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van Staveren, Daniël; Arkesteijn, Monique; Den Heijer, Alexandra

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Managing public real estate and the trade-off between supporting user activities and sustainable development: case of the Netherlands police

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Daniël van Staveren, Monique Arkesteijn and Alexandra Den Heijer
Department of Management in the Built Environment, Faculty of Architecture, TU Delft, Delft, The Netherlands

Abstract

Purpose – Corporate real estate management (CREM) is complex due to an increasing number of real estate (RE) added values and the tensions between them. RE managers are faced with trade-offs: to choose a higher performance for one added value at the cost of another. CREM research mainly deals with trade-offs in a hypothetical sense, without looking at the characteristics of the RE portfolio nor the specific context in which trade-offs are made. The purpose of this paper is to further develop the concept of real estate value (REV) optimisation with regard to tensions between decreasing CO_2 emissions and supporting user activities.

Design/methodology/approach – Mixed method study. REV optimisation between user activities and energy efficiency for police stations in the Netherlands built between 2000 and 2020 is analysed. This is complemented by interviews with an RE manager and senior user of police stations and analysis of policy documents.

Findings – xThe characteristics of the police station portfolio indicate no correlation between user activities and energy efficiency for the case studied. This is complemented by interviews, from which it becomes clear that there was in fact little tension between supporting user activities and energy efficiency. The performances of these two different added values were optimised separately.

Originality/value – This study combines different scales (building and portfolio level) with different types of data: portfolio analysis, document analysis and interviews. This creates a comprehensive image of whether and how the Netherlands police optimised the two RE values.

Keywords Real estate, Management, Value, Trade-off, Police

Paper type Research paper

1. Introduction

Real estate (RE) accounts for an estimated 30% of global greenhouse gas emissions and 40% of global energy use (UN, 2016). The UN sustainable development goals concern a

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transition to affordable and clean energy and sustainable cities and communities for everyone. To adhere to these goals, governments across the globe adopt policies and laws which move organisations to improve the sustainable performance of their accommodation. Consequently, RE strategies of public organisations increasingly focus on improving the efficiency of the accommodation in terms of energy demand, CO_2 emitted, materials used and the public funds deployed for this. These aspects are commonly referred to as the supply side of accommodation (De Vries, 2006; Den Heijer, 2011). Next to supply-related challenges, public organisations deal with challenges related to the demand side, commonly represented through user goals and organisational goals. Aligning the supply with the demand is one of the core issues in the field of Corporate real estate management (CREM) (Valks, 2021). This also goes for the central case in this study: The Netherlands Police (NP) and police stations built between 2000 and 2020. In The Netherlands, over 200 police stations accommodate police teams who provide critical services to civilians. It is crucial for these buildings to adhere to several goals. For one, law enforcement organisations are increasingly challenged in attracting personnel to guarantee local enforcement (Charrier, 2000). This includes the NP: more than a quarter of the employees are expected to leave the force between 2020 and 2026 (Netherlands Police, 2019). Attractive and well-functioning police stations can contribute to attracting and retaining new personnel. Simultaneously, the NP is confronted with an increasingly stricter government norm regarding CO_2 emissions (Netherlands government, 2020). Finally, the NP has set ambitions regarding efficiency in space use: for police stations, a workplace norm dictates a maximum number of 0.4 workplaces per FTE and 21.5 m^2 gross floor area (GFA) per workplace, plus an additional 3.5 m^2 GFA per FTE. This norm exceeds the police norm for more generic, office-oriented work: 0.7 workplace per FTE. The reason for this difference is that users of police stations are working outside more than other police services (Netherlands Police, 2013). Altogether, these ambitions cause an increasing mismatch in the demand for and supply of police stations. These challenges impose difficulties in strategic decision-making due to potential tensions between RE-added values (Valks, 2021; Den Heijer, 2021).

The purpose of this research is to further develop the concept of real estate value (REV) optimisation with regard to tensions between the REVs decreasing CO_2 emissions and supporting user activities. The following sub-questions are established:

Q1. Which performance measurement system is suitable to assess the performance of Dutch police stations?

Q2. What is the correlation between energy efficiency and available floor space for Dutch police stations?

Q3. Which thresholds for the performance of both sustainability and supporting user activities prevailed during the development of Dutch police stations?

Q4. How did stakeholders optimise the performance of the two REVs?

The research follows four steps: First, a performance measurement framework is established, including a summary of different REVs based on previous CREM research. Second, the literature is reviewed for possible tensions to occur between REVs. The review brings forward a tension between available space for users and energy efficiency. This tension is selected for the third step: analysis of a database including all Dutch police stations built between 2000 and 2020. The analysis uncovers the correlation between energy efficiency and available user space. Finally, a senior user and RE developer of a recently developed police station were interviewed to uncover how the

REVs were optimised. This is complemented by a document analysis regarding the prevailing policy and RE strategy of the NP.

2. Theory

The theory section consists of three parts and answers the first research question. First, a performance measurement system is introduced. Second, an overview of the different REVs is given. Third, the scientific gap is introduced.

2.1 Performance measurement system to identify trade-offs

By measuring the performance of several aspects of the same portfolio, the correlation between these aspects can be analysed. This does not tell whether trade-offs are made, but may hint where RE managers have made trade-offs when deciding about the performance regarding different RE values. Thus, a performance measurement framework is established. The use of this framework is to specify abstract concepts using concrete, measurable items (Kroes and Van de Poel, 2015). Thus, it becomes clear what the abstract concept entails, how it can be measured, and, potentially, how a tension with another abstract concept may occur. An example of an abstract concept is "increasing user satisfaction". The scholars compared in this research (see Appendix 1) specified user satisfaction using 12 different indicators, ranging from measuring complaints and operating expenses of a help desk to the ratio between office space and common areas. This shows that authors think differently about what user satisfaction entails.

Likewise, authors specified other REVs using different measurable items, which are reviewed in this section. The focus of the review is on which system elements authors use to specify abstract concepts (e.g. criteria, values, goals, etc.). The works in Table 1 are reviewed. In Appendix 2, the analysis of how the authors specify abstract concepts can be found.

From the literature, it becomes clear that scholars use combinations of different elements to specify abstract concepts. For example, "organisational performance" is commonly referred to, though some authors refer to "organisational goals", "organisational objectives" or "strategic objectives/goals". "Adding value" is most commonly used to describe how RE can enable organisational performance. However, some use "value parameters", "effects of corporate real estate (CRE)" or "RE strategy". To specify how value can be added, authors refer to "criteria" or "indicators". Some refer to a concept such as "flexibility" as an "added value"; others may also specify this as a "criterion". Some also refer to key performance indicators (KPIs), though it is not made clear what the difference between KPIs and indicators is. The differences in vocabulary could perhaps be explained by the different institutions and times in which the research was conducted.

Most scholars do not include a definitions page nor reflect on the terminology of choice. Except for two cases where "indicator" is distinguished from "performance measure" (Lindholm, 2008b; Jensen and Van der Voordt, 2016), indicators are used to measure aspects of RE, while a performance measure is a combination of two indicators set in proportion to one another to compare the performance without clouding the comparison due to specific factors (Ho *et al.*, 2000). For example, "investment costs" per "square meter" can be used to compare RE portfolios of different sizes without distorting the comparison (Kroes and Van de Poel, 2015).

By comparing the terms used by different CREM scholars, this research establishes that, in most cases, the scholars are aligned with the abstract ideas underlying the terms used. Nonetheless, the field lacks a unified vocabulary and performance measurement system. Hence, the measurement framework in Figure 1 is proposed.

