

Helping Corporate Real Estate Management with the implementation of a modern work environment that supports employees and their activities : an analysis of different preferences in 5 European countries

Citation for published version (APA):

Appel - Meulenbroek, H. A. J. A., Kemperman, A. D. A. M., Liebregts, M. M. M., & Oldman, T. (2014). Helping Corporate Real Estate Management with the implementation of a modern work environment that supports employees and their activities : an analysis of different preferences in 5 European countries. In *Proceedings of the 21st Congress of the European Real Estate Society (ERES 2014), 25-28 June 2014, Bucharest, Romania*

Document status and date:

Published: 01/01/2014

Document Version:

Accepted manuscript including changes made at the peer-review stage

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

Helping Corporate Real Estate Management with the implementation of a modern work environment that supports employees and their activities: An analysis of different preferences in 5 European countries

Rianne Appel-Meulenbroek*; Eindhoven University of Technology, Department: Real Estate Management & Development, the Netherlands

Astrid Kemperman; Eindhoven University of Technology, Department: Urban Planning, the Netherlands

Marianne Liebrechts; BNP Paribas, the Netherlands

Tim Oldman; Leesman, UK

* Corresponding author: +31(0)40 247 2092 / h.a.j.a.appel@tue.nl

Structured Abstract:

Purpose – Nowadays the worker is the most important production factor for knowledge organisations, and thus Corporate Real Estate Managers must focus on supporting the employees. The trend towards activity based working in modern work environments demands a work environment that is adapted to their preferences in order to contribute to employee satisfaction and maximally leverage their talent. Because the way employees experience and use the office environment depends on national culture, implementing new ways of working might require different strategies in different countries. This paper describes research into employee preferences regarding work activities and the work environment in 5 European countries, and the implications of differences that came forward.

Design/methodology/approach –Based on a literature review, hypotheses are proposed about the importance of different activities in and features/facilities of the modern work environment. These are tested with the Leesman database, from which 32,006 employee questionnaires from Sweden, the Netherlands, Great Britain, France and Germany were selected. The tests include 21 workplace activities, 19 workplace features and 18 workplace facilities. The data are analysed with principal component analyses and F- Tests to study differences between the countries.

Findings – Based on the importance assigned to the 21 workplace activities, 4 factors could be distinguished (interaction, collaboration, concentration, facility dependent activities). The Germans attach more importance to interaction activities, while the Dutch and Swedish employees mention collaboration as most important. The importance assigned to the 37 workplace features and facilities could be clustered into 7 workplace factors. While the French and Germans find it most important to be able to work place independent with the right ICT, the Swedish really care about meeting areas. Building services are only important to British employees. More differences between the countries are discussed, after relating the workplace components to the most important activities.

Implications – Multinationals are implementing new ways of working at their locations around the world, without taking these differences into account. The results of this study stress that a one-size-fits-all concept is not always the best way to support your employees. This might explain why the implementation of new ways of working is not always successful, and is increasingly being opposed by employees.

Originality value – Previous studies have focused on employee satisfaction with the work environment that is offered (pre and/or post move) or asked designers about the influence of culture on the workplace design. In this paper we actually ask employees what their preferences are, regardless of the current work environment. It is the first study that compares and tests differences between preferences of European employees on this scale, and also to relate these preferences for the work environment with preferences for certain activities and compare countries.

Keywords: new ways of working, work environment, CREM, employee preferences, European differences

Introduction

The way of working has changed due to developments of technology, globalization, information abundance and individualization of the society (Bijl, 2009). As innovation has become a central element for companies, inexpensive and efficient work processes no longer ensure continuity. The ability to rapidly develop and sell new ideas now contributes to the continued existence of an organization in the increasingly competitive business environment. Activities of employees, like knowledge sharing, are very important conditions for organisations to be innovative (Appel-Meulenbroek, 2014). As a consequence, the employee is no longer seen as a replaceable tool of the work process, but the process is seen as a tool to support the unique work of the employee.

Knowledge work can be defined as: *“the acquisition, creation, packaging, or application of knowledge. Characterized by variety and expectation rather than routine, it is performed by professional or technical workers with a high level of skill and expertise”* (Davenport, Jarvenpaa and Beers, 1996). This new character of work requires a different organization of work, leading to a changing way of working. To ensure that the talent of the employees can be used optimally, the work environment of an employee should be aligned with the work activities of an employee. Through innovation in office design and its use, organizations try to align the accommodation, ICT and facilities to the changed work processes for an optimal performance of the organization as a whole (Vos and Van der Voordt, 2001). As Inalhan (2009) mentions: *“a growing number are introducing new ways of working practices in their physical work environments to respond better to dynamics in the work society and to handle space (facilities) more effectively and efficiently.”*

But to create a successful work environment, it is important to have insight in the demands and behaviour of employees using this environment (Oseland, 2009). These preferences of employees should be taken into account during the design of a new physical work environment. If not, it may take a long time before the employees accept the work style or the workers may even oppose to the changes pursued by management. As the implementation of a different way of working is a long, complex, multidisciplinary and radical changing process, it is not surprising that initiatives can also fail. According to Bijl (2009) roughly 80 % of the implementation processes did not appear to result in success.

Although multinationals implement an exact copy of a workplace strategy in multiple countries, research has shown that national culture also influences how the work environment is or should be designed (Steelcase, 2009). The way employees experience and use work areas is also culturally dependent dimension (Plijters, 2012). These post occupancy evaluations of designs and their use are very valuable, both for practice as for scientific insights. But the analysis of employee behaviour this way is always related to an existing work environment. It would be interesting to study in general what employees find important in their physical work environment, and whether this differs between countries. This paper contains such an analysis of stated preferences of 32,006 employees from 5 different European countries on importance of workplace activities, features and facilities. The central research questions in this paper are:

- 1) does the importance of workplace activities differs between countries,
- 2) does the importance of the features and facilities of the workplace environment differ between countries and
- 3) is there a difference in the importance of elements of the work environment for important workplace activities per country?

The first section describes the few studies that exist on national culture and workplace design. Then literature on workplace activities, features and facilities is discussed, to determine which ones should be taken up in research on workplace design. After the literature review, the research approach is described, followed by the results and concluded with a discussion and recommendations.

