer by wire), anti-lock braking systems (brake by wire), GPS navigation technology and lasers.

Business Impact: Autonomous vehicle efforts focus on safety, convenience and economical applications, positioning this as a driver-assistance technology as well as an autopilot system in future deployment scenarios. Autonomous vehicles can help to address distraction issues for in-vehicle content consumption with the rise of infotainment applications. While driving on auto pilot the ‘driver’ could perform work related activities and thereby using travel time efficiently. Once travel time can be used to work, the period spent in the car can be a less limiting factor which allows travel time to be longer and resulting in a further distance. This makes a larger reach for physical presence.

New Computer Interfaces

Desktop computers are now WIMP interface[17]. But mobile phones have shown that other concepts are possible. The new interfaces will change the way computers will be used. The revolution has already started.

Concepts

Windows, MacOS, Gnome are WIMP interfaces: Windows + Icons + Menus + Pointers (mouse or arrows).

To this concept, others oppose:

NUI: Natural User Interface.

The user interface is natural gestures, it was with hands that are addressed and moved objects.

OCGM: Objects, Containers, Gestures, Manipulations.

In this new approach containers are no more windows, but objects that can contain other objects. The actions of the users are recognized by various computer peripherals. Manipulations are all effects from the user on objects.

This last concept should be the basis of Windows 8. It promises a radical change. But in the meantime, various techniques are emerging that are already usable.

True motion video

[17] WIMP stands for "windows, icons, menus, pointer (Hinckley, 1996)

TrueMotion technologically turns a PC into WII and even goes further. With the the WII whose commercial success is immense, we made a first step in the field of virtual reality. To provide a technology similar to PCs, the company Sixense developed a paddle similar and even more elaborate.

The Nintendo's Wiimote knows in which direction you point the hand. The TrueMotion controller through a dock producing an electromagnetic field is much more accurate because it knows what you point out but also with in which angle you look! TrueMotion should work with current games on PC according Sixense, and even better on games designed to take advantage of all its features. A prototype was presented at CES (Consumer Electronics Show) and will lead to a commercial product whose price would be around 100 euros, with a game included.

Surfaces

It is a table or an interactive whiteboard, with a computer and cameras that interpret the gestures of the user and display contents based on that. The version of Sony, attracTable goes even further. It can recognise the age, sex and the facial expressions of the user, like joy or disappointment, and react according to these parameters. The table is equipped with two cameras connected to the computer controlling a device.

Being human

Microsoft Research Cambridge gives researchers the task of writing a report on what could be the human-computer interface of the future, given technological innovations that are already appearing. The report first provides an evolution of computers themselves, becoming more intelligent, capable of learning, may in part what is expected of them and react without waiting to receive commands. The interface will change the GUI (Graphical User Interface) such as Windows, KDE, Gnome to something that responds to speech, gestures, eye and is even considered an interaction with the thought, something that is technically possible today. In addition it will introduce in the interaction to GPS, cameras, radio waves (RFID Low-cost Radio Frequency Identification) that will create an interconnection between man, computer, personal environment or work. All this is planned for 2020.

You will change roles and employers more frequently.

“Gone are the days when people would spend most of their productive lives working for one company and retire 30 years later with a gold watch,” Wilen-Daugenti says. She expects workers in the future to have serial careers, and average at least 10 different employers. “The proliferation of virtual organisations will accelerate this multiple-job trend, as more people join workgroups from remote locations or choose to work as contractors." A greater number of small businesses will provide niche services. Using the Internet, businesses are now able to easily find skilled people from all over the world, Wilen-Daugenti explains. As a result, more people will become self-employed and focus on “microwork” freelance or contract work that produces niche services or products, such as graphic design or custom painting.

Learning foreign languages will become even more important.

Since technology is bringing globalization to the forefront of business, it will become increasingly important for workers to be able to relate to diverse cultures and to communicate with people from around the world. “Our research indicates that employers predict a growing demand for workers who can do business in Spanish, Chinese, Russian and Arabic,” says Caroline Molina Ray, executive director of research and publications at Apollo Research Institute and an MBA program graduate from University of Phoenix. She suggests that anyone wanting to get a leg up in the international marketplace should study these languages.

Appendix 5 Interview Protocol

Interview Protocol

Date:

Data interviewee:
Institution:
Interviewee (title and name):
Interviewer: R.P.C. Rosa
Documents obtained:
Post interview comments or leads:

Sections:
A: Interview Background
B. ICT trends
C. Real Estate
D. End of interview

Interviews for 'Corporate Real Estate Portfolios 2040 according to ICT trends'.

Introductory Protocol

To facilitate my note-taking, I would like to audio record our conversations today. For your information, only I will be privy to the recordings which will be eventually deleted after they are transcribed. Essentially, all confidential information will be left out, your participation is voluntary, and we do not intend to inflict any harm. Thank you for your agreeing to participate.

We have planned this interview to last no longer than one hour. During this time, we have several questions that I would like to cover. If time begins to run short, it may be necessary to interrupt you in order to push ahead and complete this line of questioning. With your permission, any question after this meeting will be sent via mail.

Introduction

You have been selected to interview because you have been identified as someone who has a great deal to share about ICT trends and their influence on future office use. My research project as a whole focuses on the future demand for offices, with particular interest in understanding how ICT trends influence ways of working regarding the location, time and facilities to support the activities of office workers. This topic is chosen because not much is known about link between ICT and Real Estate Portfolio's. My study does not aim to evaluate your techniques or experiences. Rather, I am trying to learn more about what how to cope with the changes, and hopefully learn about how to prevent office vacancy.

Briefly describe your role (master student in Real estate & Housing at the TU Delft) as it relates to Corporate Real Estate Portfolios 2040 according to ICT trends (if appropriate).

Main research question

For my master thesis, the following main research question needs to be answered as much as possible:

What is the future demand of office workers for real estate portfolios in the Netherlands in the year 2040 as a result of ICT developments over the next two decades and how can the supply be matched with this demand?

A. Interviewee Background

1. Please tell me more about your organisation and its origin and future vision.

2. What is your function in this institution?

3. How long have you been in your current position and how long at this institution?
Current position:
At this institution:

4. What is your field of work?

5. How are you involved in Corporate Real Estate and/or ICT trends?

6. Interesting background information on interviewee:

B. ICT trends

1. Which trends and developments do you observe?

2. How are these developments changing?

Probes: have you heard of hype cycles and adoption rates?

3. On what do you base your findings?

(If interviewee did not state anything about physical or virtual communication, propose your own findings. If interviewee did mention anything relevant, continue to next question without explanation.)

4. To what extent can ICT replace natural communication between office workers or between office workers and clients?

Probes: when can it be replaced and when not?

5. What is your vision on office portfolios of companies in the Netherlands in the year 2040 according to current ICT developments?

Probes: is it changing – why or why not? Who influences the changes (e.g. management teams, workers, clients etc.?

C. Real Estate (Offices, Workplaces, Location)

1. Which current and changing trends in ICT influence the demand for office space until 2040?

Probes: does it have anything to do with generations or other external influences?

2. How do the trends influence the use of office space and office location in the extreme situation?

Probes: what will happen on short term (5 years) and what will happen on long term (10 year)?

3. How can existing and to develop real estate be matched to the future demand for offices space caused by ICT innovations during the functional life cycle?

Probes: What should be done with existing vacant buildings? What needs to be considered when (re)developing offices?

C. End of interview

Check if all answers have been answered thoroughly and if not ask how or where you can get the answers. Thank the interviewee for his/her time and cooperation.