Author	Title	Institution	Publication type
Lindholm, Gibler and Leväinen, (2006)	Modelling the value-adding attributes of RE to the wealth maximisation of the firm	Helsinki University of Technology, Finland	Journal article
Scheffer *et al.* (2006)	Enhancing the contribution of corporate RE to corporate strategy	University of Twente, Netherlands. Delft University of Technology, Netherlands	Journal article
Appel-Meulenbroek and Feijts (2007)	CRE effects on organisational performance: measurement tools for management	Eindhoven University of Technology, Netherlands	Journal article
De Vries (2007)	Presteren door Vastgoed	Delft University of Technology, Netherlands	PhD dissertation
Lindholm (2008a)	Identifying and measuring the success of corporate RE management	Helsinki University of Technology, Finland	PhD dissertation
Van der Zwart (2015)	Building for a better hospital	Delft University of Technology, Netherlands	PhD dissertation
Van der Voordt *et al.* (2016)	Value Adding Management (VAM) of buildings and facility services in four steps	Delft University of Technology, Netherlands	Journal article
Den Heijer (2021)	Campus of the future: managing a matter of solid, liquid and gas	Delft University of Technology, Netherlands	Book

Source: Created by authors

Table 1. works studied to define system elements for performance measurement in CREM

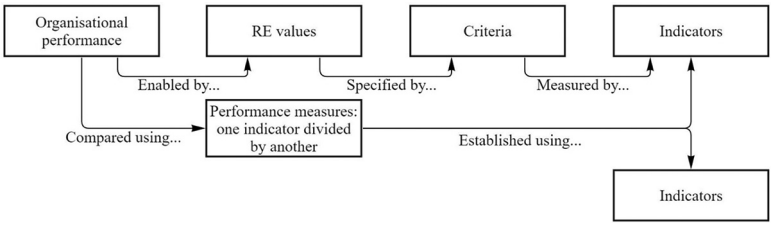

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Figure 1. CREM performance measurement system

2.2 Added values of real estate

The next step is to inventory the different added values of RE and how they are specified. There is no review paper that can be used to answer this question; however, several works exist which include a dissemination of REVs commonly strived for, including their indicators. Since a systematic literature review is not in the scope of this paper, the most prominent CREM works (see Table 2) regarding REV and indicators are studied.

The authors together propose 21 different added values of RE, which they defined using 116 criteria (after correction for overlap). To measure the different criteria, the authors propose 68 indicators. The REVs are grouped in Table 3 according to four CREM perspectives (Den Heijer, 2011): the financial, technical, organisational and functional perspective.

Now that there is an overview of the REVs, the next section answers which tensions have been identified in the literature between these REVs.

2.3 Tensions between added values of CRE

Making trade-offs is regarded as a solution to situations where objectives are naturally conflicting and there are no alternatives which satisfy all goals sufficiently. This forces the decision maker to decide which goal to prioritise over the other. Hence, making trade-offs means choosing a higher performance for objective X at the cost of objective Y (Da Silveira, 2005; Keeney, 2002). In this study, this is regarded as REV optimisation. In the literature regarding RE management, different tensions between RE values are mentioned. Jensen and Van der Voordt (2020) propose a total of 22 relationships (either positive or negative) between productivity and 11 other RE values. These, however, are based on estimations by the authors and should be regarded as hypotheses. Shi *et al.* (2016) found a total of 13 tensions between objectives through interviews with 24 construction industry practitioners. The most problematic tension practitioners bring forward is between cost effectiveness and green certification. However, the tension is not specified using criteria or indicators. Likewise, cost effectiveness versus functional effectiveness and demonstration effect are

#	Author	Publication type	Year
1	De Vries	PhD dissertation	2007
2	Lindholm	PhD dissertation	2008a
3	Den Heijer	PhD dissertation	2011
4	Riratanaphong	PhD dissertation	2013
5	Van der Zwart	PhD dissertation	2015
6	Van der Voordt *et al.*	Journal article	2016
7	Appel-Meulenbroek *et al.*	Journal article	2018
8	Amos and Boakye-Agyeman	Journal article	2023a

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Table 2. Works studied to establish commonly strived for added values of RE and their measurable items

Supply		Demand	
Financial	Technical	Organisational	Functional
Controlling risk [3,4,6,8]	Reducing CO_2 footprint [2,3,4,6,8]	Improving quality of place [2,3,4]	Increasing flexibility [2,8]
Increasing RE value [2,3,4,6,8]	Optimising m^2 footprint [2,3,4,6,8]	Supporting image [3,5,6,7,8]	Increasing user satisfaction [2,3,4,5,6,7,8]
Reducing costs [2,3,4,5,6,8]	Reduction of travel and transport activities [6]	Supporting culture [3,5,6,7]	Community and well-being [4,5,7]
Profitability [1]	Reduction of waste [4,8]	Stimulating collaboration [3,7]	Supporting user activities [2,3,4,5]
		Increasing innovation [3,6,8]	Productivity [4,6,7,8]
		Quality of CRE organisation [2,4]	Supporting health and safety [4,6,7,8]
		Corporate social responsibility [6,8]	

Notes: References to the authors (see Table 1) who defined the added values are added in superscript
Source: Created by authors

Table 3. Added values of RE according to CREM scholars, categorised using the four perspectives of CREM (Den Heijer, 2011)

also heavily weighed but not specified. This makes it difficult to understand the nature of the tension. Oliver *et al.* (2019) present trade-offs more specifically than above-mentioned authors. For example, installing innovative installations to decrease CO_2 emissions requires more specialised operations and maintenance due to errors in the first months of operation of the building. In addition, sustainability measures take up space as a result of internal bike storage, showers to facilitate sustainable mobility and larger mechanical spaces for the geothermal installation. This creates a tension with the available space for occupants of the building. Regarding the occupants, Van der Voordt and Jensen (2018) found that privacy, opportunities to concentrate, perceived productivity and storage facilities are traded-off for an increased efficiency in floor space use due to implemented activity-based work settings.

The theory above shows that, in general, tensions between supply and demand are observed. Organisations pursue financial goals, which in turn pressure the available resources to maximise the REVs. In attempts to maximise the added value within the financial constraints, it would seem that RE managers are faced with tensions between sustainable and functional goals of the organisation. The question is, then, whether that is true for the NP and whether RE managers trade one goal for another and how? Previous work limitedly answers this question: either the tensions are hypothetical, as is the case with Jensen and Van der Voordt (2020) and Amos and Boakye-Agyeman (2023b). Or, when an empirical approach is used, e.g. by interviewing practitioners about the tensions they observe (Shi *et al.*, 2016), the tensions are described in abstract form, making it difficult to grasp how the tensions are caused. An empirical approach where tensions are specified is lacking, for example, by studying how characteristics of a building or portfolio reflect possible tensions.

This research relies on measurable items instead of abstract concepts and studies the characteristics of police stations in the Netherlands and which policies and RE strategy were in place at that time. Thus, it becomes clear how this context influenced optimisation of the two REVs and which tensions occurred between them.

3. Methodology

This research is a mixed method study, relying on qualitative and quantitative data. Both have strengths and weaknesses. A qualitative approach (interviews, in this case) is subject to potential biases of the interviewee (Queirós *et al.*, 2017). And that which an interviewee may experience may not reflect what the measurable characteristics of a portfolio tell us. Interviews are suited to reflect on the causes behind quantitative data. A quantitative approach has less focus on understanding the context of the problem (Queirós *et al.*, 2017). This research acknowledges that quantitative and qualitative methods represent two different paradigms. Thus, they are incommensurate, meaning that the researcher should be careful in claiming that both parts are complementary to one another when researching the same phenomenon (Guba, 1987). Rather, in line with Sale *et al.* (2002), the two parts of this research are used to study different phenomena, and the outcomes are used to complement both parts. To be specific, quantitative data will allow for an exact performance measurement to indicate where one REV may have been traded for another. And the qualitative data explain the context in which the trade-off was made. First, the quantitative part is performed, from which the results are used to define the scope for the qualitative part.