Culture and workplace design

According to Leung et al. (2005) culture can be defined as values, beliefs, norms, and behavioural patterns of a group. The culture of people has consequences for the way people think, behave, solve problems, make decisions, plans and lay out their homes and cities, and even organize their economic, political and transportation systems (Hall, 1976). Different levels of culture can be distinguished (Karahanna et al, 2005): supranational, national, professional, organizational and group. Culture consists of values and practices, but their importance in determining the culture is not the same at each level (see Figure 1). In contrast to corporate (organizational) culture, the national culture is based mainly on values and to a lesser extent on practices. Values are the core of culture and harder to influence than practices (Hofstede, 1991), so it is even more important for the work environment to match these values (to a certain extent).

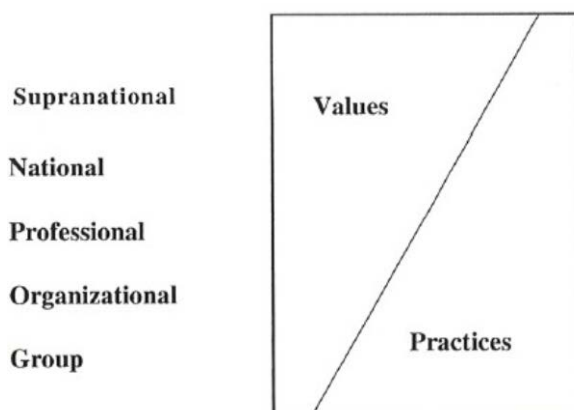


Figure 1 Values and practices at cultural levels (Karahanna et al, 2005)

Organisations and their Corporate Real Estate Management (CREM) are well aware of the organizational culture and brand, and do take this into account during workplace decision making (Appel-Meulenbroek et al 2010). The national culture appears to be neglected more, as multinationals implement an exact copy of a workplace strategy in multiple countries (Steelcase, 2009). But national culture influences managerial and work behaviour (Ali and Brooks, 2008), so it should not be neglected. Steelcase indicates that if an organization wants to use the workplace as a strategic element it is important to align the workplace with both national and organizational culture. With the projected decrease in workforce (in western European countries) during the next decennia, the work environment and corporate culture also turn into important elements of competitive advantage in attracting the best knowledge workers (Puybaraud, 2007).

Hofstede and McCare (2004) defined five dimensions on which cultures can be classified: power distance (autocratic vs consultative), individualism/collectivism, femininity/masculinity, uncertainty avoidance and long-term orientation. Power distance can be described as *“the extent to which it is accepted by less powerful member of institutions and organizations that power is distributed unequally”* (Hofstede, 1991). The dimension individualism versus collectivism describes the strength of the relations between individuals. In an individualistic society everyone has to look after himself or herself. Masculinity reflects societies in which social gender roles are clearly distinct. Uncertainty avoidance concerns how comfortable people feel in case of ambiguous situations. Orientation refers to whether people are oriented on the future or the present. The five European countries in this paper can be positioned on these dimensions as visible in Figure 2.

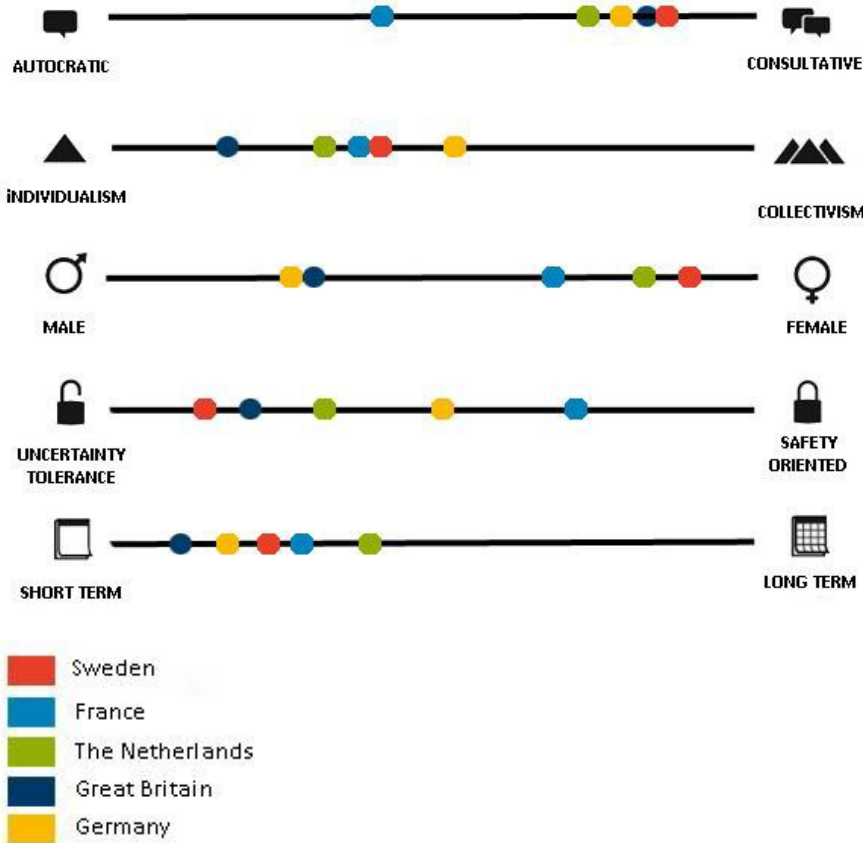


Figure 2 Dimensions of 5 European countries (adapted from Steelcase, 2009; Sweden is added)

Steelcase (2009) has analysed these dimensions for national culture in eleven countries in order to describe the influence of national culture on the work environment, based on insights from observations and findings from secondary research. The focus of that research was to align the local and organizational culture, as they influence the design of the work environment. The analysis resulted in a description of how different countries are coping with space optimization, alternative work locations and creative collaboration. According to Steelcase (2009) national culture affects the way that businesses optimize spaces. The tolerance for stocking densities and acceptance of alternative workplace strategies determine how the space can be optimized in the best manner in a culturally acceptable way. A high score on power distance influences the physical environment of an organization, as it results in hierarchy within the organization. The physical environment must be a reflection of that authority and position. Individualism results in workplaces that are designed to make best use of real estate, are progressive and aim to drive innovation. The dimensions power distance and uncertainty avoidance influence the way a country offers alternative work locations. Employees in cultures with high uncertainty avoidance are more cautious with sharing information. Employees in these countries also want to first consult with colleagues before they make decisions. Cultures where employees like to keep information to themselves interact differently with work than cultures where employees like to share information. Creative collaboration takes place in reserved spaces by a formal process in countries that are safety oriented. Companies in a country that have a low score on uncertainty will sooner adopt new spaces and processes, thus Steelcase's results.