Post Interview Comments and/or Observations:

Appendix 6 Strategies against scenario's

Table 29 Strategies against scenario's

Scenario's	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Talent Towns •small cities (100,000 - 200,000 inhabitants) •specialised workers and firms •People do not have to meet in person •virtually •specialists from all over the world •personal interaction with their fellow specialists, which determines their location choice •they select their place of residence on the basis of the attractiveness of the living environment and the availability and quality of consumption amenities such as restaurants, theatres, childcare centres, schools •business services •Dutch operate worldwide •dynamic world with excellent opportunities, but also major challenges. •strongly competitive •(TT sector dependent)	**Office** Central offices hinder choice in location **Location** Central offices hinder choice in location Office located in different small cities **Workforce** Not virtual, need to meet at central office or work from home. No working in between and in other networks Need to live close to office and commute. Corporate real estate portfolio's focused in	**Office/workplace** Virtual communication means, personal interaction. **Location** Central Office located at small cities Third place offices provide choice in location even abroad. **Workforce** Virtual communication means, personal interaction. or work from home. Live according attractiveness of the living environment	**Office/workplace** Virtual communication means, personal interaction. **Location** Central Office located at small cities Third place offices provide choice in location even abroad. **Workforce** Virtual communication means, personal interaction. or work from home. Live according attractiveness of the living environment	**Office/workplace** Virtual communication means, personal interaction. **Location** Third place offices provide choice in location even abroad, but should be at specific TT. **Workforce** Virtual communication means, personal interaction. or work from home. Live according attractiveness of the living environment
Conclusion	*Mismatch virtual and residence from different tt clusters and central office not in all clusters*	*Limited match virtual and residence from different tt and central office*	***Match** virtual and residence from different tt and central office*	*Match virtual and residence from different tt*
Cosmopolitan Centres large cities (each of 2 to 8 million inhabitants) globalisation Cities develop into clusters of these specialised activities.	**Office** Activities in a cluster or abroad. Central offices within in cluster hinder choice in location/office within cluster. CT is very important **Location** Activities in a cluster or abroad. Central offices within in cluster hinder choice in location/office within cluster. Office located in cluster cities of specialization	**Office** Activities in a cluster or abroad. Central offices within in cluster. Choice in third place offices within specific cluster. CT is very important **Location** Activities in a cluster or abroad. Central offices within in cluster. Choice in third place offices within clusters. Office located in cluster	**Office** Activities in a cluster or abroad. Central offices within in cluster. Choice in third place offices within different clusters. **Location** Central offices within in cluster. Choice in third place offices within different clusters. Airport locations are important Headquarters **Workforce**	**Office** Activities in a cluster or abroad. Central offices within in cluster. Choice in third place offices within different clusters. **Location** Central offices within in cluster. Choice in third place offices within different clusters. Airport locations are important Headquarters **Workforce**

	Headquarters **Workforce** fields specialist workers substantially benefit from grouping together Not virtual, need to meet at central office or work from home. No working in between and in other networks Need to live close to office and commute.	cities of specialization Headquarters **Workforce** fields specialist workers substantially benefit from grouping together Not virtual, need to meet at central office or work from home. No working in between and in other networks. Need to live close to office and commute.	fields specialist workers substantially benefit from grouping together Not virtual, need to meet at central office or work from home. No working in between and in other networks Can live in or near cluster.	fields specialist workers substantially benefit from grouping together Not virtual, need to meet at central office or work from home. No working in between and in other networks Can live in or near cluster.
Conclusion	*Limited match virtual and residence in cluster and central office*	*Limited match virtual from third place offices and residence cluster and central office in cluster*	*Match virtual from third place offices and residence cluster and central office in cluster*	*Match virtual between third place offices and residence in cluster*
Egalitarian Ecologies Variety and dispersion medium-sized cities (100,000 - 500,000 inhabitants) east and south of the Netherlands cater local demand Living and working activities spread out over space No xenogamy Firms turn away from large cities and settle in medium-sized cities agreeable living conditions for their employees inwards	**Office** Activities in a cluster. Central offices within in cluster serves local workers. **Location** Living and working activities spread out over space. Office located in cluster cities of specialization outside cities. **Workforce** fields specialist workers substantially do not benefit from grouping together with other workers. Not virtual, need to meet at central office or work from home. No working in between and in other networks Live close to office and commute.	**Office** Activities in a cluster or abroad. Central offices within in cluster serves local workers. **Location** Living and working activities spread out over space. Office located in cluster cities of specialization outside cities **Workforce** fields specialist workers substantially do not benefit from grouping together with other workers. Not virtual, need to meet at central office or work from home. No working in between and in other networks Live close to office and commute.	**Office** Activities in a cluster or abroad. Central offices within in cluster serves local workers. **Location** Living and working activities spread out over space. Office located in cluster cities of specialization outside cities **Workforce** fields specialist workers substantially do not benefit from grouping together with other workers. Not virtual, need to meet at central office or work from home. No working in between and in other networks Live close to office and commute.	**Office** Activities in a cluster or abroad. A Central offices is needed to concentrate all workers of one organisation. **Location** Office needs to be located in one cluster **Workforce** fields specialist workers substantially do not benefit from grouping together with other workers. Not virtual, need to meet at central office or work from home. No working in between and in other networks Live close to office and commute.
Conclusion	Match organisations are inwards and do their own thing. The do not need to mingle with other organisations. The central office is sufficient.	Limited match Third place offices are not mainstream for inward organisations but offices near workers homes can be convenient.	Limited match Third place offices are not mainstream for inward organisations but offices near workers homes can be convenient.	Mismatch organisations are inwards and do their own thing. The do not need to mingle with other organisations. The central office is sufficient.
Metropolitan Markets few very large metropolises with more than 10 million inhabitants Large factories, huge office buildings and sky-high apartment blocks characterise these cities.	**Office** One central office with image and culture expressed. **Location** Central offices hinder choice in location within the large metro pole. No office located in different parts of the	**Office** One central office with image and culture expressed. Satellite office for workers. **Location** One central office for the whole metro pole. And satellite offices **Workforce**	**Office** One central office with image and culture expressed. Third place offices for workers. **Location** One central office for the whole metro pole. And satellite offices **Workforce**	**Office** Lack of image and culture. **Location** No central office for the whole metro pole only satellite offices **Workforce** Not always virtual, need to meet at an office or

Concentration in metropol need face-to-face contacts with experts in firm are situated in close vicinity to each other. Job satisfaction or else other	metro pole **Workforce** Not virtual, need to meet at central office or work from home. No working in between and in other networks' Need to live close to office and commute. Corporate real estate portfolios focused on centrality not on workers	Not always virtual, need to meet at an office or work from home. Do not need to live close to office and commute. Corporate real estate portfolios focused on centrality and workers	Not always virtual, need to meet at an office or work from home. Do not need to live close to office and commute. Corporate real estate portfolios focused on centrality and workers	work from home. Do not need to live close to office and commute. Corporate real estate portfolios focused on workers
Conclusion	Limited Match Central offices have a prominent location in the metro pole, but remotely living workers have to commute a lot.	Match Central offices have a prominent location in the metro pole, remotely living workers do not have to commute a lot because of satellite offices.	Match Central offices have a prominent location in the metro pole, remotely living workers do not have to commute a lot. More variety in third place offices.	Limited match remotely living workers do not have to commute a lot. More variety in third place offices, but there is no central image and culture expression.
Final *Conclusion*			Best fit	

Appendix 7 New accommodation requirements

Questions to be answered when a new accommodation is needed.

Users

1. Who are the users and are these constantly changing?
2. What are their activities and according to what ration?
3. What attracts users to a certain workplace?

Accommodation

4. What interior aspects are needed to support each activity?
5. To what extent must spatial quality be implemented per activity?
6. Should spatial quality be divers or monotone per workplace?
7. Who is going to pay for the accommodation

Location

1. What facilities need to be accessible by what transportation means within what period of time?
2. Identity
3. Accessibility: public transport (hubs), car, cities, business districts, neighbourhoods. Travel time is important, longer travel time needs to be compensated with better working environment while traveling.