The quantitative part consists of three steps:

(1) *Database and performance measurement system.* A database was established to measure the performance of all Dutch police stations built between 2000 and 2020. The NP provided access to their accommodation database. For a proper measurement, indicators of interest had to be registered for each police station. This was the case for m^2 GFA, designated full time employees (FTEs) and energy used

(kWh/m^2) for the year 2021. Other interesting indicators, such as number of workplaces or ratio common space versus office space, were not measured for all police stations. Frontczak *et al.* (2012) found available office space to be the most significant factor for office user satisfaction, for which m^2 GFA per FTE is proposed as a performance measure. This measure is proposed by CREM scholars (Lindholm, 2008a; Van Der Zwart, 2015) and used in practice (see EN15221-7 norm). Indeed, many indicators have been proposed to measure user satisfaction. However, there was no police database available that measures user satisfaction with uniform KPI's other than m^2 GFA/FTE. However, during the interviews, there was room to discuss all possible KPIs brought to the table by the interviewees. To measure CO_2 reduction, yearly kWh used per building is measured (Jensen and Van der Voordt, 2016), again in line with the EN15221-7 norm, which proposes kWh energy used per m^2 GFA. This results in the performance measurement system pictured in Figures 2 and 3.

It has to be noted that initially, the ambition was to add a financial indicator to the performance measurement system, since financial and sustainability objectives may be at tension: see Shi *et al.* (2016) and Oliver *et al.* (2019) in the theory section. Despite that the NP manages and monitors investment costs for each project, the indicators to measure financial performance changed over time. Hence, there is no continuous measurement of investment costs for the police stations. Thus, this indicator could not be used for the data analysis:

(2) *Regression analysis.* To uncover whether a tension possibly exists between the REVs "supporting user activities" and "reduction of CO_2 emissions", a regression analysis was performed using the performance measurement system explained in step 1. The regression may hint at a tension when there is a negative correlation between the two REVs; and

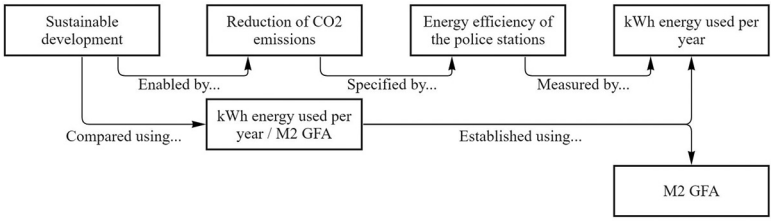

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Figure 2. Performance measurement system for CO_2 emission reduction

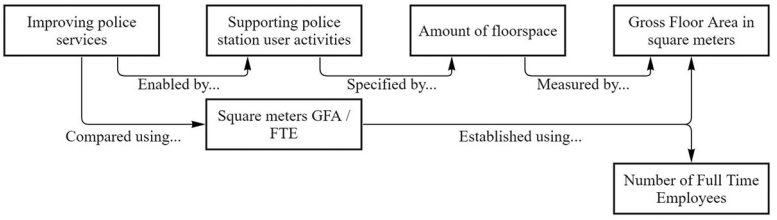

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Figure 3. Performance measurement system for supporting user activities

(3) *Select outliers.* A negative correlation, however, does not prove that trade-offs were made. Therefore, the quantitative findings have to be complemented with information about the CREM context. This is done by selecting outliers, which are buildings with a very high energy efficiency and very low amount of available space per employee. For these outliers, tensions may have been more apparent between the two REVs compared to buildings that perform closer to average on these aspects. To evaluate this, the qualitative part of this research was executed.

The qualitative part consists of the following steps:

(1) *A document analysis* regarding the policies and strategies that were effective during the development of the police stations. These could influence REV optimisation during the development of the police stations. Two documents were brought forward by a police RE manager involved with RE strategy and policy. And, the business case document for the outlier police station, Venray, was analysed;

(2) *Interviews.* The data analysis brought forward police stations where, potentially, the two REVs were optimised. One police station was zoomed in on: Venray, for which two interviews were held: one with the responsible RE manager and one with a senior user. This police station is chosen based on the following criteria:

- A potential trade-off may have occurred between user activities and energy efficiency, based on the data analysis;
- The police station is developed within the past five years to increase chances of finding interviewees that were involved with the development; and
- The police station is smaller than the building where the police team transitioned from, increasing the chances of tensions regarding available floor space.

Two outliers passed these criteria: Venray and Uden. However, when an inquiry was made to interview users of the police station in Uden, a police RE manager advised against it, since recently the users had complained about aspects of the police station that had not been built according to expectations. An extra interview initiated by the police RE department would potentially result in annoyance.

Questions used during the interviews included, "the data shows *performance x* for this police station, is that correct in your perception?" and "regarding this *criterion x*, how would you rate the performance and why?". In the last part of the interview, the interviewee was asked to reflect on the question, "were there tensions between the two aspects and if so, were trade-offs made and how?". Prior to the interviews, participants signed an informed consent agreement in line with the EU General Data Protection Regulation.

3. Results

The results are presented in the following order. First, research question two is answered by presenting the regression analysis and outliers that indicate a potential tension between the REVs. Second, research question three is answered through document analysis and interviews. Finally, the fourth research question is answered: how did stakeholders optimise the performance of the two REVs?

3.1 Regression analysis and outliers: energy efficiency and space per employee

The database initially counted 71 police stations, all built between 2000 and 2020. After excluding the buildings that were leased, sold or where data was missing, 57 remained. Finally, a correction was made for 65% of the buildings, since these accommodated other police units in addition to the police team. This distorts the comparison of objects since the norm for a police team was 0.4 workplaces per FTE and for other police units 0.7 (further referred to as the flex norm). After correction, the mean m^2 GFA/FTE decreased from 25 to 21.3.

The energy efficiency of police stations increased over time, and the amount of square metres per FTE slightly decreased; see also Figures 4 and 5. The average available amount of space per FTE is 21.3 m^2 GFA and the average energy efficiency is 165 kWh/m^2 GFA.

The analysis shows that police stations built after 2010 are more energy efficient, while the same police stations also offer less space per employee (relative to the mean). Also, the nationalisation of the police from 25 self-operating regions to one police organisation in 2013 is reflected in the graphs: policy made police stations more energy efficient, and flex norms prevented the development of new outliers regarding that aspect.

To uncover whether there is a negative correlation between the two aspects (i.e. a potential trade-off was made), a regression analysis is performed. The regression analysis shows that the correlation for two aspects is low to non-existent: 1) the trend line in Figure 6 shows both an upward and downward trend in the same data set (thus, non-monotonic), and

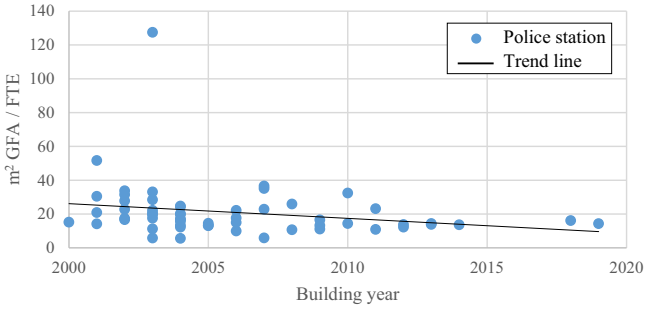

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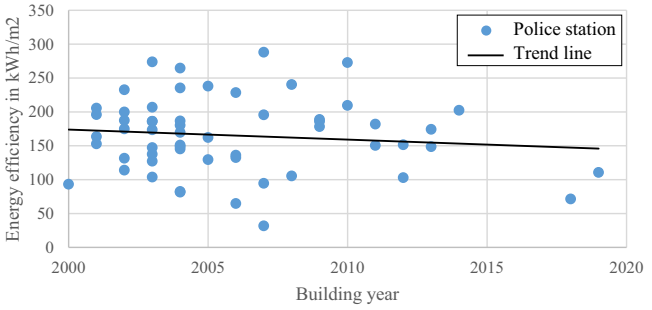
Figure 4.
Space available per FTE of Dutch police stations



Source: Created by authors

Figure 5.
Energy efficiency of Dutch police stations

2) the correlation tests presented in Table 4 show that correlation is unlikely. Take note of the difference between the Spearman correlation and the Pearson correlation: one is negative while the other is positive, confirming the non-monotonic relationship. Thus, the data analysis does not suggest a tension between energy efficiency and available space per employee over the years of 2000–2020. To validate this, the research zooms in on particular objects in the next paragraph.