Plijters (2012) has also studied which dimensions of national culture affect workplace design. Based on literature review and empirical research this study determined for Germany, Great Britain and The Netherlands how the work environment is designed regarding the dimensions of Hofstede. According to Plijters, national culture affects the type of the office, the number of people in the office, the privacy, the placement of management and the differentiation in the workplace based on function the most. In case of a high power distance there is a differentiation in workplace based on hierarchy. Also, in individualistic cultures workplaces are designed more progressively, focused to drive innovation and to optimally use real estate, thus Plijters' results.

Workplace activities, features and facilities

The main idea behind most forms of new ways of working is to optimally support employees with a work environment that matches their needs during different activities. So as Raymond & Cunliffe (1997) state: *"activities are at the centre of any decision-making about the workplace"*. Several types of activities can be distinguished in service organizations (Van der Voordt & Vos, 2001), for which the number of users, workdays, formality level, concentration level, and required facilities can vary (Tabak, 2009; Mooij, 2002). Van der Voordt and Vos (2001) distinguish types of activities on the basis of the nature of the activity. Tabak (2009) made a distinction of workplace activities based on whether they are job related or not, the number of participants and intentionality. Appel-Meulenbroek, Groenen and Jansen (2011) determined a classification of activities based on these aspects as well (see Table 1) and used it to study use of modern workplace environments.

	Social	Physiological	Job related	Individual	Group	Planned	Unplanned
Behind the computer			X	X			X
Writing			X	X			X
Reading			X	X			X
On the Phone			X		X	X	X
Archiving			X	X			X
In a meeting			X		X	X	
Informal talk	X		X		X		X
Presenting			X		X	X	
Lunch	X	X			X	X	X
Toilet visit		X		X			X
Coffee break	X	X				X	X
Other break	X	X			X	X	X

Table 1 Taxonomy of activities (Appel-Meulenbroek, Groenen and Jansen, 2011)

The goal of organizations (and CREM) that are implementing new work environments specifically aimed at the employees and their activities is usually an increase in satisfaction and productivity. In a Corenet survey, 271 CRE managers worldwide were asked to rank possible CRE strategies, showing that (after reducing costs) increasing productivity is indeed an important strategy (Gibler, Lindholm and Anderson, 2010). A study by Haynes et al. (2000) among more than 1,000 respondents in 27 different office environments showed that 70% regarded the work environment as an important or very important influence on their perceived productivity. Also, satisfied employees work more productively than unsatisfied employees (Fisk and Rosenfeld, 1997; Wyon, 2004; Inalhan, 2009; Van der Voordt, 2004).

Various studies have looked at the influence of features and facilities of the work environment on employee satisfaction. There is not always a clear line to what defines a feature and what defines a facility. In this paper, features are regarded to be part of the workspace, e.g. a desk, chair, but also greenery, art and pictures and characteristics like air quality control. Facilities on the other hand, are more focussed on a certain service on a more general level (= the office as a whole) in the work environment, e.g. parking facilities, a restaurant and aspects such as cleanliness.

Previous studies have shown that a large amount of environmental characteristics influence employee productivity and satisfaction (Brill et al, 2001; Barber, 2001, Batenburg and Van der Voordt, 2008). Brill et al. (2001) asked 13,000 respondents from 80 organizations to rank environmental aspects and came up with a top 10 (see Table 2). The top 10 presented by Brill et al. not only shows the most important features and facilities, but also links them with associated activities in their naming of the features. Some aspects are part of the physical work environment (e.g. lighting), while others are more a condition created by the work environment. These conditions must be operationalised into features. Batenburg and Van der Voordt (2008) distinguish 8 categories with aspects of the physical environment that influence satisfaction of employees. Several categories and aspects can be interpreted as features, and they are similar to the results of Brill et al (see Table 2). Their category services is split in what this paper considers to be features and what is considered as facilities (see Table 3). Batenburg and Van der Voordt also mention the categories 'looks', 'image' and 'psychological aspects', which are mostly outside the scope of this paper and thus not mentioned in the tables. Barber (2001) held 1,500 telephone interviews with US employees. The top 5 of aspects

was mentioned by 70% as making them more productive, and the top 10 by at least 50% and are similar to the other studies in Table 2. So, Table 2 and Table 3 appear to present a complete overview of work environment features and facilities to support employees.

Brill et al. 2001	Batenburg and Van der Voordt, 2008	Barber, 2001
1. Ability to concentrated individual work	<ul style="list-style-type: none"> Office layout Psychological <ul style="list-style-type: none"> Not disturbed by noise 	4. Quiet space 9. Privacy
2. Favourable conditions for spontaneous social interaction	<ul style="list-style-type: none"> Informal meeting space 	
3. Favourable conditions for undisturbed meetings and group work	<ul style="list-style-type: none"> Formal meeting space 	
4. Ergonomic comfort and enough space for office attributes	Work environment <ul style="list-style-type: none"> Size Desk + comfort level Screen/keyboard Chair + comfort level Ergonomic aids Workplace layout Services <ul style="list-style-type: none"> Archive storage Psychological <ul style="list-style-type: none"> Room for personal attributes 	2. Storage space 5. Possibility to personalize the workplace to individual workstyle 6. Ergonomic seating
5. Favourable conditions for side by side work and to invade for a chat	<ul style="list-style-type: none"> Office layout Orientation in the office 	
6. Short distance to colleagues and easy to find	Accessibility	
7. Good spots for taking a break ¹	<ul style="list-style-type: none"> Office layout 	
8. Access to the necessary technology ¹	Services <ul style="list-style-type: none"> ICT helpdesk Presentation aids 	1. State-of-the-art technology
9. Good lighting and daylight entry	Climate <ul style="list-style-type: none"> Temperature Ventilation Air quality Daylight Lighting Acoustics Noise level 	8. Lighting control 10. An exterior window
10. Personal influence of air quality and temperature	<ul style="list-style-type: none"> Individual climate control Individual lighting control 	3. ability to control climate personally

Table 2 Work environment features

¹ This is considered to be a facility instead of a feature in this paper, so it will be moved to table 3

Reception
Postal service
Opening hours building
Canteen
Coffee/tea machines
Cleaning
Security and surveillance
Booking confidential rooms
Reservation of project rooms
Presentation resources
Clean and tidy
ICT

Table 3 Work environment facilities (Batenburg and Van der Voordt, 2008)

Research approach

To answer the research questions, secondary data, collected for the Leesman database (www.leesmanindex.com), is used. Leesman collects data among employees in organizations on how well office environments support employees in their work. The database is currently the broadest contemporary resource of data related to workplace effectiveness. Leesman uses this data for measuring and benchmarking the performance of the physical work environment of an organization. In this research the data is used for analysing the relation between national culture and preferences of employees with regard to the work environment.