ICT

8. What kind of internet connection is needed per worker? Down/upload speed, bandwidth)
9. How many access points (wireless and wired)are needed per worker?
10. How many electrical points are needed per workplace?
11. Which devices (e.g. (3D)printers, (3D)scanners, video conference equipment) are demanded and how many per workplace are needed?
12. What kind of apps are needed to guide and comfort workers, consigning workplace availability, social media, travel information etc.?
13. Cloud computing

Appendix 8 Critical success factors for designing and implementing the workplace of the future

An organisation's ability to successfully implement the workplace of the future hinges on a number of key factors including:

- **Cross-Functional Integration.** Migrating to the workplace will result in multiple dimensions of change across the Real Estate, HR, IT, and Finance functions. As a result, organisations must adopt a multi-disciplinary approach that takes a holistic view of the workplace and integrates these four enabling functions when designing and implementing the workplace.
- **Strong Stakeholder Engagement.** All stakeholders, including representatives from employees and human resource departments need to be identified and included in the processes from the outset. The workplace will have a wide-ranging impact within and outside the organisation, and having the engagement and buy-in of stakeholders who can champion the initiative in their respective areas will be critical in managing the multiple dimensions of change.
- **Commitment to Invest in Mobile Technologies, Web 2.0 Tools, and Workspace Management Solutions.** Shared workspace environments require a mobile-device-based workforce, and access to portable telecommunications (either VoIP or tablets). Workers adopting telecommuting arrangements will benefit from Web 2.0 collaboration tools and will also require the mobile devices equipment with remote connectivity and the appropriate software to allow secure access to the organisation's intranet. Implementing the workplace of the future will also require the use of workspace management systems that enable personnel to identify their preferred worksite/workspace and make reservations in advance. This can be done with help of (mobile) applications on, for example, smartphone. Organisations must be willing to make these investments and embrace the technologies required to support a workplace of the future model. In addition, existing initiatives for these types of technology need to be optimised to support the workplace of the future effort.
- **Effective Workforce Analysis.** Current and projected workforce data must be analysed to develop workforce groupings based on job functions, job levels, and attributes of employee mobility. Under the workplace of the future, these workforce groupings will be used to define appropriate workspace solutions for the workforce, including designating space types (e.g., conventional, telecommute, hoteling, satellite office, etc.) and sharing ratios (employees per seat). Effective workforce analysis will also be useful in:
  - ***Optimising in-flight technology initiatives**:* for instance, some organisations may already be considering outfitting all employees with laptops as a first step in the move towards a more virtual workforce. An assessment of workforce segments as part of designing the workplace of the future will help to evaluate and optimise the significant technology costs associated with this policy.
  - ***Identifying highly mobile segments of the workforce that could be used for a pilot roll-out of the workplace of the future**:* for instance, if one group of employees represents a highly mobile segment of the workforce, that group could be targeted as a pilot population for roll-out of the workplace of the future concept.
  - ***Designing a roll-out strategy for the implementation plan:*** for instance, new employees should be immediately assigned a workspace solution under the workplace of the future based on their work groupings. However, current employees whose work groupings fit non-conventional space designations (e.g., telecommute, hoteling) should be given the option to transition out of their

existing workspaces to the new workplace of the future designated workspaces. The transition options presented to this group of employees should include incentives that will require employees to accept the new physical workspace sharing ratios for access to new mobile technologies that are designed to boost productivity and performance.

Appendix 9 How to design for your company culture, consider these points:

What is your branding like?

Consistency is key. If your branding leans towards minimalist, your workplace should represent that in some form. Another example: If you use lots of large fonts or bright colors, integrate that same idea into the workplace. Consider logos, colors, and everything that is connected to the brand identity.

What type of work is being done?

Designing a great workplace is more than paint on the walls and a fancy waiting area. The way you work together (and work separately) will dictate how to plan the space. For instance, if you collaborate on team projects consistently, a grouping of desks or one large table would be most effective. Private desks are great for individuals working on solo projects. Either way, designing for culture also means designing for the job being done (it's all connected!).

What are the company values?

These are things such as diversity, responsibility, leadership...They can easily be shown in the workplace as a tangible idea, and not just part of a mission statement on the company "About" page. For instance, if the company boasts an affinity towards sustainability, green choices for furniture and paper should be approached accordingly.

What is important to the employee?

Basically, what is important to the agency? It could be the case that you have a very active group of exercise enthusiasts. Why not add bivi bike hooks for bicycle storage, or some treadmill desks? Encouraging self expression through things like exercise culture, and accommodating unique needs of employees will help create a community of individuals that complement each other, whether directly or indirectly. You and your employees are an important part of brand reputation.

Accomodate Change

One of the worst things a company can do is to lock in an design and never change. As a business grows, figuring out how to best organize the office space can be a powerful tool - but being stagnant and not looking for opportunities to adjust the workplace based on new needs can be a disaster.

Plan For Mobility

With smartphones, laptops, tablet computers being almost ubiquitous in society, it is no surprise that planning for mobility is a key part of future-proofing your office. But mobility doesn't just mean adding wifi to the office - it means much more.

Companies that have embraced mobility like Microsoft Amsterdam or Credit Suisse have added hotdesk-style workstations where certain employees - like salespeople - can drop in and get some work done quickly and then leave again. Other companies like Atlassian have added phonebooths or quiet rooms to allow for mobile phone conversations.