Although the data does not suggest a tension between the two aspects, there are specific police stations of which the characteristics hint at a potential tension. This concerns the objects where the values for both aspects are distributed far from the mean. These outliers were identified using the Z-score, which is an indicator for how far a value diverts from the mean based on the mean and standard deviation of a data set (Kannan *et al.*, 2015). Since a low value in kWh/m^2 actually corresponds with a high performance in energy efficiency, a negative Z-score should be associated with a high performance. Therefore, the sum of the

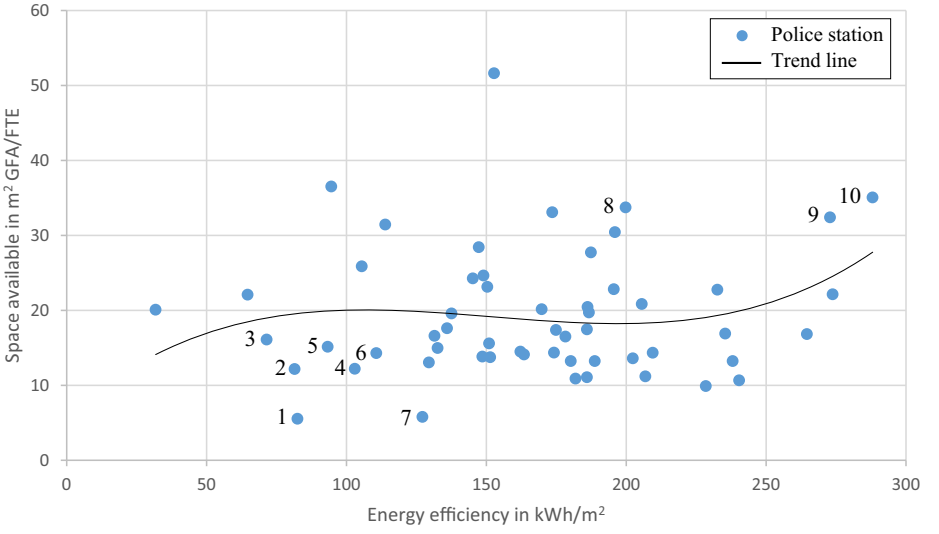


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Figure 6.
Correlation between available space per employee and energy efficiency of Dutch police stations built between 2000 and 2020. The police stations where trade-offs may have occurred are numbered in line with Table 5 and are identified using the Z-score. In favour of the readability of this figure, the police station with a surface area of 120 m^2 per FTE was left out. All other graphs and analysis include this police station

Table 4.
Indicators for correlation between energy efficiency and available space per employee for Dutch police stations built between 2000 and 2020

Indicator	Value
P-value	0.55
Spearman correlation	0.08
Pearson correlation	−0.038

Source: Created by authors

Z-scores of the two aspects per police station represents potential tensions between the aspects. See Table 5. The complete table is added in the appendix.

For some police stations, the Z-score belonged in the higher or lower ranges, though a tension was less likely since only one of the two aspects performed as an outlier.

Table 5 shows that there are more police stations with a high energy performance and with a lower amount of m^2 GFA per employee, then vice versa. This can be explained by the building years: the later the year, the stricter the building regulations, thus ruling out police stations with an above-average kWh/m^2 energy use after 2000. Before 2000, the data set includes police stations with lower energy efficiency. The police stations presented in Table 4 will be used as a basis to select interviewees for the qualitative part.

3.2 Prevailing thresholds for energy efficiency and available floor space for Dutch police stations: document analysis

In 2013, the NP were nationalised into one national police force. Instead of operating through 25 self-managing police regions, one national police-corps was created with unified strategy and policies under which ten regional units and one central unit operate. The organisation is supported by a centralised police services centre and managed by a five-member Force Command with its own support section: the commissioner staff. One of the expected results of the nationalisation was a cost reduction of around €280m over the period of 2013–2025 (after subtracting investments) due to, amongst other, improved efficiency of police accommodation (Netherlands Police, 2012b). At the same time, the NP concluded that police stations are abundant in number (Netherlands Police, 2013). One police team should be accommodated by no more than one police station. This rendered 43 police stations abundant in 2012. To align the number of police stations with policy and strategy, several interventions were proposed:

- concentrate a police team in one of the existing police stations (without investment);
- increase the size of an existing police station to accommodate the police team;
- build or lease a new police station to accommodate the police team; and
- maintain the current situation.

It has to be noted that the strategy to build new buildings is a means to merge two or three regional police teams into one building. The discarded police stations are sold and, in some

#	Location	kWh/m^2	Z-score kWh/m^2	m^2 GFA/FTE	Z-score m^2 GFA/FTE	Sum Z-score
1	Rotterdam	82.5	−1.504	5.517	−0.954	−2.457
2	Utrecht (1)	81.5	−1.522	12.160	−0.551	−2.073
3	Venray	71.5	−1.704	16.082	−0.314	−2.017
4	Eindhoven	103	−1.131	12.193	−0.549	−1.680
5	Utrecht (2)	93.3	−1.307	15.128	−0.371	−1.679
6	Almere	127.2	−0.691	5.776	−0.938	−1.629
7	Uden	110.7	−0.991	14.284	−0.423	−1.414
	...	...	...	...	...	...
8	Kerkrade	199.8	0.629	33.713	0.755	1.384
9	Beilen	272.9	1.958	32.391	0.675	2.633
10	Uithuizen	288.1	2.234	35.040	0.835	3.070

Notes: The table is sorted by the sum of the two Z-scores, from low to high
Source: Created by authors

Table 5. Selection of police stations with an inverted performance regarding energy efficiency and space available per FTE, using the Z-score

instances, reused by another organisation; however, some are also demolished. To align the supply of accommodation (and other resources) with the demand, including the cost reduction of €280m, an accommodation organisation was initiated. This organisation established several policies that apply to police stations, which can be found in two documents:

(1) Strategic accommodation plan (SAP) 2013–2025 (Netherlands Police, 2013); and

(2) Policy-framework for accommodation (PFA): policy-related principles for the accommodation of the NP (Netherlands Police, 2012a).

The document analysis is presented from the perspectives of the two REVs this study focusses on: supporting user activities and decreasing CO_2 emissions. And, the documents are scanned for policy regarding the relationship between the two REVs.

3.2.1 Supporting user activities. The documents mention this aspect several times. For example, the police set an ambition to realise professional and inspiring working environments with proper working conditions to inspire employees and stimulate an increased operational performance (Netherlands Police, 2012a). In addition, working spaces have to contribute to meeting each other, communication and collaboration. A specific ambition regarding how police teams work is mentioned: the SAP states that teams will increasingly rely on additional technologies to get in contact with civilians: through internet, or by visiting civilians at their homes. Police employees will be able to work away from the office, and the organisation will be more accessible online (Netherlands Police, 2013). This ambition brought forward the following norms for the police stations: a maximised flex norm of 21.5 m^2 GFA per workplace and 0.4 workplaces per FTE (Netherlands Police, 2013). Per FTE, 3.5 extra m^2 GFA was added for specific space used by police teams (locker rooms, holding chambers).