The data is collected by an online questionnaire. A project specific URL link to the survey is sent to an appointed person from an organization that will send out this URL out on the day the survey is launched. This URL link will provide employees of the organization entrance to the online survey hosted on the server of Leesman.

In 2010 the first questionnaires were presented to employees and from that moment on 35,901 employees have completed the questionnaire (up till 2013). In 2013, 95% of the data was derived from employees from Europe. For this study data from 32,006 respondents from 5 European countries were selected. Table 4 gives an overview of the number of respondents per country.

Country	Number of locations	Number of respondents	Percentage of total
France	7	280	0.9 %
Germany	7	79	0.2 %
The Netherlands	12	990	3.1 %
Great Britain	204	21129	66.0 %
Sweden	12	9528	29,7 %
Total	242	32006	100.0 %

Table 4 Selected respondents from Leesman Database

All respondents worked in an office building, but in diverse industries. However, because they are all office organisations, to a large extent their employees have similar work processes and behaviour

(Shpuza, 2006; Steen, 2009). In some countries a smaller amount of employees has completed the questionnaire. Therefore, these results will be interpreted with care.

The Leesman questionnaire contains questions on the importance employees attach to workplace activities, workplace features and workplace facilities. The database contained only a limited number of missing values; the highest percentage of missing values was only 2% for some of the workplace features and facilities. Table 5, shows that the Leesman activities cover the entire taxonomy from literature and even elaborates further on certain activities. Only the types of break are not distinguished. All the necessary work environment features (see Table 6) and facilities (see Table 7) for the analyses could also be selected from the database.

For all the variables, respondents indicated their importance by 1 (important) or 0 (not important). The next section will sum up the data description and results, after which these results are discussed in the last section.

Taxonomy of activities	activities included in analyses
Behind the computer	Individual routine tasks
Writing	Individual focused work, desk based
Reading	Reading
On the Phone	Telephone conversation
Archiving	Individual focused work away from your desk
In a meeting	Video conferences
	Hosting visitors, clients or customers
	Private conversations
	Business confidential discussions
	Learning from others
	Collaborating on focused work
Informal talk	Collaborating on creative work
	Informal social interaction
	Informal, unplanned meetings
Presenting	Private conversations
	Planned meetings
	Larger group meetings or audiences
	Audio conferences
	Spreading out paper or materials
Lunch Toilet visit Coffee break Other break	Using technical / specialist equipment or materials
	Relaxing / taking a break

Table 5 Activities included in analyses

Taxonomy of features (Brill et al. 2001)	Work environment features
Ability to concentrated individual work	Quiet rooms for working alone or in pairs
	Dividers (between desks / areas)
	Space between work-settings
	Noise level
Favourable conditions for spontaneous social interaction	Atriums and communal areas
Favourable conditions for undisturbed meetings and group work	Meeting rooms (small)
	Meeting rooms (large)
Ergonomic comfort and enough space for office attributes	Desk
	Chair
	Archive storage
	Personal storage
	Ability to personalise my workstation
Favourable conditions for side by side work and to invade for a chat	People walking past your desk
	Variety of different types of workspace
Short distance to colleagues and easy to find	Accessibility of colleagues
Good lighting and daylight entry	Natural light
	Office lighting
Personal influence of air quality and temperature	Temperature control
	Air quality

Table 6 Work environment features

Taxonomy of facilities (Batenburg and Van der Voordt, 2008)	Work environment facilities
Reception	Reception areas
Postal service	Mail and post-room services
Opening hours building	Hospitality services
Canteen	Restauran/canteen
Coffee/tea machines	Tea, coffee and other refreshment facilities
Cleaning	General cleanliness
Clean and tidy	General tidiness
Security and surveillance	Security
Booking confidential rooms	Desk/room booking systems
Reservation of project rooms	
Presentation resources	Audio-visual equipment
ICT	Computing equipment
	Telephone equipment
	Printing/copying/scanning equipment
	Remote access to work files or network
	In-office network connectivity
Good spots for taking a break	Guest/visitor network access
	Informal work areas/break out zones
	Leisure facilities on site or nearby

Table 7 Work environment facilities

Importance of workplace activities per country

The respondents indicated the importance for 21 workplace activities as shown in Table 5. First, factor analysis was used to determine whether the collection of work activities of employees can be reduced to a smaller set. Specifically, Principal Component Analysis with Varimax rotation was used, and factors were extracted until eigenvalues were less than or equal to 1.0. Four factors of importance of workplace activities were identified. These factors were labeled based on the loadings of the workplace activities on these factors. The results of the analysis are shown in Table 8.

Summed over all 21 variables, the first factor explains 15 % of the sum of variances of the workplace activities, and was labeled *interaction based work activities* because planned meetings, business confidential discussions, private conversations, audio conferences, larger group meetings or audiences, hosting visitors, clients or customers and video conferences scored high on this factor. These activities mostly involve others and are often planned in advance. The second factor was called *collaboration activities* and activities such as collaboration on focused and creative work, and learning from others loaded high on this factor. For all these workplace activities it is essential that employees work together with other employees during a longer period. The distinction between interaction and collaboration is in line with innovation and knowledge sharing literature (Appel-Meulenbroek, 2014). This factor explains 12 % of the sum of variances of the 21 workplace activities. The third factor was named *facility dependent work activities* because for example reading, spreading out paper or materials, using technical or specialist equipment or materials and relaxing / taking a break loaded high. This factor explains 11 % of the sum of variance of all workplace activities. The last factor was labeled *concentration based activities* and included the variables such as individual focused work desk based and reading. This last factor explains 8 % of the sum of variances of the 21 workplace activities. While performing these workplace activities, the expectation is that employees do not want to be disturbed and need privacy.

In order to analyze the importance of workplace activities in different countries it is tested whether the mean factor scores of importance of workplace activities differ significantly per country. The results of the F-test are presented in Table 9. The results indicate that respondents from Germany indicate interaction based work activities as more important than respondents from the other countries. In contrast to respondents from France, Germany and Sweden, respondents from the Netherlands and Great Britain indicate interaction based work activities not important. In the Netherlands and Sweden respondents attach importance to collaboration activities. In France, Germany and Sweden facility dependent work activities are less important for the respondents. Concentration based work activities are less important for respondents in France, Germany and the Netherlands than compared to Sweden and the United Kingdom.