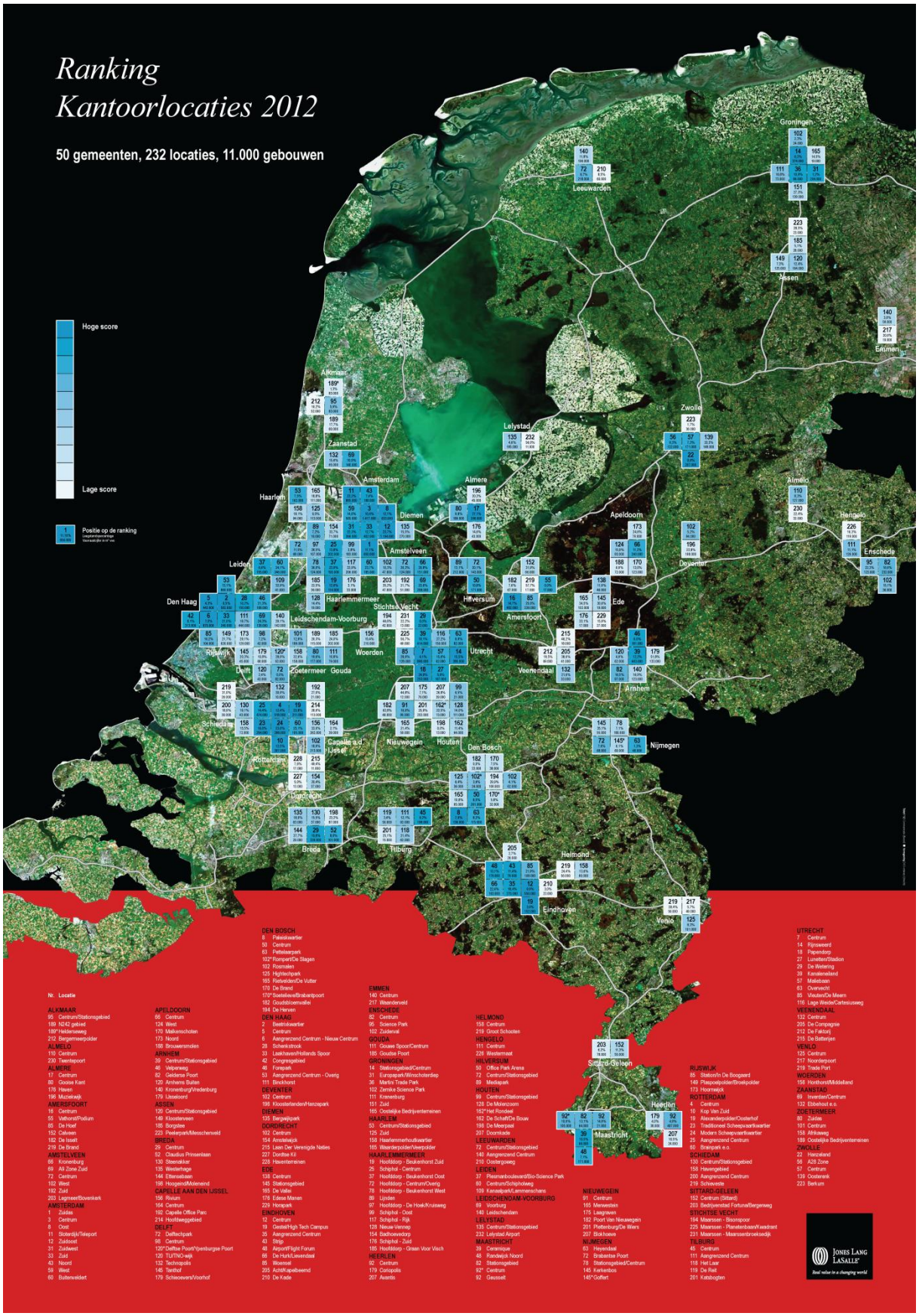
Get Rid Of Single-Use Spaces

Office space is expensive and having space sit empty is a complete waste. A good example of this would be having an executive conference room that is only used for board meetings. Companies looking toward the future should plan on having the sections of their office able to handle any variety of activities.

Conference spaces can be used for collaboration, quiet work, meetings

Lunchrooms can be used for all-hands meetings, events, workspaces

Appendix 10 Ranking office locations



Appendix 11 Design and implementation of third place offices, by Spaces

Paul Somers (interview March 29, 2013) how Spaces approaches the design and implementation of third place offices:

The first step is to find a location. Depending on the target group, accessibility by public transport and car and bike are important. Some location might provide good accessibility for public transport while being badly accessible by car.

Once the location has been determined, it is important to find or create a remarkable building, preferably with an open/transparent front. This is crucial for bypassing people to observe the activities on the ground floor, which can attract them to come in. Open floors are essential to have the flexibility to (re)create both large and small spaces. A balance must be created between open space and (closed) office space. The ground floor needs to be at least 1000m² to place all facilities needed on this floor and to handle all the traffic of different users and visitors.

Having a reception on the ground floor is important. Receptionists should know all the users and how it is going with their business. Important is for them to also know what their (daily) demands on which can be anticipated to satisfy the users. Other than that, the receptionists are the human aspects. It is important that people keep their own identity and be themselves.

With the use of an architect an environment should be made for different people who have different ways of working. The ground floor should be a mix between a coffee shop, a hotel and a library. The working places there should not be fixed workplaces, fixed workplaces should be on a 'first come first serve' basis. The ground floor should be functioning as a living room and upstairs the bedrooms are situated, just like in a house. The floors above the ground floor can be reserved for more private work environments. The design of the interior is of great importance. The design needs to be focused on mixed-users. The life cycle of furniture needs to be implemented concerning the period they will be used until they will be replaced. The shorter the period is, the more specific or extreme the design can be, but for a longer time period (e.g. longer than five or ten years) the more neutral and timeless furniture will be appropriate.

Parties that offer third place offices should down selling space to organisations. Down selling by reducing space at their first office and offer them shared spaces instead. Down selling private office space means more (individual) tenants. When organisations expend, more space can be offered on a flexible basis. In the end, it is about offering workers from organisations as well as individuals a professional environment close to home.

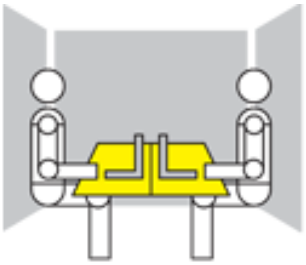
Next to these hard factors, the soft factors are also very important, maybe even more important than the hard factors. People are spoiled, with internet. They can be well informed about alternatives, which challenge competing workplaces. To satisfy the users their needs must be actively researched. Organising events is also a service. The users need to be served with fun, business, sports and emotional wellbeing. It is all about community building. Digital as in real life demands need to be matched.

To get workers to work a certain way, alternatives need to be completely remove. To realise a paperless office, printers need to be left out and replacement needs to be provided instead, for example, by tablets or electronic paper with excess to information stored in the cloud. The absence of paper means that there are no file cabinets needed. Because routine work will be taken over by software or outsourced to overseas cheap labour countries like India, workers will perform creative processes. The work place needs to allow inspiring setting to support

Appendix 12 Office spaces

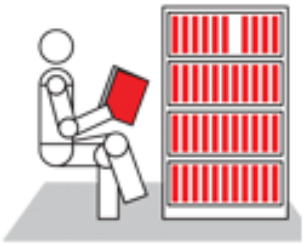
One of the most fundamental questions during the briefing stage concerns the office concept: what kind of office design best suits the working processes and culture of the organisation? Should all employees have their own workstation or are they going to share desks? Would enclosed offices or a more open working environment be better? Perhaps a solution that holds the middle is best? How many and what kind of meeting spaces do we need?

Planning Office Spaces is a clear, accessible book written to help solve these problems, looking at each of these issues in turn and showing the alternatives on offer and clearly indicating the advantages and disadvantages. It is ideally suited for both office designers and their clients to help them reach the best, most suitable office design while ensuring that they have considered all of the issues that need to be addressed (van Meel et al., 2010).



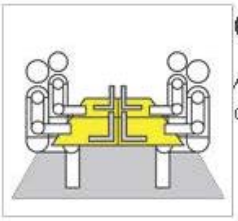
Work spaces

Meeting spaces



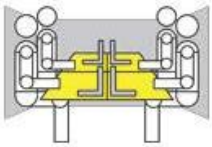
Support spaces

Work spaces



Open office

An open workspace for more than ten people, suitable for activities which demand frequent communication or routine activities which need relatively little concentration.



Team space

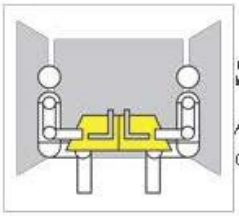
A semi-enclosed workspace for two to six people; suitable for teamwork which demands frequent internal communication and a medium level of concentration.

Cubicle

A semi-enclosed workspace for one person, suitable for activities which demand medium concentration and medium interaction.

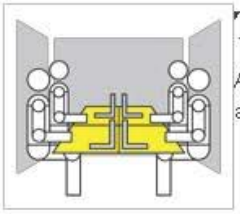
Private office

An enclosed workspace for one person, suitable for activities which are confidential, demand a lot of concentration or include many small meetings.



Shared office

An enclosed workspace for two or three people, suitable for semiconcentrated work and collaborative work in small groups.

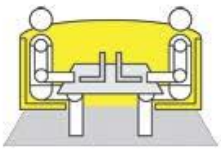


Team room

An enclosed workspace for four to ten people; suitable for teamwork which may be confidential and demands frequent internal communication.

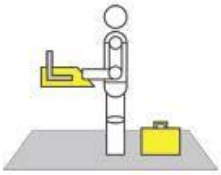
Study booth

An enclosed workspace for one person; suitable for short-term activities which demand concentration or confidentiality.



Work lounge

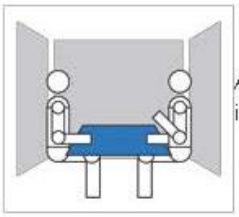
A lounge-like workspace for two to six people; suitable for short-term activities which demand collaboration and/or allow impromptu interaction.



Touch down

An open workspace for one person; suitable for short-term activities which require little concentration and low interaction.

Meeting spaces



Small meeting room

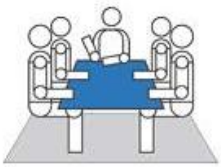
An enclosed meeting space for two to four persons, suitable for both formal and informal interaction.

Large meeting room

An enclosed meeting space for five to 12 people, suitable for formal interaction.