3.2.2 Decreasing carbon dioxide emissions. In the documents, CO_2 emissions are not directly referred to. At that time, in the Netherlands, energy efficiency was operationalised by giving buildings an energy label, which represents different factors related to CO_2 reduction. In the SAP and PFA, the following policies were noted regarding energy labels:

- Newly built police stations were required to perform according to energy label A (minimum); and
- Existing police stations were renovated to energy label B. It has to be noted that after 2013, stronger ambitions were set in accordance with technological, legal and societal developments. Currently, the NP aims to realise almost or fully energy neutral police stations (Netherlands Police, 2022).

3.2.3 Relationship between carbon dioxide emissions and user activities. The literature suggests a tension between CO_2 reduction, investment costs and available space for users. And, reducing the available amount of m^2 GFA per employee may result in productivity decrease, but it positively influences investment and exploitation costs. This research poses the question: if the ambition regarding sustainability had been increased from Label A to (almost) energy neutral, did this influence supporting user activities in the form of less space per FTE?

Regarding this, the PFA states that "...investments are aimed at increasing the added value of an object [...] by upgrading or facelifting the object, applying sustainability measures and interventions to adhere to user requirements or being compliant to the law "(PFA, p. 37).

In the SAP, it becomes clear that the savings from realising a more compact police portfolio will be allocated to two types of investments. The first involves investments to transform buildings to be suited for flex-working. This means reorganising floor spaces, including ICT infrastructure, building adaptations, renovations or maintenance (SAP, p. 43).

The second involves investments in new buildings, for which the police relied on an indicative norm regarding exploitation costs of €200/m^2 GFA (SAP, p. 44). Exploitation was the primary indicator to control costs, not investment costs. It is not stated specifically that sustainability measures are included in this norm for exploitation costs.

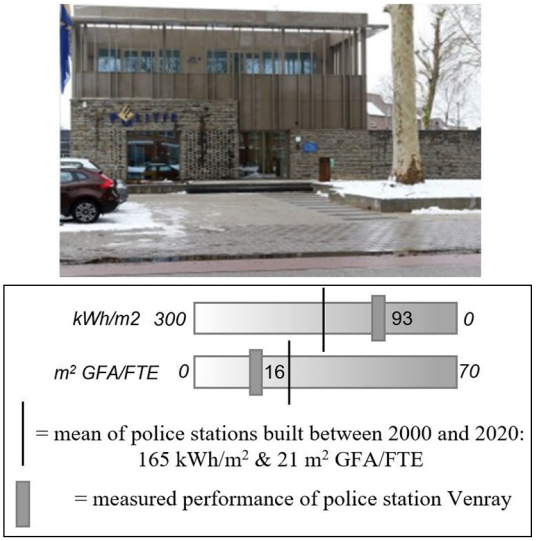
Finally, the SAP states that "trade-offs regarding accommodation will be made transparently and in line with Dutch law by initiating a decision-making process where choices are made between functional requirements, financial costs and gains and added value to society" (SAP, p. 25).

From these documents, it does not become clear which trade-off(s) RE managers were supposed to make between realising financial savings as a result of a more compact portfolio and the sustainability ambitions. As far as the documents go, it seems that the two ambitions are set next to each other. However, the documents do acknowledge that there may be tensions between these aspects and that potentially, RE managers will encounter trade-offs, and that this requires additional decision-making during the development of the project. In the interviews, this research explores whether RE managers were, in fact, confronted with tensions and trade-offs.

3.3 Optimising support for user activities and sustainable development: interviews

The findings from the data- and document-analysis are complemented with relevant context-related information, using two interviews: one with the RE manager and one with the team captain of the Venray police team. The RE manager recognises himself in the performance pictured in Figure 7 as well as the findings of the data- and document-analysis:

> If we had decided to lower the ambition regarding energy label, this would not have resulted in a higher ambition regarding the space per employee, or other factors influencing user activities.



Sources: Created by author. Photo courtesy of the Netherlands Police, permission of use granted for this study. Retrieved from politie.nl, October 2023

Figure 7.
Police station Venray with performance regarding available floorspace and energy efficiency

The original police station was 3,000 m^2 GFA, with many personal workspaces isolated from each other in office rooms. The new building would measure 981 m^2 GFA, with open spaces to work in using shared desks. This performance aligns with the policy dictated in the SAP: 0.4 workplace per FTE and 21.5 m^2 GFA per workplace, plus 3.5 m^2 GFA per FTE, which amounts to 992.2 m^2 GFA based on 82 FTE (Netherlands Police, 2015).

The statement of the RE manager was confirmed in the interview with the senior user: according to his experience, supporting user activities was not sacrificed for energy efficiency or vice versa; the REVs had always been discussed separately from each other. They were treated as given norms, dictated by policy. When the interviewee was asked about user activities, it became clear that even though the police station is much more compact compared to the old building, the police team is very satisfied. There were a couple of colleagues unhappy with this building initially because they had to give up their enclosed office space. However, after two months, these persons valued the new police station better than the old. The interviewee stated:

> Police officers are recruited based on their ability to connect with others. It is an essential personality trait for police work. Thus, getting rid of the enclosed office spaces actually aligns with why most colleagues choose their profession: they want to work together.

The interview with the team captain is in line with the findings from the document- and data-analysis: energy efficiency was not traded for available space per user or other user criteria, or vice versa. More compact police stations, in combination with other technologies, actually made police services more accessible to civilians and stimulated collaboration; both were used to specify user activities, as this research shows. Thus, optimisation could occur separately from the energy efficiency REV without a disruptive effect. That being said, there is no guarantee that all future police stations will succeed the same way Venray did. The way Venray team lead supported new ways of collaborating, combined with diverse ICT solutions, supported the success of the police station.

4. Discussion

This section discusses the results of this research in light of the scientific gap and practical implications. Two implications are pointed out. While it may seem straightforward that certain tensions arise between REVs, this does not always apply. Context plays a crucial role; it strongly depends on the RE strategy and policy of an organisation. In the case of the NP RE strategy, efficiency and cost reduction were combined with improving police services and energy efficiency, which resulted in fewer and increasingly compact police stations, combined with new ICT technologies and working from other locations. The newer police stations (Venray and Uden) reflect how policy in the form of maximised norms influences their characteristics. In light of the findings of Oliver *et al.* (2019) and Frontczak *et al.* (2012), one could expect that a tension would emerge between sustainability ambitions and supporting user activities. Rather, the tension between user activities and sustainability measures for Dutch police stations seems limited: the main activities of the police officers (patrolling the streets) require less office space. Thus, a compact office did not compromise user activities. This advocates for a thorough understanding of the relationship between RE and user activities; one may, unjustly, conclude that tensions arise and dictate CREM practices based on these false assumptions. Research by Van der Voordt (2004) shows, even for a desk-work focussed organisation, that after renovation, a 30% efficiency gain for available floor space did not result in negative experiences by the users afterwards. In fact, users were satisfied due to improved communication, more advanced ICT and increased appreciation for furnishing. This sheds a new light on the findings of Frontczak *et al.* (2012),

who present available floor space as a KPI for supporting user activities. Certainly, there are thresholds for available floor space that, when exceeded, lead to dissatisfied users. Defining these thresholds could be an issue for future research.

Second, this research further develops the concept of REV optimisation and offers practitioners a case to propose management activities to optimise the trade-off in such a way that the desired performances of RE values are maintained. If not, opportunities to optimise trade-offs may be missed. For example, the Venray senior user had asked for even more sustainability measures than the proposed energy label A: he had asked the RE department to also include infrastructure to charge electric vehicles to be "future proof". This wish was not granted, according to the interviewee, because of insufficient budget. It is unknown whether this is the result of an intentional trade-off of the RE manager, where cost reduction due to a more compact police station is prioritised over additional sustainability performance. Another reason may be that, in 2015, there was no policy in place for electric vehicles, making it difficult for the RE manager to facilitate this idea. This information could not be retraced and advocates for research not being ex-post as this one, but while RE managers are faced with tensions.

