Master of Science Thesis

HYBRID OFFICE PORTFOLIO OPTIMISATION - PAS METHOD

A study on integrating Hybrid Working Demands into the PAS method to optimise the Netherlands Police Office Portfolio

Martijn Eversdijk - 5945925

Management in the Built Environment

First mentor: Dr. Ir. (Monique) Arkesteijn - TU Delft
Second mentor: Dr. Ir. (Vitalija) Danivska - **TU Delft**
Third mentor: Dr. Ir. (Hedieh) Arfa - TU Delft
Company mentor: Ir. (Casper) Bovy - **The Netherlands Police**

October 2025

CONTEXT

How many days per week do you usually work in the same office?

- 0-1
- 2
- 3
- 4-5

(Crawford, 2024)

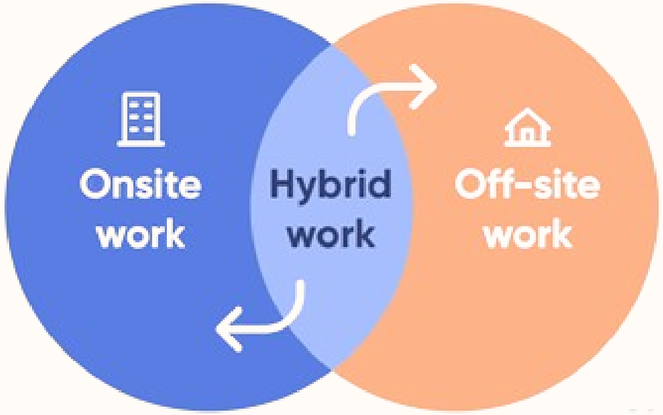
CONTEXT

How many days per week do you usually work in the same office?

- Provides freedom for knowledge workers (Appel-Meulenbroek et al., 2022)
- Empty offices (Sokolic, 2022)
- The role, use and value of office real estate portfolio (Gibson, 2003)

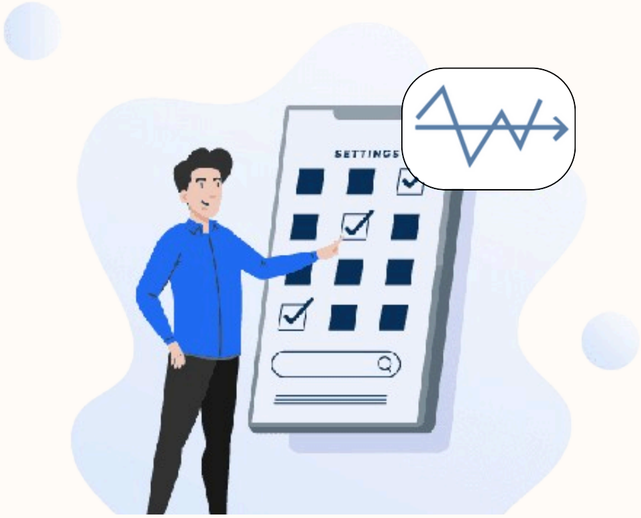
(Crawford, 2024)