Table 8 Factor analysis importance workplace activities

Workplace Activities	Factors			
	<i>interaction based work activities</i>	<i>collaboration activities</i>	<i>facility dependent work activities</i>	<i>concentration based activities</i>
Business Confidential Discussions	.581	.112	.222	.239
Private Conversations	.379	.035	.312	.132
Audio Conferences	.657	.253	-.019	.208
Larger Group Meetings Or Audiences	.594	.265	.246	.142
Hosting Visitors Clients Or Customers	.661	.104	.193	.153
Individual Focused Work Away From Your Desk	.426	.259	.290	-.059
Video Conferences	.703	.216	.147	-.022
Collaborating On Focused Work	.172	.641	.070	.226
Collaborating On Creative Work	.270	.742	.071	.003
Creative Thinking	.205	.621	.222	.095
Learning From Others	.039	.583	.454	-.023
Individual Routine Tasks	.019	.130	.635	.152
Reading	.210	.274	.340	.331
Informal Social Interaction	.210	.386	.447	.158
Spreading Out Paper Or Materials	.398	.306	.448	-.218
Using Technical Or Specialist Equipment Or Materials	.398	.306	.448	-.218
Relaxing Taking A Break	.233	.178	.563	.073
Individual Focused Work Desk Based	-.097	-.021	.187	.641
Informal Unplanned Meetings	.310	.340	.012	.507
Planned Meetings	.325	.277	-.094	.557
Telephone Conversations	.286	-.042	.295	.508
<i>Eigenvalues</i>	3.188	2.523	2.351	1.688
<i>% of explained variance</i>	15.182	12.013	11.197	8.037

(N=32006)

Table 9 Importance of workplace activities per country

Countries	Mean Factor Scores	<i>interaction based work activities</i>	<i>collaboration activities</i>	<i>facility dependent work activities</i>	<i>concentration based activities</i>
	France (N=280)		.11	-.05	-.17
Germany (N=79)		.48	.12	-.20	-.35
Netherlands (N=990)		-.25	.20	.03	-.19
Sweden (N=9528)		.08	.36	-.19	.02
United Kingdom (N=21129)		-.03	-.17	.09	.01
Total		.00	.00	.00	.00
<i>F-test</i>		<i>F=39.861</i>	<i>F=494.767</i>	<i>F=126.508</i>	<i>F=16.740</i>
<i>P value</i>		<i>P=.000</i>	<i>P=.000</i>	<i>P=.000</i>	<i>P=.000</i>

Importance of features and facilities of the physical work environment per country

To analyze the importance of workplace features and facilities, again first a factor analysis is conducted to determine whether the set of workplace features and facilities of employees can be reduced to a smaller number of factors. Factor analysis was conducted on 37 workplace features and facilities describing their importance to the respondents (see Table 10). Principal Component Analysis with Varimax rotation was used, and factors were extracted until eigenvalues were less than or equal to 1.0. Seven factors describing the importance of workplace features and facilities were found.

The first factor explains 10 % of the sum of variance of these workplace features and facilities and is labeled *ICT + place independence* because variety of different types of workspace, accessibility of colleagues, audio or visual equipment, in office network connectivity, remote access to work files or network, guest or visitor network access and informal work areas loaded high on this factor. The second factor is called *building services* as it loaded all features and facilities related to services in the office environment. This factor explains 9 % of the sum of variance of all workplace activities. The third factor, *climate*, explains 9 % of the sum of variances of the 37 workplace features and facilities. This factor includes natural light, office lighting, temperature control, air quality, noise levels and people walking past your desk. The fourth factor was called *personalization + privacy* because all features and facilities that provide the ability to personalize the work environment or create a more personal space loaded high on this factor. This factor declares 7 % of the sum of variance of all workplace features and facilities. The next factor, explaining 6 % of the sum of variance, is called *meeting areas* and includes quiet rooms for working alone or in pairs and small and large meeting rooms. The factor that is called *office equipment* owes its name to the high loading on telephone equipment, computing equipment and printing / copying and scanning facilities. The last factor was labeled *desk / chair* and concerns the importance of a desk and a chair.

To test whether respondents from the five countries have different mean scores for the factors describing the importance related to workplace facilities and features Anova and F-test were conducted. Table 11 shows the results. The factor *ICT + place independence* is more important for employees in France and Germany. In contrast, this factor is less important for employees from Great Britain. French employees indicate the elements 'building services', 'climate', 'personalization + privacy', 'meeting areas' and 'a desk or chair' as less important. In Germany 'a workplace to work place independent' and 'climate' are more important elements of the work environment for employees than in other countries. 'Building services', 'meeting areas' and 'office equipment' are elements of the work environment that are less important for employees from the Netherlands. Employees from Sweden indicate the elements 'a work environment for working place independent' and 'meeting areas' as important. In Great Britain the element 'informal and service facilities' is the most important element of the physical work environment. Remarkably, employees from Sweden and Great Britain are less extreme in determining whether an element of the work environment is important for them. This is reflecting in the less extreme means of the factor variables.