Finally, REV optimization, as seen in the case of the NP poses whether REVs can be treated as linked vessels to optimise trade-offs. The size of the vessels dictate the maximum threshold for the preferred amount of added value. And CREM can indicate what the minimum threshold for added value should be per REV. A vessel can overflow; for example, a building can be built so compactly that an overshoot in cost reduction occurs. Then, CREM can transfer the overshoot in added value from one vessel to another, e.g. towards additional sustainability measures. This way, the trade-off is optimised. Continuing on this line of thought, RE managers can put the user in a position to optimise: how far would they want to prioritise sustainable development over supporting user activities?

5. Limitations

The following limitations apply. First, the data set brought forward 10 police stations where, potentially, tensions between user activities and energy efficiency appeared. However, this research could only focus on one police station due to the limited projects built in the past five years. Interviewing more RE managers and users regarding the decision-making during the development of the police stations increases our understanding of whether trade-offs were made. Second, this research focussed on newly developed police stations. It is, however, from a sustainability perspective, pressing to also look at sustainable renovation of existing police stations in relation to supporting user activities. For future research, this is a topic to consider. Finally, it can be debated whether 'supporting user activities' is a more appropriate REV to use in this research or "increasing user satisfaction". The reason to choose for the first is rather simple: two authors use m^2 GFA/employee to specify supporting user activities (van der Zwart, 2015; Lindholm, 2008a), and only author uses this performance measure to specify user satisfaction (Frontczak *et al.*, 2012). That being said, a critical review of "user satisfaction" and "supporting user activities" learns that the distinction between the two REVs is rather weak. The proposed criteria are only partially specified and too diverse. An effort to better distinguish the two REVs would be worthwhile.

6. Conclusions

This research further developed the concept of REV optimisation regarding supporting user activities and sustainable development for police stations in the Netherlands. The quantitative results show that there is weak to no correlation between energy efficiency and available square metres GFA per FTE. In addition, the qualitative analysis suggests that

trade-offs between the two aspects were not made: the two ambitions were defined separately from each other, and when one of the REVs were to change due to emerging demands in the project, this did not result in efforts to optimise performance of the two REVs with respect to each other. This research posits that CREM can be improved by treating the added values of RE as communicating vessels. Management activities to define minimum and maximum thresholds regarding added values are necessary to optimise trade-offs in favour of the desired RE performance. Finally, this study shows that whether tensions exist between user activities and sustainable development depends on the type of RE strategy and policy and the type of user activities. These aspects are crucial to take into account by scholars and RE managers who intend to make good trade-offs.

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Table A1. RE values overview

Value	Criterion	Indicator	Source
Financial			
Controlling risk	Technical condition	% of campus in (very) bad technical condition	Den Heijer (2011), Riratanaphong (2013)
	% of portfolio easily sold or disposed of	Market analysis	Den Heijer (2011), Amos and Boakye-Agyeman (2023a)
	Uptime of critical activities	Uptime of critical activities	Van der Voordt *et al.* (2016)
	Total risk expenses	Total risk expenses	Van der Voordt *et al.* (2016)
	Total insurance expenses	Total insurance expenses	Van der Voordt *et al.* (2016)
	Diversifying (smart location policy; a mix of rent, lease and ownership) when operating as investment		Amos and Boakye-Agyeman (2023a)
	Performance assessment of real estate investment		Amos and Boakye-Agyeman (2023a)
	Safety in buildings/protocols for fall prevention		Amos and Boakye-Agyeman (2023a)
	Future adaptive reuse potential		Amos and Boakye-Agyeman (2023a)
Increasing real estate value	Value of the land property	Valuation tools	Den Heijer (2011), Van der Voordt *et al.* (2016)
	Value of the campus buildings	Valuation tools	Den Heijer (2011)
	Cost of new development		Van der Voordt *et al.* (2016), Amos and Boakye-Agyeman (2023a)
	Business return on real estate assets		Lindholm (2008a)
	Real estate return on investment		Lindholm (2008a), Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
	Real estate return on equity		Lindholm (2008a), Riratanaphong (2014)
	Return on property management	Result before finance cost as percentage of invested capital per year	Riratanaphong (2014)
		Number of development projects of obsolete properties	Lindholm (2008a)
	Locations for future real estate development that attract value		Amos and Boakye-Agyeman (2023a)
Reducing costs	Costs/benefits of proposed projects in comparison with alternatives, using project databases and references on investment level	Costs/m^2, workstation or f.t.e of total FM, space, workplace	Den Heijer (2011), Van der Voordt *et al.* (2016), Amos and Boakye-Agyeman (2023a)
	Effect on organisational costs (personnel) in comparison with alternative projects		Den Heijer (2011)
	Future expansions based on new business plans		Van der Zwart (2014)
	Occupancy cost as a percentage of total operating expense	Occupancy cost as a percentage of total operating expense	Lindholm (2008a), Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)

(*continued*)

Table A1.

Value	Criterion	Indicator	Source
	Occupancy cost as a percentage of operating revenue by building or business unit	Occupancy cost as a percentage of operating revenue by building or business unit	Lindholm (2008a), Riratanaphong (2014)
	Space (square feet or metres) per unit (dollar) of revenue	Space (square feet or metres) per unit (dollar) of revenue	Lindholm (2008a), Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
	Total operating expenditures versus budget including general administration, capital expenditures, moves, adds, rearrangements, facility/properties services and other business services (mail and copy contres, risk and/or security). Considering outsourcing vs inhouse FM services	Utility (electricity and water) cost/ unit	Riratanaphong (2014), Van der Zwart (2014), Amos and Boakye-Agyeman (2023a)
		Facility costs (buildings and equipment)	Riratanaphong (2014)
		Depreciation expense	Riratanaphong (2014)
	Total occupancy cost per employee, including employee behaviroral approach to reduce costs	Total occupancy cost per employee	Lindholm (2008a), Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
	Facility management costs (environment, working conditions, quality)		Riratanaphong (2014)
	Investment level that fits the scale of the building		Van der Zwart (2014)
	Controlling investment costs and real estate costs		Van der Zwart (2014)
	Low initial investment costs		Van der Zwart (2014)
	Sober plans with slim-fit buildings		Van der Zwart (2014)
	Whether workplace standards are used		Lindholm (2008a)
		Occupancy cost per square foot/ metre	Lindholm (2008a)
		Occupancy cost per dollar/unit of revenue	Lindholm (2008a)
		Occupancy cost per unit of production	Lindholm (2008a)
		Occupancy cost as a % of total labour and overhead by business unit	Lindholm (2008a)
		Occupancy cost by building	Lindholm (2008a)
		Percent of space occupied	Lindholm (2008a)
		Percent operational space versus non-operational space	Lindholm (2008a)
		Total owned and leased space (square feet/metres)	Lindholm (2008a), Amos and Boakye-Agyeman (2023a)
		Persons per seat	Lindholm (2008a)
		Number of moves per year	Lindholm (2008a)
		Cost of under used space	Lindholm (2008a)

(*continued*)

Table A1.