CONTENT



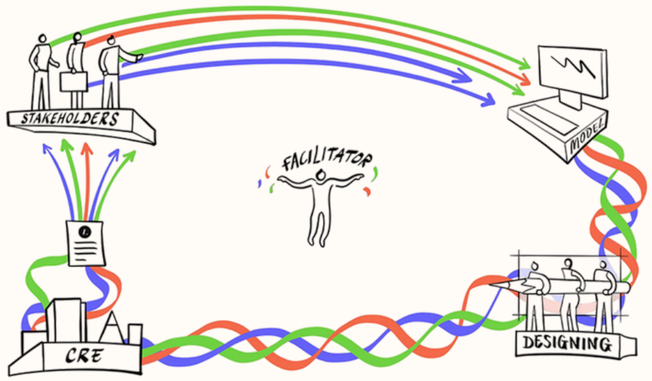
Why

The Problem



What

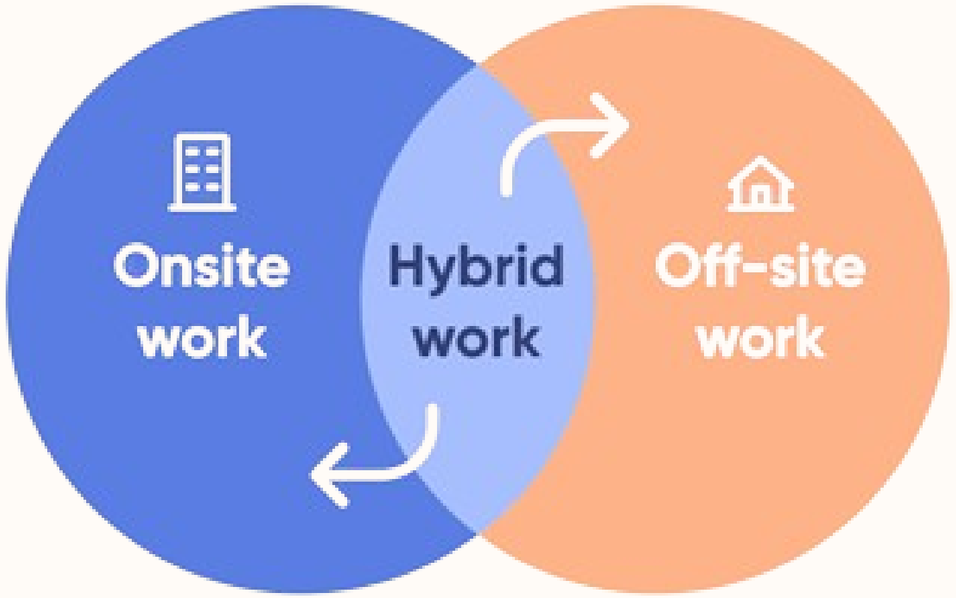
HOPO -model

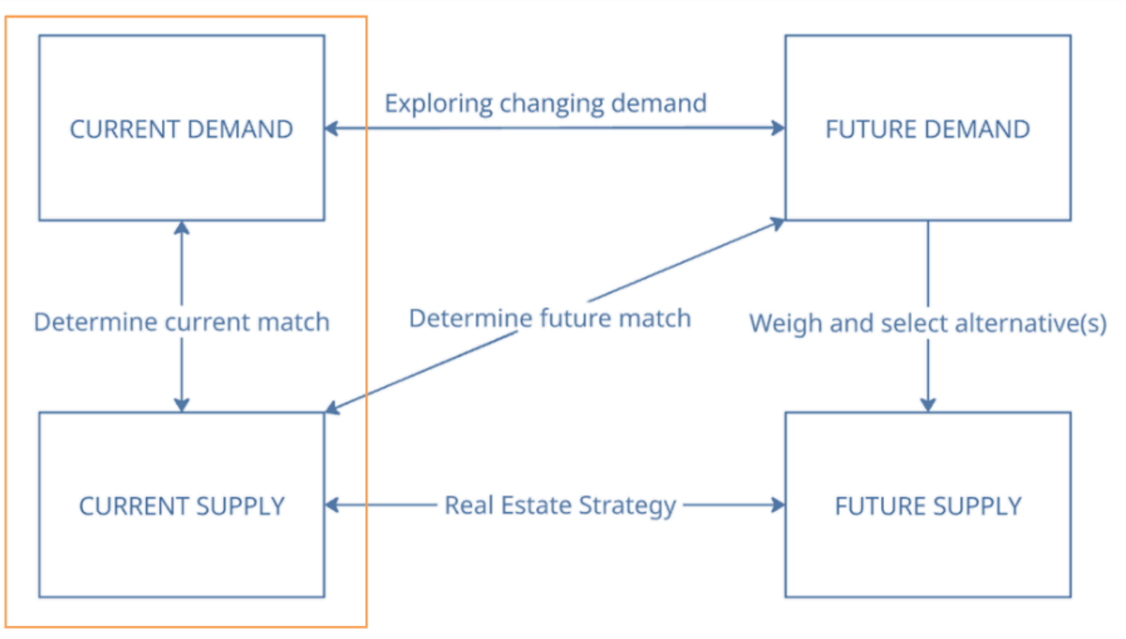


How

PAS Application

PROBLEM ANALYSIS





Hybrid Work (Miroslavov, 2024) with current mismatch according to the DAS framework (De Jonge et al., 2009)