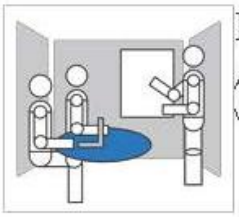
Small open meeting space

An open or semi-open meeting space for two to four persons; suitable for short, informal interaction.



Large open meeting space

An open or semi-open meeting space for five to 12 people; suitable for short, informal interaction.



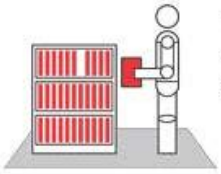
Brainstorm room

An enclosed meeting space for five to 12 persons; suitable for brainstorming sessions and workshops.

Meeting point

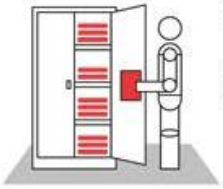
An open meeting point for two to four persons; suitable for ad hoc, informal meetings.

Support spaces



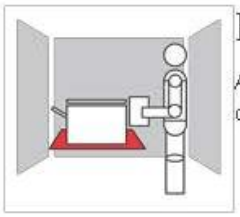
Filling space

An open or enclosed support space for the storage of frequently used files and documents.



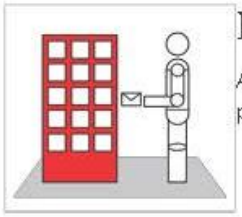
Storage space

An open or enclosed support space for the storage of commonly used office supplies.



Print and copy area

An open or enclosed support space with facilities for printing, scanning and copying.



Mail area

An open or semi-open support space where employees can pick up or deliver their personal mail.

Pantry area

An open or enclosed support space where people can get coffee and tea as well as soft drinks and snacks.

Break area

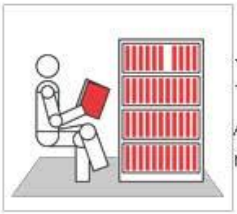
A semi-open or enclosed support space where employees can take a break from their work.

Locker area

An open or semi-open support space where employees can store their personal belongings.

Smoking room

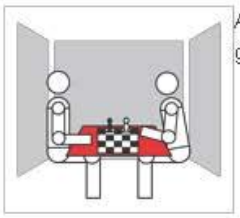
An enclosed support space where employees can smoke cigarettes.



Library

A semi-open or enclosed support space for reading of books, journals and magazines.

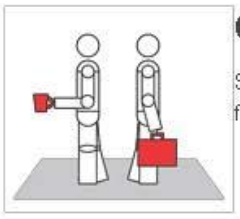
Games room



An enclosed support space where employees can play games (e.g. computer games, pool, darts).

Waiting area

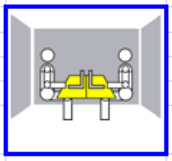
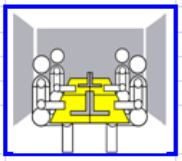
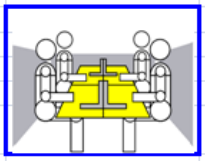
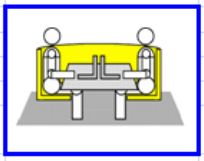
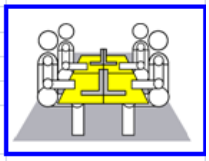
An open or semi-open support space where visitors can be received and can wait for their appointment.



Circulation space

Support space which is required for circulation on office floors, linking all major functions.

Figure 90 Surface area per workplace

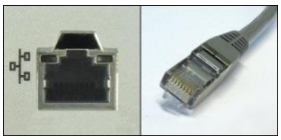
werkplekken						
1-persoonsruimte	2-persoonsruimte	teamwerkplek	half open werkruimte	loungewerkplek	stiltewerkplek	open werkruimte
						
Een afgesloten ruimte voor 1 persoon, geschikt voor activiteiten die veel concentratie vereisen (lezen, schrijven, denken) of vertrouwelijk zijn.	Een afgesloten ruimte voor 2 personen, geschikt voor semi-geconcentreerd werk en samenwerking in klein teamverband	Een afgesloten ruimte voor 3 of meer personen, geschikt voor teamwerk, of routinematige activiteiten (@@maar moeten we het dan een teamruimte noemen?)	Een half-open ruimte voor meerdere personen, geschikt voor activiteiten die vragen om interne communicatie, of relatief weinig concentratie vereisen. Half hoge scheidingen kunnen gebuikt worden om bijv. teams te groeperen	Een half-open werkplek voor 2 tot 4 personen met het uiterlijk van een bank of café zitje	Een afgesloten ruimte voor 1 persoon, die flexibel gebruikt kan worden voor activiteiten die veel concentratie vereisen (maximaal een halve dag).	Een open ruimte voor meerdere personen, geschikt voor activiteiten die vragen om interne communicatie, of relatief weinig concentratie vereisen.
oppervlakte per medewerker						
15 m2	7 m2	6 m2	6 m2	6 m2	6 m2	6 m2

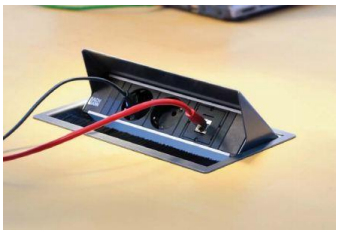
Appendix 5 ICT in differen the workplaces

CYOD (Choose Your Own Device)

Supported Cisco Video Endpoints

BYOD (Bring Your Own Device)





werkplekken

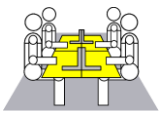
1-persoonsruimte

Een afgesloten ruimte voor 1 persoon, geschikt voor activiteiten die veel concentratie vereisen (lezen, schrijven, denken) of vertrouwelijk zijn.

CYOD X%

BYOD

open werkruimte



Een open ruimte voor meerdere personen, geschikt voor activiteiten die vragen om interne communicatie, of relatief weinig concentratie vereisen.

BYOD

stiltewerkplek

Een afgesloten ruimte voor 1 persoon, die flexibel gebruikt kan worden voor activiteiten die veel concentratie vereisen (maximaal een halve dag).

CYOD X%

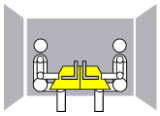
BYOD

Half open werkruimte

Een half-open ruimte voor meerdere personen, geschikt voor activiteiten die vragen om interne communicatie, of relatief weinig concentratie vereisen. Half hoge scheidingen kunnen gebuikt worden om bijv. teams te groeperen

BYOD

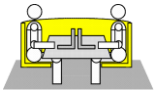
2-persoonsruimte



Een afgesloten ruimte voor 2 personen, geschikt voor semi-geconcentreerd werk en samenwerking in klein teamverband.

BYOD

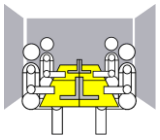
loungewerkplek



Een half-open werkplek voor 2 tot 4 personen met het uiterlijk van een bank of café zitje.

BYOD

teamwerkplek



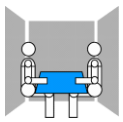
Een afgesloten ruimte voor 3 of meer personen, geschikt voor teamwerk, of routinematige activiteiten (@@maar moeten we het dan een teamruimte noemen?)

BYOD

Source: (Meel, et al., 2010)

overlegruimten

kleine overlegruimte



Een afgesloten ruimte voor overleg met 2 tot 4 personen. Denk aan kleine vergaderingen en vertrouwelijke gesprekken, Door op de kamer te overleggen hebben anderen geen last van het geluid. De ruimte is vrij te gebruiken.

CYOD

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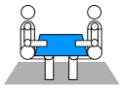
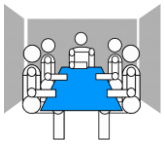
open overlegruimte (klein)



Een open ruimte voor kort informeel overleg met 2 tot 4 personen.

BYOD

grote overlegruimte

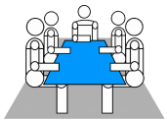


Een afgesloten ruimte voor overleg met 4 tot 8 personen. Denk aan vergaderingen en gepland overleg.

CYOD

BYOD

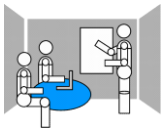
open overlegruimte (groot)



Een open ruimte voor informeel overleg met meer dan 4 personen.