Value	Criterion	Indicator	Source
		Real estate cost per CRE employee	Lindholm (2008a)
Profitability	Solvability		De Vries (2007)
	Profitability		De Vries (2007)
Technical			
Reducing CO_2 footprint	Energy use and CO_2 emission (susatinability tools, greencalc, DCBA)		Den Heijer (2011), Van der Voordt *et al.* (2016), Riratanaphong (2014), Lindholm (2008a), Amos and Boakye-Agyeman (2023a)
	Consumption of primary energy	Green procurement for real estate life cycle maintenance (LED lighting, etc.)	Van der Voordt *et al.* (2016), Amos and Boakye-Agyeman (2023a)
Optimising m^2 footprint	m^2 per function type or user group	References on space use from a database	Den Heijer (2011), Van der Voordt *et al.* (2016)
		Number of energy audits	Lindholm (2008a), Riratanaphong (2014)
	Reduced use of natural resources	Water, gas and electricity consumption in the building operations	Van der Voordt *et al.* (2016), Amos and Boakye-Agyeman (2023a)
Reduction of travel and transport activities	Access to transport		Van der Voordt *et al.* (2016)
Reduce waste	Contaminated sites management	Average amount of waste per person	Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
	Recycling and treatment of sewage and wastewater		Amos and Boakye-Agyeman (2023a)
Functional			
Increasing flexibility	Multi-functional character of space types	Post-occupancy evaluation of space use	Den Heijer (2011), Amos and Boakye-Agyeman (2023a)
	Use by different user groups	Post-occupancy evaluation of space use	Den Heijer (2011)
	Separation between supporting structure, filling and expandable zones		Amos and Boakye-Agyeman (2023a)
	Rent and short-term lease contracts		Amos and Boakye-Agyeman (2023a)
Increasing user satisfaction	User satisfaction over the years	Post-occupancy evaluation: user satisfaction	Den Heijer (2011), Van der Voordt *et al.* (2016), Appel-Meulenbroek *et al.* (2017)
	Used materials		Van der Zwart (2014)
	Art as part of healing environment		Van der Zwart (2014)
	Quality of indoor environment (lighting, airconditioning, temperature, noise level, etc.)		Lindholm (2008a), Riratanaphong (2014), Van der Voordt *et al.* (2016)
	Provision of safe environment	User satisfaction survey	Riratanaphong (2014)

(*continued*)

Table A1.

Value	Criterion	Indicator	Source
	Location success factors (access to employees, amount of local amenities, access for customers)	Employee attitude survey (perceptions and attitudes related to satisfaction)	Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
		Ratio of office space to common areas	Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
	Provision of amenities		Amos and Boakye-Agyeman (2023a)
		Amount of workplace reforms and space modification	Riratanaphong (2014)
	Survey rating regarding facilities, building, property management and CRE services		Riratanaphong (2014)
		Average call frequency	Riratanaphong (2014)
		Cost per m^2 help desk	Riratanaphong (2014)
	Measured satisfaction with workplaces		Van der Voordt *et al.* (2016), Den Heijer (2011), Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
	Measured satisfaction with collaborative space		Van der Voordt *et al.* (2016), Riratanaphong (2014)
	Feeling of control		Appel-Meulenbroek *et al.* (2017)
	Preferences		Appel-Meulenbroek *et al.* (2017)
	Emotional state, mood		Appel-Meulenbroek *et al.* (2017)
	Environmental awareness		Appel-Meulenbroek *et al.* (2017)
	Personalisation acts		Appel-Meulenbroek *et al.* (2017)
	Employee satisfaction with professional skills		Lindholm (2008a), Riratanaphong (2014)
	Employee satisfaction with information sharing		Lindholm (2008a), Riratanaphong (2014)
	Overall tenant satisfaction with property management services	Number of complaints	Riratanaphong (2014)
	Average call frequency and cost per square foot (metre)		Riratanaphong (2014)
	Location success factors	Proximity to required transportation modes	Lindholm (2008a), Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
		Access to customers	Lindholm (2008a), Riratanaphong (2014)
		Distance to other sites and businesses	Lindholm (2008a), Riratanaphong (2014), Amos and Boakye-Agyeman (2023a)
	Crowding		Appel-Meulenbroek *et al.* (2017)
	Privacy feeling		Appel-Meulenbroek *et al.* (2017)
	Withdrawal during discretionary periods		Appel-Meulenbroek *et al.* (2017)

(*continued*)

Table A1.

Value	Criterion	Indicator	Source
Community and well-being	The contribution to public policy and societal priorities	Percentage of complaints regarding environmental impact	Riratanaphong (2014)
	Social behavior, cohesion		Appel-Meulenbroek *et al.* (2017)
	Well-being (of patients)		Van der Zwart (2014), Appel-Meulenbroek *et al.* (2017)
Supporting user activities	References on similar concepts at other universities: best practices and lessons learned elsewhere (project database with new concepts)		Den Heijer (2011)
	Image of the building		Van der Zwart (2014)
		Square feet per employee	Van der Zwart (2014), Lindholm (2008a)
	Suitability of premises and functional environment	Risk Inventory and Evaluation	Riratanaphong (2014)
	Effective use of space (e.g. amount of space, vacancy rates, interruptions due to open space layout)		Riratanaphong (2014), Den Heijer (2011), Amos and Boakye-Agyeman (2023a)
Productivity	Perceived support to individual output	Percentage of perceived productivity support from working environment	Riratanaphong (2014), Van der Zwart (2014), Appel-Meulenbroek *et al.* (2017)
	Perceived support to team output	Percentage of perceived productivity support from working environment	Riratanaphong (2014), Van der Zwart (2014)
	Performance		Appel-Meulenbroek *et al.* (2017)
	Organisational effectiveness		Appel-Meulenbroek *et al.* (2017)
	Turnover		Appel-Meulenbroek *et al.* (2017)
	Smoothly functioning ICT for property management		Amos and Boakye-Agyeman (2023a)
	Facilities maintenance for optimal operations		Amos and Boakye-Agyeman (2023a)
Health and safety		Sick leave	Van der Voordt *et al.* (2016), Riratanaphong (2014), Appel-Meulenbroek *et al.* (2017), Amos and Boakye-Agyeman (2023a)
		# of accidents	Van der Voordt *et al.* (2016)
	Sick building syndrome		Appel-Meulenbroek *et al.* (2017), Amos and Boakye-Agyeman (2023a)
	Stress		Appel-Meulenbroek *et al.* (2017)
	Arousal		Appel-Meulenbroek *et al.* (2017)
	Fatigue		Appel-Meulenbroek *et al.* (2017)
	Sleep quality		Appel-Meulenbroek *et al.* (2017)

(*continued*)

Table A1.

Value	Criterion	Indicator	Source
Organisational			
Improving quality of place	Quality before and after	Maslow's pyramid with cumulative user needs, connected to investment levels	Den Heijer (2011)
	User requirements and willingness to pay for quality, using project reference database on quality and costs		Den Heijer (2011)
		Number of building quality audits and	Lindholm (2008a), Riratanaphong (2014)
		Risk inventory and evaluation	Riratanaphong (2014)
Supporting image	Image before and after	Reputation monitor of user group (faculty or university)	Den Heijer (2011), Appel-Meulenbroek *et al.* (2017)
	Use of buildings as marketing tool by users	Project database: reference on image and costs	Den Heijer (2011)
	Used materials		Van der Zwart (2014)
	Art as part of healing environment		Van der Zwart (2014)
	Role of nature in design		Van der Zwart (2014)
	Perception of corporate identity		Van der Voordt *et al.* (2016)
	Perception of corporate value		Van der Voordt *et al.* (2016)
	Perception of corporate brand		Van der Voordt *et al.* (2016), Amos and Boakye-Agyeman (2023a)
Supporting culture	Culture before and after	Post-occupancy evaluation	Den Heijer (2011), Van der Voordt *et al.* (2016), Appel-Meulenbroek *et al.* (2017)
	Opportunity costs (related to other ways of supporting culture)		Den Heijer (2011), Van der Zwart (2014)
	Real estate as the outboard engine of the organisation		Van der Zwart (2014)
	Front-back-office concept		Van der Zwart (2014)
	The building supports interaction between people		Van der Zwart (2014)
	Improve communication between staff and healthcare professionals		Van der Zwart (2014)
	Match between culture and work environment		Van der Voordt *et al.* (2016)
	Motivation, commitment and morale		Appel-Meulenbroek *et al.* (2017)

(*continued*)

Table A1.