Table 10 Factor analysis for the importance of workplace features and facilities

<i>Workplace features and facilities</i>	<i>Factors</i>						
	<i>ICT + place independence</i>	<i>Building Services</i>	<i>Climate</i>	<i>Personalization + privacy</i>	<i>Meeting areas</i>	<i>Office equipment</i>	<i>Desk\chair</i>
Variety of different type of workspace	.587	.262	.166	.234	.163	-.068	-.012
Accessibility of colleagues	.433	.207	.309	.168	.167	.115	-.004
Audio visual equipment	.682	.161	.107	.104	.074	.073	.022
In office network connectivity	.524	.015	.210	-.032	.187	.310	.064
Remote access to work files or network	.618	.050	.130	-.020	.158	.257	.040
Guest visitor network access	.681	.201	.077	.214	.095	.044	.014
Informal work areas break out zones	.401	.296	.201	.163	.336	.051	.009
Atrium and communal areas	.285	.554	.191	.193	.135	-.048	.085
Restaurant canteen	.055	.424	.055	.139	.154	-.173	.290
Leisure facilities onsite or nearby	.385	.441	.085	.223	.047	-.153	.102
Hospitality services	.477	.532	.062	.233	.0476	.004	-.003
Mail and post room services	.214	.606	.155	.230	.070	.214	-.022
Tea coffee and refreshments	-.015	.351	.161	-.038	.146	.063	.283
Reception area	.247	.626	.125	.181	.110	.113	.010
Security	.230	.591	.223	.120	.043	.220	-.022
General cleanliness	-.030	.488	.377	-.063	.11-	.308	.005
General tidiness	.068	.563	.375	.032	.084	.242	-.025
Natural light	.118	.207	.309	.168	.167	.115	-.004
Office lighting	.162	.227	.634	.209	.093	.179	.061
Temperature control	.056	.171	.603	.078	.042	.189	.098
Air quality	.229	.145	.684	.176	.065	.034	.068
Noise levels	.169	.086	.673	.186	.151	.016	.068
People walking past your desk	.222	.164	.502	.397	.115	-.028	.053
Dividers between desk or areas	.153	.029	.202	.648	.128	.011	.113
Personal storage	-.045	.202	.083	.477	.148	.343	.091
Archive storage	.375	.205	.098	.516	.028	.138	-.016
Ability to personalise workstation	.166	.174	.117	.656	.000	.081	.038
Space between work settings	.178	.131	.196	.623	.096	.105	.012
Quiet rooms	.378	.109	.2167	.185	.487	-.061	.056
Meeting rooms large	.195	.150	.099	.095	.783	.153	.032
Meeting rooms small	.142	.111	.142	.044	.815	.167	.053
Desk room booking systems	.398	.205	.174	.181	.447	.132	.032
Computing equipment	.130	.020	.120	.033	.044	.640	.210
Telephone equipment	.146	.107	.136	.189	.106	.617	.133
Printing equipment	.099	.216	.184	.179	.160	.533	.074
Desk	.023	.040	.077	.101	.023	.190	.797
Chair	.043	.040	.106	.055	.016	.186	.799
<i>Eigenvalues</i>	<i>3.711</i>	<i>3.480</i>	<i>3.287</i>	<i>2.634</i>	<i>2.219</i>	<i>1.982</i>	<i>1.589</i>
<i>% of explained variance</i>	<i>10.030</i>	<i>9.407</i>	<i>8.883</i>	<i>7.118</i>	<i>5.996</i>	<i>5.358</i>	<i>4.296</i>

Table 11 Importance of workplace facilities and features per country

<i>Countries</i>	<i>Mean Factor Scores</i>						
	<i>ICT + place independence</i>	<i>Building Services</i>	<i>Climate</i>	<i>Personalization + privacy</i>	<i>Meeting areas</i>	<i>Office equipment</i>	<i>Desk\chair</i>
France (N=266)	.62	-.42	-.30	-.52	-.24	.05	-.30
Germany (N=59)	.60	-.44	.11	-.17	-.12	-.12	-.33
Netherlands (N=929)	.01	-.17	.04	.02	-.27	-.20	-.02
Sweden (N=9489)	.14	-.26	.12	-.03	.20	-.18	.05
United Kingdom (N=20728)	-.07	.13	-.05	.02	-.07	.09	-.02
Total	.00	.00	.00	.00	.00	.00	.00
<i>F-test</i>	<i>F=105.79</i>	<i>F=290.42</i>	<i>F=56.23</i>	<i>F=23.76</i>	<i>F=143.10</i>	<i>F=131.15</i>	<i>F=15.92</i>
<i>P value</i>	<i>P=.000</i>	<i>P=.000</i>	<i>P=.000</i>	<i>P=.000</i>	<i>P=.000</i>	<i>P=.000</i>	<i>P=.000</i>

The importance of elements of the work environment for important workplace activities per country

Since many new work environments are based on the alignment of the office environment to workplace activities it is interesting to analyze the relation between the importance of elements describing the work environment for important workplace activities in different countries. For implementation of such a work environment in different countries, knowledge about the differences between the importance of elements of the work environment for important workplace activities is necessary. In order to analyze the importance of workplace elements for important workplace activities in different countries ANOVAs and F-test as a result of comparing the means of the factors related to the importance of the elements of the work environment were conducted. Table 12 shows the results of comparing the means of the factors of the importance of elements of the work environment for different workplace activities for different countries. In this table only significant results are presented.

Results show a significant difference between countries for all 7 elements of workplace features and facilities that came forward in the factor analysis. As the number of employees from Germany is smaller than the number of employees from other countries, the analysis is also performed without the data of employees from Germany to check for consistency of results. This showed no problems with this lower number of respondents.

In general, employees from all countries indicate a work environment to work place independent as important for all workplace activities. However there is one exception. In contrast to the employees from France, the Netherlands, Sweden and Germany, the employees from Great Britain indicate an environment to work place independent for individual focused work as less important.

Building services are important for all workplace activities for employees from Great Britain. Employees from the Netherlands indicate this element of the work environment as important for individual focused work away from your desk, learning from others, audio conferences, spreading out papers or materials, using technical or specialist equipment or materials, larger group meetings or audiences and hosting visitors / clients / customers. In Germany this element of the work environment is only important if employees indicate private conversations as important. Employees from Sweden want building services if they have to spread out papers or materials, if they use technical or specialist equipment or materials or if they have video conferences. In France this element of the work environment is only important for employees if they use technical or specialist equipment or materials.

The climate of the office environment is indicated as important for all workplace activities by employees from Germany and Sweden. Employees from Great Britain and the Netherlands indicate climate as important for almost all workplace activities, except for holding a private conversation. In France the climate is only important for two workplace activities; when employees have to learn from others and if employees have to use technical or specialist equipment or materials.

Personalization + privacy of the work environment is important for all workplace activities for the employees in both the Netherlands and Great Britain. In contrast, the employees in France do not indicate personalization + privacy as important for any workplace activity. In Sweden and Germany the employees indicate this element of the work environment as not important for individual focused work away from your desk, informal unplanned meetings and planned meetings. Additionally the employees from Germany indicate personalization + privacy not to be important for individual focused work away from their desk, informal social interaction, business confidential discussions, telephone conversations and audio conferences. Employees from Sweden and Great Britain indicate meeting areas as important for almost all workplace activities.

With regard to the importance of meeting areas employees of Sweden indicate this element of the work environment as important for all workplace activities. Also Great Britain and Germany indicate meeting areas as important for most of the workplace activities. Employees in Great Britain do not need meeting areas for individual focused work desk based, routine tasks, learning from others and the use of technical or specialist equipment or materials. German employees do not find meeting areas as important for the activities: individual focused work desk based individual focused work away from your desk, informal social interaction, private conversations, telephone conversations, audio conferences and for the use of technical or specialist equipment or materials. In contrast to Germany, Great Britain and Sweden, the employees from the Netherlands and France only need meeting areas for a small number of workplace activities. In the Netherlands employees want meeting areas for private conversations, audio conferences, for larger group meetings, for video conferences and if they host visitor, clients or customers. In France meeting areas are only needed if larger group meetings are important for employees.