BYOD

brainstormruimte

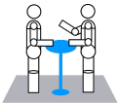


Een afgesloten ruimte voor 'brainstormachtige' activiteiten. De indeling van de kamer is flexibel. De ruimte is voorzien van speciale inventaris zoals whiteboards en flipovers.

CYOD

BYOD

ontmoetingsruimte



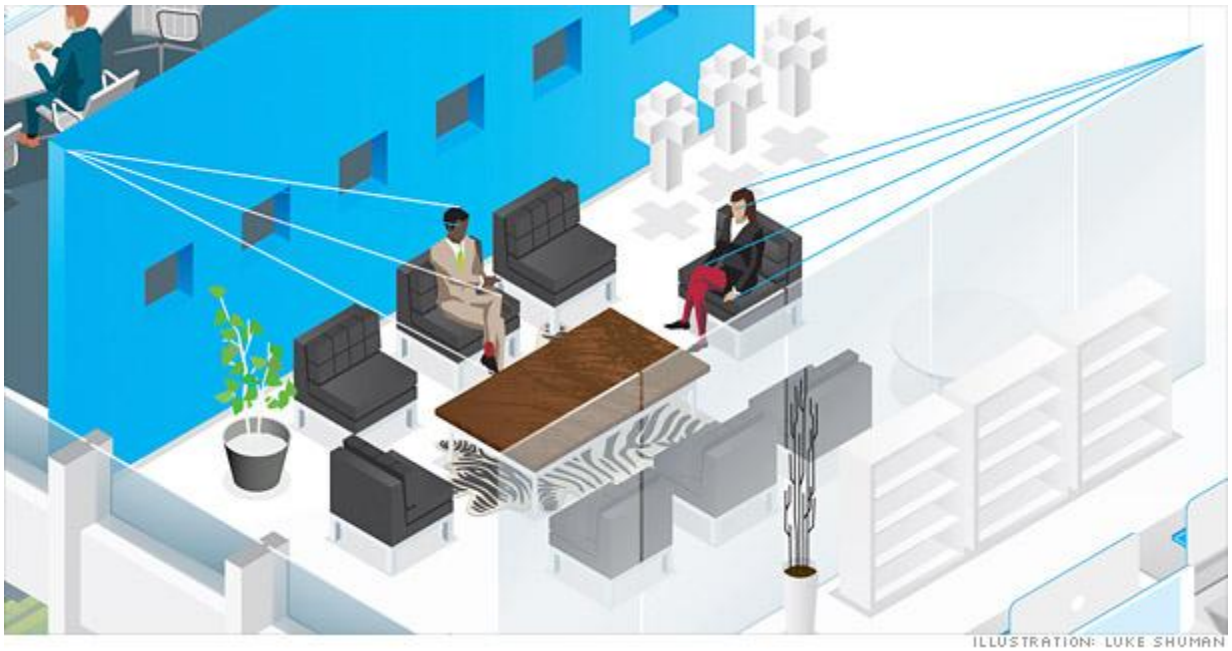
Een open ruimte met bijvoorbeeld statafels waaraan medewerkers makkelijk en snel kunnen overleggen.

BYOD

Source: (Meel, et al., 2010)

Appendix 13 The office of the future

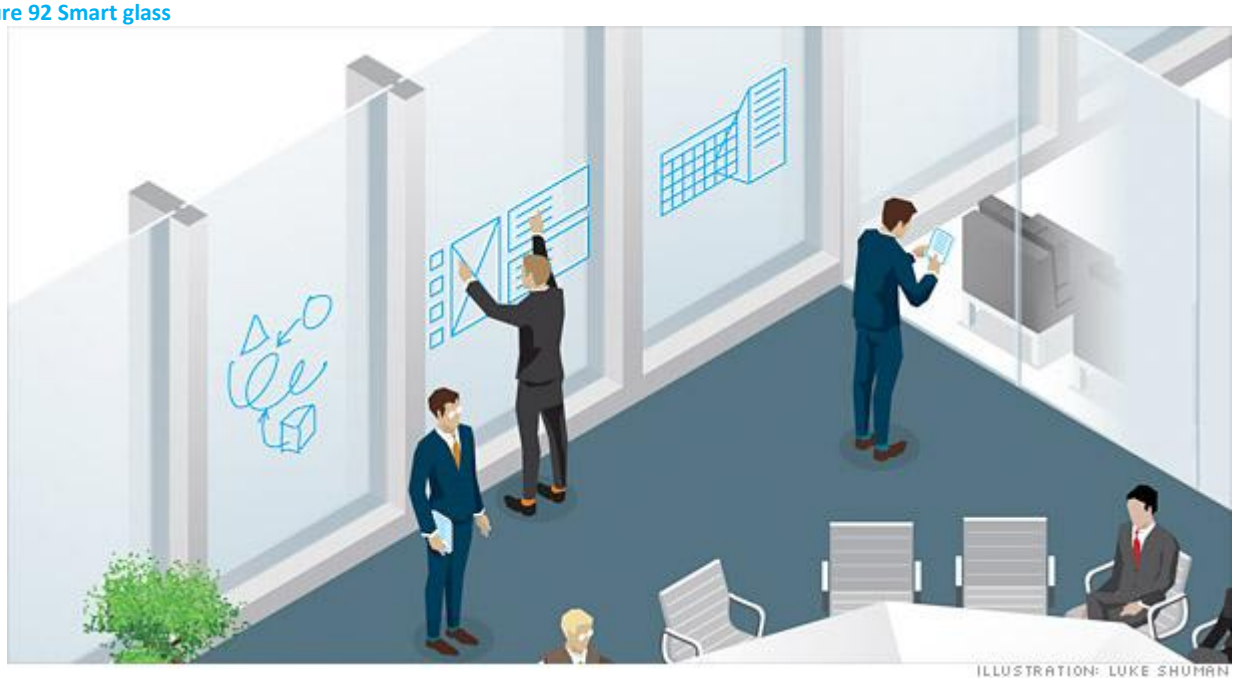
Figure 91 Office matchmaker



On the other hand, with much less potential employment, we will potentially see greater social and political upheaval that will also be reflected in the workplace. With job security virtually eliminated by technological obsolescence, security at the workplace will increasingly be a factor.

Software will be able to track employee whereabouts and marry that data with information about current projects to produce a list of potential collaborators.