Value	Criterion	Indicator	Source
Stimulating collaboration	Multidisciplinary output, before and after	Output assessment (before and after)	Den Heijer (2011), Appel-Meulenbroek *et al.* (2017)
	Effect on community building, sense of belonging	Post-occupancy evaluation: user questionnaire	Den Heijer (2011)
Increase innovation	Innovation before and after	Output assessment (before and after)	Den Heijer (2011)
		Level of enclosure/openness	Van der Voordt *et al.* (2016)
		Average walking distance	Van der Voordt *et al.* (2016)
	Diversity of meeting and workspaces	Emphasis on knowledge work settings, user participation in design phase	Van der Voordt *et al.* (2016), Amos and Boakye-Agyeman (2023a)
	Design that allows innovative processes		Amos and Boakye-Agyeman (2023a)
Corporate social responsibility	People: diversity of staff		Van der Voordt *et al.* (2016), Amos and Boakye-Agyeman (2023a)
CRE unit quality	Time used in project versus time budgeted for the project		Lindholm (2008a), Riratanaphong (2014)
	Money spent on project versus money budgeted on project		Lindholm (2008a), Riratanaphong (2014)
	Amount advice given to other business units		Lindholm (2008a), Riratanaphong (2014)
	CRE involved in strategic planning		Lindholm (2008a), Riratanaphong (2014)
	CRE integrated with HR strategies		Lindholm (2008a), Riratanaphong (2014)
	CRE actively involved in initiatives such as special asset use, consolidations or shared services opportunities	Percent shared services	Lindholm (2008a), Riratanaphong (2014)

Source: Created by authors

Appendix 2

Table A2. Analysis of RE value specification

Source	Organisational performance	CRE values	Criteria	Indicators
Den Heijer (2021)	Organisational goals	Adding value	Assessment criteria, criteria	Measurable indicators
Lindholm, Karen M. Gibler and Kari I. Leväinen (2006)	Goals of the firm, objective, organisational objective	Adding value	–	Key performance indicators
De Vries (2007)	Organisational goals	Adding value, RE goal	–	Indicators
Van der Zwart (2015)	Organisational goals	Added value	Criteria	Performance indicators
Van der Voordt, Hoendevanger, Jensen, Bergsma (2016)	Organisational objectives	Value parameters, added value	–	KPI's
Scheffer *et al.* (2006)	Business objectives, business driving forces	Elements of added value	Measurable items	–
Lindholm (2008a)	Strategic objectives, strategic goals, business objectives	RE strategy	–	Performance measures
Appel-Meulenbroek and Feijts (2007)	Organisational performance	Effects of CRE, added value of RE, CRE strategies	Measures, added value types	–

Source: Created by authors

Appendix 3

Location	kWh/m^2	Z-score kWh/m^2	m^2 GFA/FTE	Z-score m^2 GFA/FTE	Sum Z-score	Potential trade-off unlikely
Oosterhout	31.8	−2.4255	20.06976744	−0.0719868	−2.49749	Available space more than average
Rotterdam	82.5	−1.504	5.517	−0.954	−2.457	
Utrecht	81.5	−1.522	12.160	−0.551	−2.073	
Venray	71.5	−1.704	16.082	−0.314	−2.017	
Naaldwijk	64.7	−1.827	22.079	0.050	−1.778	Available space more than average
Eindhoven	103	−1.131	12.193	−0.549	−1.680	
Utrecht	93.3	−1.307	15.128	−0.371	−1.679	
Almere	127.2	−0.691	5.776	−0.938	−1.629	
Uden	110.7	−0.991	14.284	−0.423	−1.414	
Roosendaal	129.5	−0.649	13.029	−0.499	−1.148	
Pijnacker	132.6	−0.593	14.958	−0.382	−0.975	
Nunspeet	131.5	−0.613	16.585	−0.283	−0.896	
Harderwijk	105.5	−1.086	25.852	0.278	−0.807	
Emmen	136	−0.531	17.595	−0.222	−0.753	
Houten	148.6	−0.302	13.820	−0.451	−0.753	
Wageningen	151.4	−0.251	13.731	−0.456	−0.707	
Voorburg	137.6	−0.502	19.574	−0.102	−0.604	
Gorinchem	151	−0.258	15.573	−0.344	−0.603	
Elst	162.2	−0.055	14.485	−0.410	−0.465	
Geldrop	163.5	−0.031	14.096	−0.434	−0.465	
Schijndel	94.6	−1.284	36.508	0.924	−0.360	
Assen	181.9	0.304	10.876	−0.629	−0.326	
Gieten	113.9	−0.933	31.429	0.616	−0.317	
Doorn	174.2	0.164	14.352	−0.418	−0.255	
Amsterdam	186	0.378	11.069	−0.617	−0.239	
Oud-Beijerland	180.2	0.273	13.227	−0.487	−0.214	
Hoogeveen	145.2	−0.364	24.252	0.181	−0.182	
Almelo	150.4	−0.269	23.122	0.113	−0.156	
Heerenveen	149	−0.295	24.625	0.204	−0.091	
Dokkum	174.9	0.176	17.365	−0.236	−0.060	
Sprang-Capelle	188.8	0.429	13.213	−0.487	−0.058	
De Meern	178.3	0.238	16.492	−0.289	−0.051	
Hengelo	169.8	0.084	20.130	−0.068	0.015	
Joure	147.3	−0.326	28.419	0.434	0.108	
Leiden	206.9	0.758	11.175	−0.611	0.147	
Veenendaal	186	0.378	17.454	−0.230	0.148	
Doetinchem	202.4	0.676	13.581	−0.465	0.211	
Burgum	186.7	0.391	19.706	−0.094	0.297	
Terneuzen	186.2	0.382	20.434	−0.050	0.332	
Ter Aar	209.5	0.805	14.333	−0.420	0.386	
Alphen aan den Rijn	228.5	1.151	9.882	−0.689	0.462	
Sneek	195.6	0.553	22.805	0.094	0.646	
Weert	205.6	0.734	20.829	−0.026	0.708	
Leiden	240.4	1.367	10.643	−0.643	0.724	

(*continued*)

Table A3. Outlier analysis Dutch police stations built between 2000 and 2020

Location	kWh/m^2	Z-score kWh/m^2	m^2 GFA/FTE	Z-score m^2 GFA/FTE	Sum Z-score	Potential trade-off unlikely
Hoek van Holland	187.4	0.404	27.714	0.391	0.795	
Amsterdam	238.1	1.325	13.220	−0.487	0.838	
Zierikzee	173.6	0.153	33.067	0.716	0.868	Energy performance close to average
Deventer	235.4	1.276	16.882	−0.265	1.011	Available space is low
Asten	196	0.560	30.422	0.555	1.115	
Kampen	232.6	1.225	22.733	0.089	1.315	Available space performance is average
Kerkrade	199.8	0.629	33.713	0.755	1.384	
's-Gravenhage	264.6	1.807	16.810	−0.269	1.538	Available space performance is low
Oostburg	152.8	−0.226	51.611	1.839	1.614	
Amsterdam	273.8	1.974	22.128	0.053	2.027	Available space performance is average
Beilen	272.9	1.958	32.391	0.675	2.633	
Uithuizen	288.1	2.234	35.040	0.835	3.070	
Nieuwendijk	103.7	−1.1183	127.4545455	6.4348278	5.31657	Energy use is low

Table A3. **Source:** Created by authors

Corresponding author
Daniël van Staveren can be contacted at: vanstaveren.d@gmail.com