Office equipment is important for all workplace activities for employees in France and Great Britain. In the Netherlands, Germany and Sweden this element of the work environment is only important for a small amount of workplace activities. In the Netherlands the employees want office equipment if employees find individual routine tasks and spreading out papers or materials important and if they indicate using technical or specialist equipment or materials as important. In Germany office

Concentration based activities	Relaxing	FR	.69	UK	.33	DE	.18	DE	.10	DE	.03	FR	.17	NL	.02	
	Taking A	DE	.86			NL	.19	NL	.17	SW	.24	UK	.08	SW	.11	
	Break	NL	.20			SW	.28	SW	.20	UK	.01			UK	.03	
		SW	.27			UK	.10	UK	.22							
		UK	.14													
	Individual	FR	.63	UK	.14	SW	.15	NL	.04	SW	.22	UK	.12	SW	.10	
	Focused	DE	.60			DE	.08	UK	.04			FR	.08	NL	.04	
	Work Desk	NL	.55			NL	.06							UK	.01	
	Based	SW	.14													
	Informal	FR	.78	UK	.19	DE	.10	NL	.07	DE	.05	FR	.06	NL	.06	
	Unplanned	DE	.71			NL	.12	UK	.06	SW	.30	UK	.14	SW	.08	
	Meetings	NL	.23			SW	.18			UK	.11			UK	.01	
		SW	.26			UK	.02									
		UK	.07													
	Planned	FR	.71	UK	.17	DE	.18	NL	.05	DE	.13	FR	.12	NL	.04	
Meetings	DE	.59			NL	.11	UK	.02	SW	.30	UK	.16	SW	.08		
	NL	.14			SW	.16			UK	.11						
	SW	.21														
	UK	.02														
Telephone	FR	.66	UK	.20	DE	.12	NL	.11	SW	.26	FR	.16	NL	.03		
Conversations	DE	.61			NL	.09	SW	.04	UK	.02	UK	.19	SW	.10		
	NL	.08			SW	.20	UK	.08					UK	.01		
	SW	.19			UK	.03										
	UK	.01														

Discussion, conclusions and recommendations

The factor analysis of the work activities of office employees in Europe has shown that these can be grouped into four major components. These components provide a clear insight in the work process of knowledge workers these days. Besides facility dependent work activities, the other three factors emphasize the known paradox between communication and concentration activities in an office. The communication activities can be split into two types of communication, namely interaction (e.g. business confidential discussions, conferences and hosting visitors) and collaboration (e.g. collaborating, creative thinking and learning from others). This split is in accordance with knowledge management and collaboration literature (Kahn, 1996).

Overall, communication is considered as more important by employees than the ability to concentrate or the facility dependent work activities. This is in line with the increased focus of organisations and their management on communication and knowledge sharing. It appears as if the employees have caught on to this necessity for modern knowledge organisations. Looking at the different European countries, it becomes clear that the culture of a nation influences this. Where the Netherlands and Sweden place most emphasis on collaboration, the Germans and the French place most value on interaction. This might be due to the stronger hierarchy in these organisations, which usually demands more planned interaction and leaves less room for collaboration.

The factor analysis of the importance of work environment features and facilities has shown that these can be grouped into seven relevant categories of support of employee activities. As more and more organisations are implementing new ways of working, the first factor grouped features and facilities together to support working place independently (e.g. different types of areas and ICT). Three different work environment design features came forward, namely climate, personalization +

privacy and meeting areas. Also, office equipment facilities (e.g. printing, storage) and the furniture (desk/chair) loaded as separate components. The rest of the work environment facilities loaded onto one component of building services. This might imply that future work environment research could include less features and facilities. This makes questionnaires among employees shorter and thus less time consuming. Instead of asking about all different facilities and features, the importance of and satisfaction with only these seven components could be studied. Only components that show negative sentiment among employees can then be analysed in more detail with the separate features and facilities lists to identify possible improvements in the work environment.

Looking at the different European countries, it becomes clear that especially France and Germany attach high importance to be able to work place independently. This is remarkable, considering that not many companies in these countries have implemented activity based working yet. Employees from the UK did not mention this as important, although working in an activity based way is much more common there. Perhaps this has already become so evident in the UK that employees do not think about the necessity of these features and facilities any more. The building services are not seen as important in most countries, again except in the UK. Apparently, employees value different aspects of the work environment in this culture, than on the mainland of Western Europe. Swedish employees stand out from the rest with their emphasis on the importance of meeting areas. Personalization + privacy is a wish of employees from Sweden, the UK and the Netherlands, but is asked for a lot less in Germany and France. Again, the hierarchy in both these countries comes into mind as a possible explanation for this difference.

The new ways of working are often based on the idea that the design of a workplace optimally supports the work activities of an employee. Therefore, also a comparison was made between the seven components of the work environment related to the different workplace activities. This showed that the support through ICT + place independence is important for all activities, and there is not much difference visible between the countries. Climate is also important for all the activities for employees from many countries, except remarkably for only very few activities of the French employees.

As mentioned, the building services were only important for UK employees. They relate these facilities to all activities, so apparently they value them constantly at work. The Dutch only valued these facilities when they are away from their desk (interacting for work), the Germans for holding private conversations, and the Swedish for facility dependent activities. Only the Dutch and UK employees find personalisation important for all activities (Swedish employees for most activities). Maybe they consider this as a certain brand or representation of themselves within the office. The Germans specifically value personalisation + privacy less during interaction or when reading, while the French do not care much about it at all.

Meeting areas are important for everybody to support interaction based activities, but the Swedish employees also link them to all their other activities. Office equipment is specifically important for all activities of the French and UK employees, while the Dutch only link them to some of the facility dependent work activities. The German and French employees placed little importance on the desk and chair for their activities in general, opposed to the other three countries.

This research has shown clear differences between countries with regard to the importance of work environment features and facilities. But many multinationals are implementing new ways of working

at their locations around the world, without taking these differences into account. The results of this study stress that a one-size-fits-all concept is not always the best way to support your employees. This might explain why the implementation of new ways of working is not always successful with regard to increased satisfaction and/or productivity, and is increasingly being opposed by employees.

Previous studies have focused on employee satisfaction with the work environment that is offered (pre and/or post move) or asked designers about the influence of culture on the workplace design. In this paper we actually asked employees what their preferences are, regardless of the current work environment. It is the first study that compares and tests differences between preferences of European employees on this scale, and also to relate these preferences for the work environment to importance of activities comparing countries. This has provided more insight in user needs.