Figure 92 Smart glass

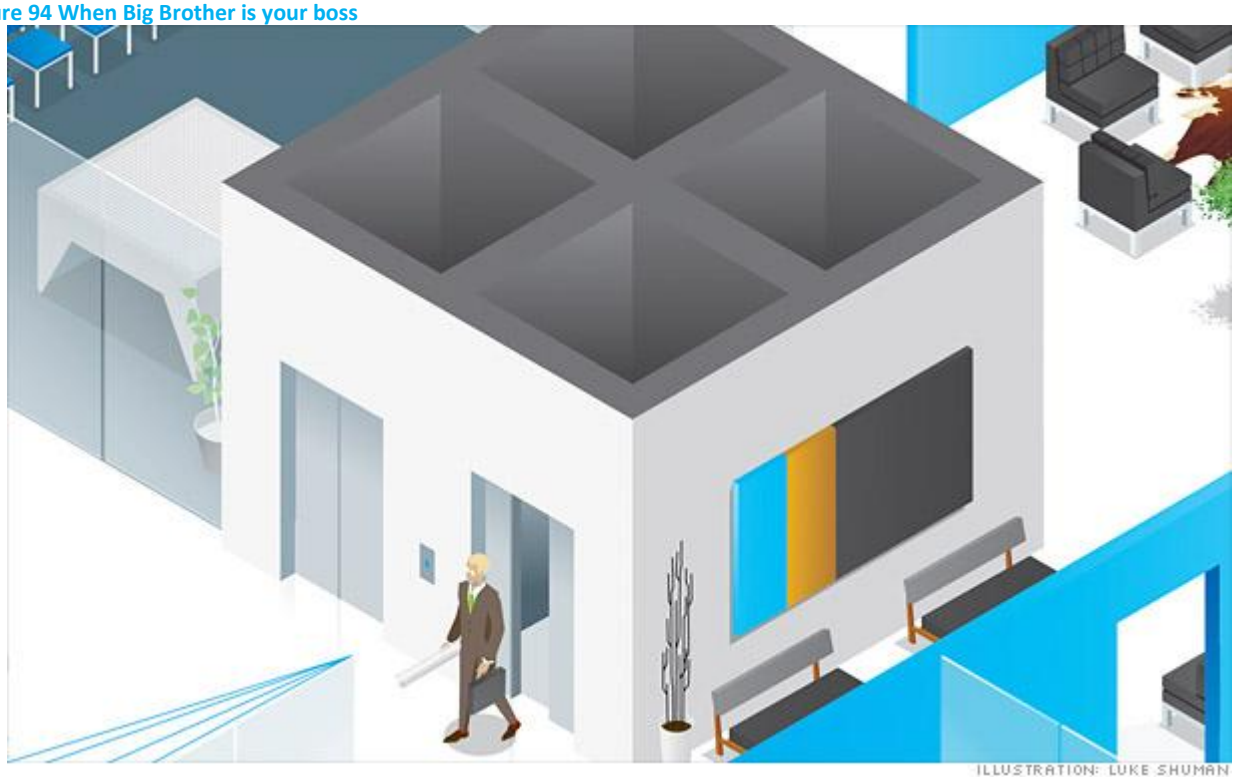


Offices will be outfitted with special window glass that can morph from solar panel to multimedia screen to frosted privacy shade.

Figure 93 Rollable glass

Ultra slim, large sheets of film will replace cumbersome paper blueprints. Designers can flip through hundreds of documents and make changes on the fly.

Figure 94 When Big Brother is your boss



The office of the future will be a digital, data-driven place. For many workers the productivity gained by having a computer program tell you exactly whom you should team up with on your next project far outweighs the big-brother nature of how the software arrived at its conclusion (tracking your whereabouts, monitoring your work). More "work product" will be recorded and stored; teleconferences will be instantly transcribed and the text saved, for example.

Privacy experts say companies will have to give employees full control over their privacy: Workers will need to grant permission to be recorded in a videoconference, for example, and they should be able to maintain their online computer through customised settings.

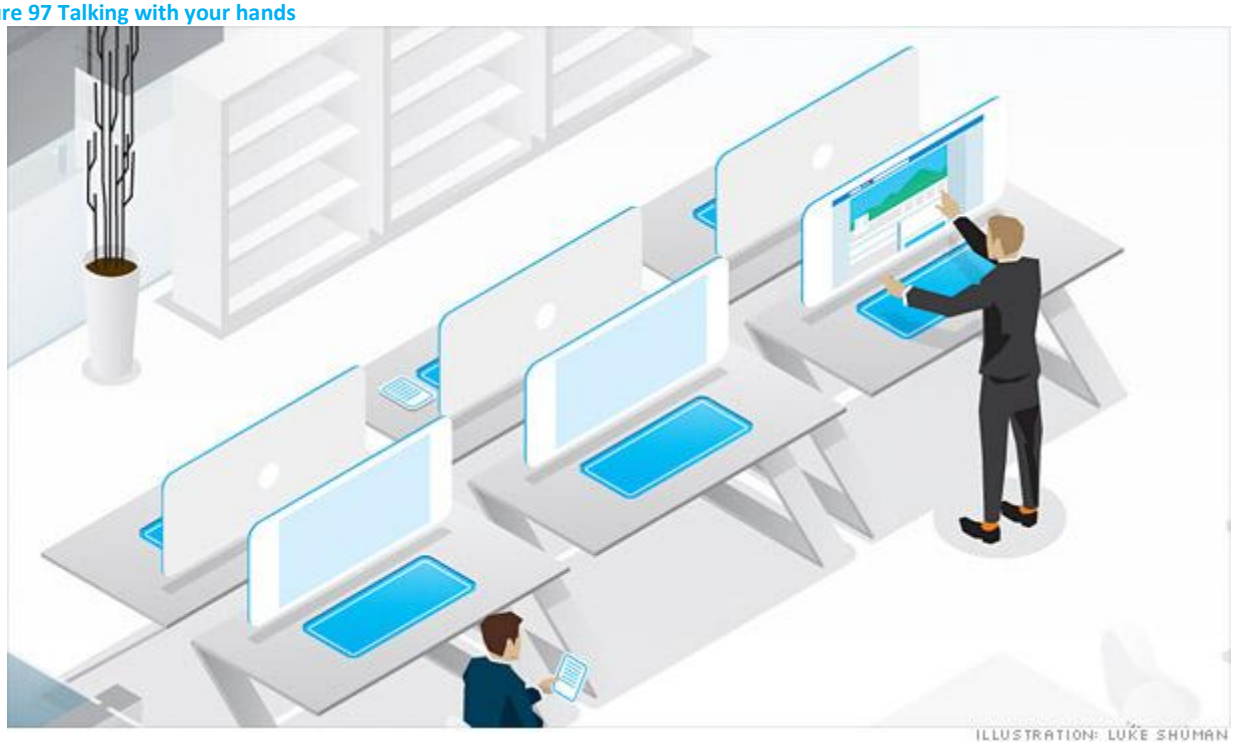
Figure 95 Teleprescenc

Moreover, as many would attest, the advent of mobile technology and Telepresence systems has not led to better work-life balance for most workers. Teleprescence will also extend to robot avatars roaming offices with users being globally remote.

Figure 96 Hologram table

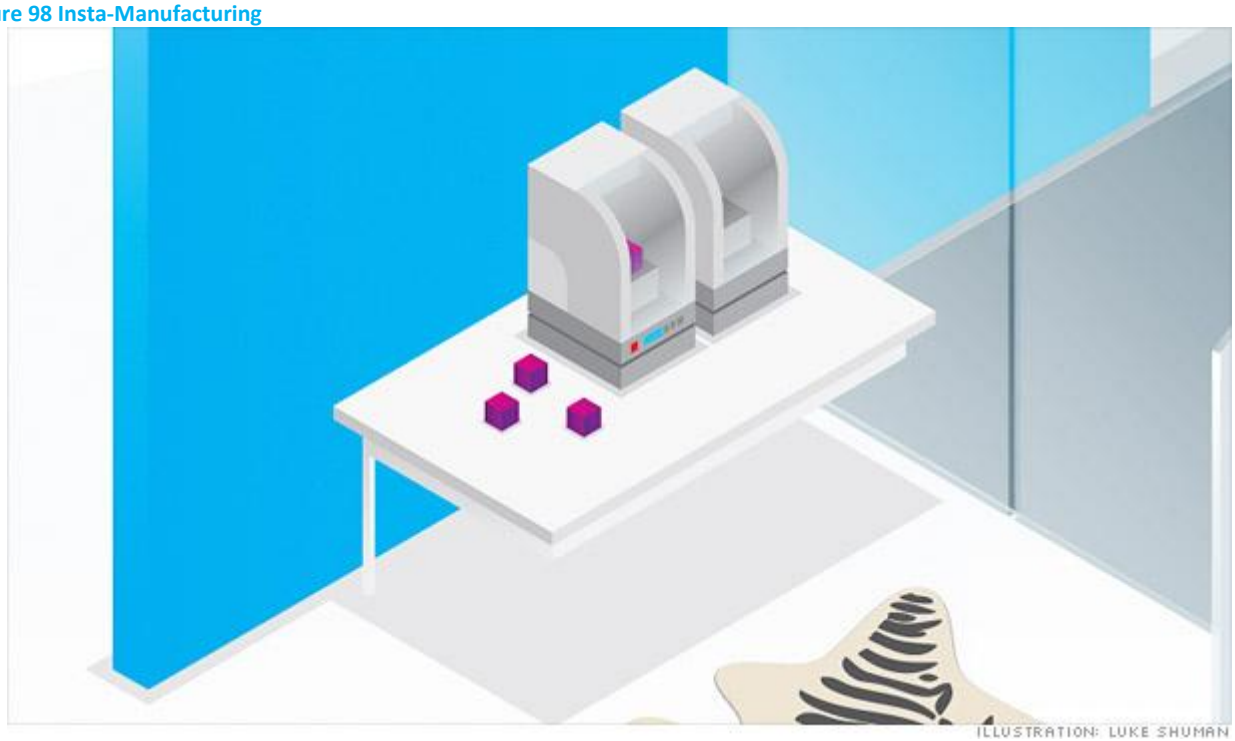
Using a combination of proprietary software and special lenses and lights, next-gen "tables" will be able to render 3-D holograms of real-world objects. No special glasses required.

Figure 97 Talking with your hands



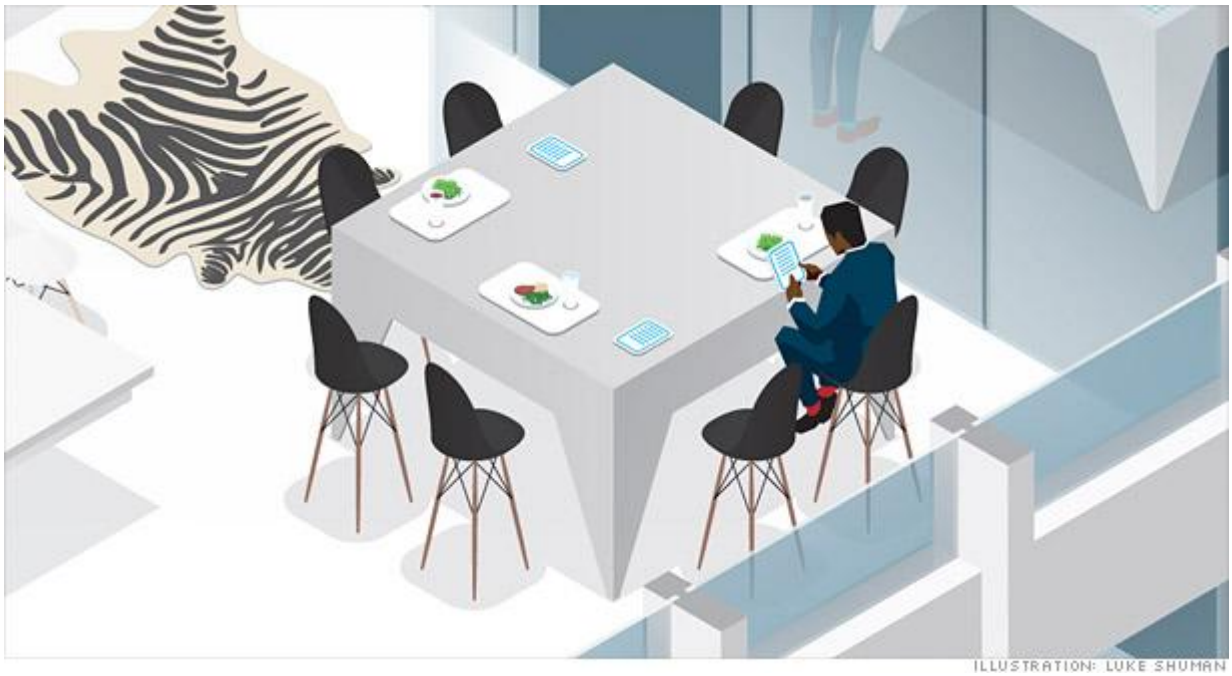
The same technology that powers game consoles like Microsoft's Kinect will let workers navigate computer screens with the flick of the wrist.

Figure 98 Insta-Manufacturing



Affordable desktop-size 3-D printers will let workers churn out small prototypes, hastening the product-development cycle.

Figure 99 Cafeteria culture

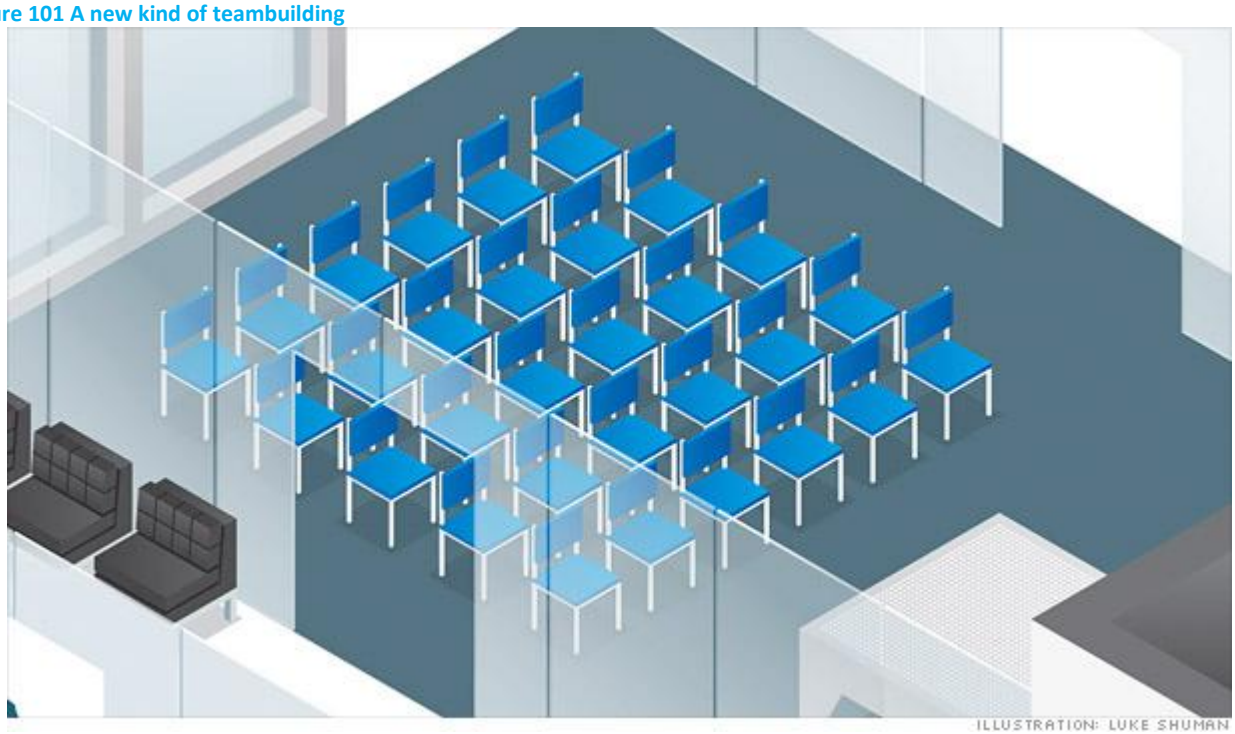


Apps on phones and desktops will let employees peruse the menu, order, and pay for lunch. All they'll need to do is pick up their meal.

Figure 100 Subtitled calls

Real-time translations will also be transcribed and scroll across a computer screen so that Teleconferencers can hear and see the words on the other end of the line. Teleconferencing suites will be outfitted with computer programs that can translate languages instantaneously, expediting chats among colleagues who don't speak each other's native tongue.

Figure 101 A new kind of teambuilding



For the past 100 years business leaders have been trained to manage teams that are similar intellectually but widely disparate psychologically, a group of engineers, say, whose members might be disciplined, introverted, anxious, cooperative, or any of a million combinations. That structure worked fine when business models lasted decades.

In tomorrow's world the leader's job will be reversed. As companies revamp business models continually, the only teams that can do the job fast enough will have members who are highly diverse intellectually; the engineers, marketers, and designers will meet in the same room.