This study only took European countries into account. In these countries the development of information and communication technology, the individualization of the society and the increasing competition between organizations are largely comparable. A recommendation for further research is to analyze the preferences of employees in countries where these developments are different. It would also be interesting to include countries that show more extreme scores on the dimensions of Hofstede, shown in Figure 2.

This analysis of the importance that employees in different countries attach to the modern work environment is based on the Leesman database. Although the selection of data provided information about 32,006 respondents from 242 different locations divided over 5 countries, the amount of respondents from France, Germany and the Netherlands is significantly lower than the amount of respondents from Great Britain and Sweden. Data from countries with a lower amount of respondents might be representing the needs for all employees in these countries less. To avoid this, equal amounts of respondents per country should be strived for in further research.

Culture consists of values and practices and practices are easier to influence than values. National culture is based more on values than organizational culture. As a consequence organizational culture is a type of culture that is easier to influence than national culture. In this paper the influence of characteristics of national culture on the work environment are analyzed. It would also be interesting to study the influence of organization culture on modern work environment preferences.

All such studies will help CREM in reaching their important goals of increasing employee satisfaction and productivity.

Reference list

- Ali, M. and Brooks, L. (2008). *Culture and IS: National cultural dimensions within IS discipline*. Conference paper, 13th Annual Conference of the UK Academy for Information Systems (UKAIS), Bournemouth University, 10-11 April, 1-14.
- Appel – Meulenbroek, R. (2014). *How to measure added value of CRE and building design; Knowledge sharing in research buildings*. Dissertation, Eindhoven University of Technology, the Netherlands.
- Appel - Meulenbroek, H.A.J.A., Groenen, P.J.M. and Janssen, I.I. (2011). An end users perspective on activity- based office concepts. *Journal of Corporate Real Estate*, 13(2), 122-135.
- Appel-Meulenbroek, R., Havermans, D., Janssen, I. & Van Kempen, A. (2010). Corporate branding: An exploration of the influence of CRE. *Journal of Corporate Real Estate*, 12(1), 47-59.
- Batenburg, R. and Voordt, D.J.M. van der (2008). *Effecten van facilitybeleving op de ervaren arbeidsproductiviteit*. Delft: Centre for People and Buildings.

- Bijl, D. (2009). *Aan de slag met het nieuwe werken*. Zeewolde: Par CC.
- Barber, C. (2001), The 21st-Century Work-place. In: Kaczmarczyk et al, People and the Workplace. GSA Office of Government-wide Policy, Washington DC. Available at: <http://www.gsa.gov/graphics/ogp/peopleandworkplace.pdf>
- Brill, M., Weidemann, S., Allard, L., Olson, J., Keable, E.B. (2001). *Disproving widespread myths about workplace design*. New York: Kimball International.
- Davenport, T., Jarvenpaa, S., and Beers, M. (1996). *Improving knowledge work processes*. Sloan Management Review, 37, 53-65.
- Fisk, W.J. & Rosenfeld, H. (1997). Estimates of improved productivity and health from better indoor environments. *Indoor Air*, 7(3), 158-172.
- Gibler, K., Lindholm, A.-L. & Anderson, M. (2010). *Corporate Real Estate Strategy and office occupiers' preferences*. Atlanta, GA: Corenet Global.
- Hall, E.T. (1976). *Beyond Culture*. New York: Anchor Books Editions.
- Haynes, B., Fides matzdorf, F., Nunnington, N., Ogunmaking, C., Pinder, J. and price, I. (2000). *Does property benefit occupiers?* Occupier. Org Report No. 1, available at: <http://occupier.org>.
- Hofstede, G. (1991). *Cultures and organizations: software of the mind*. McGraw-Hill, New York, NY.
- Hofstede, G. and McCare, R.R. (2004). Personality and culture revisited: linking traits and dimensions of culture. *Cross Cultural Res*, 38 (1), 52-88.
- Inalhan, G. (2009). *The unrecognised link between employees and their workplace (in change management projects)*. Istanbul: Istanbul Technical University.
- Kahn, K.B. (1996). Interdepartmental integration: A definition with implications for product development performance. *The Journal of Product Innovation Management*, 13(2), 137-151.
- Karahanna, E., Evaristo, J., and Srite, M. (2005). Levels of Culture and Individual Behaviour: An Integrative Perspective, *Journal of Global Information Management*, 13(2), 1-20.
- Leung, K. Bhagat, R.S. Buchan, N.R. Erez, M. and Gibson, C.B. (2005). Culture and international business: recent advances and their implications for future research. *Journal of international Business Studies*, 36 (4), 357 – 378.
- Mooij, M. (2002). *Kantoorinnovatie: efficiënt, effectief, flexibel en creatief werken in een duurzame omgeving*. Alphen aan den Rijn: Kluwer.
- Oseland, N. (2009). The impact of psychological needs on office design. *Journal of Corporate Real Estate Management*, 11(4), 244-254.
- Plijters, E. B. (2012). *Managing the Workplace in a Globalized World*. Delft: Delft University of Technology
- Puybaraud, M.C. (2007). Flexible working survey 2007 – Five years of learning. Available at: <http://www.johnsoncontrols.com>.
- Raymond, S. & Cunliffe, R. (1997). *Tomorrow's office: creating effective and humane interiors*. London: E & FN Spon.
- Shpuza, E. (2006). Floorplate shapes and office layouts: A model of the effect of floorplate shape on circulation integration. Doctoral dissertation, Georgia Institute of Technology, USA.
- Steen, J. (2009). Spatial and social configurations in offices. In D. Koch, L. Marcus & J. Steen (Eds), *7th international Space Syntax Symposium*, June 8-11, Stockholm, Sweden, 107;1-9.
- Tabak, V. (2009). *User simulation of space utilization: system for office building usage simulation*. Dissertation Eindhoven University of Technology, the Netherlands.
- Wyon, D.P. (2004). The effects of indoor air quality on performance and productivity. *Indoor Air*, 14(7), 92-101.
- Van der Voordt, T.J.M. (2004). Productivity and employee satisfaction in flexible workplaces. *Journal of Corporate Real Estate*, 6(2), 133-148.
- Van der Voordt, D.J.M., P.G. Vos e.a. (1999). *Kantoorinnovatie: Model en methoden voor evaluatie van kantoorinnovatie*. Delft: Technische Universiteit Delft.

- Vos, P.G.J.C., D.J.M. van der Voordt (2001), Tomorrow's offices through today's eyes. *Journal of Corporate Real Estate*, 4(1), 48-65.
- Steelcase (2009). *Culture Code*. Retrieved on the 26th of March, 2013 at: <http://360.steelcase.com/issues/culture-code/>.