PROBLEM STATEMENT

Existing instruments and models

I. Survey data (CfPB, 2024; Leesman, 2025)

II. The Demand Model (Cheng, 2022)

III. The Preference-based Accommodation Strategy (PAS) Method (Arkesteijn, 2019)

Research Gap (author, 2025)

PROBLEM STATEMENT

Existing instruments and models

I. Survey data (CfPB, 2023)

Integrate

II. The Demand Model (Cheng, 2022)

Reference models

Integrate

Portfolio demand model

Integrate

Fit-for-purpose

III. The Preference-based Accommodation Strategy (PAS) Method (Arkesteijn, 2019)

Adapted

Research Gap (author, 2025)

RESEARCH QUESTION

How can the PAS design and decision-making method be **adapted** into a **fit-for-purpose** design and decision-making model that **integrates** hybrid working demands for optimising office real estate portfolios?

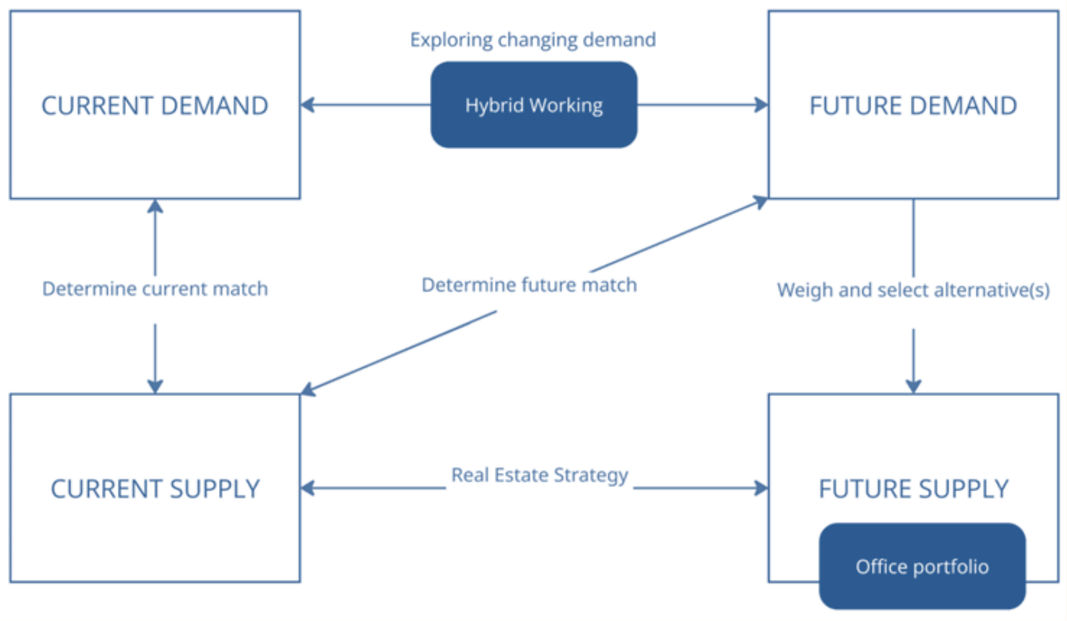
RESEARCH QUESTIONS

How can the PAS design and decision-making method be adapted into a fit-for-purpose design and decision-making model that integrates hybrid working demands for optimising office real estate portfolios?

1. What hybrid working demands can be **developed**, and how can they be **integrated**?

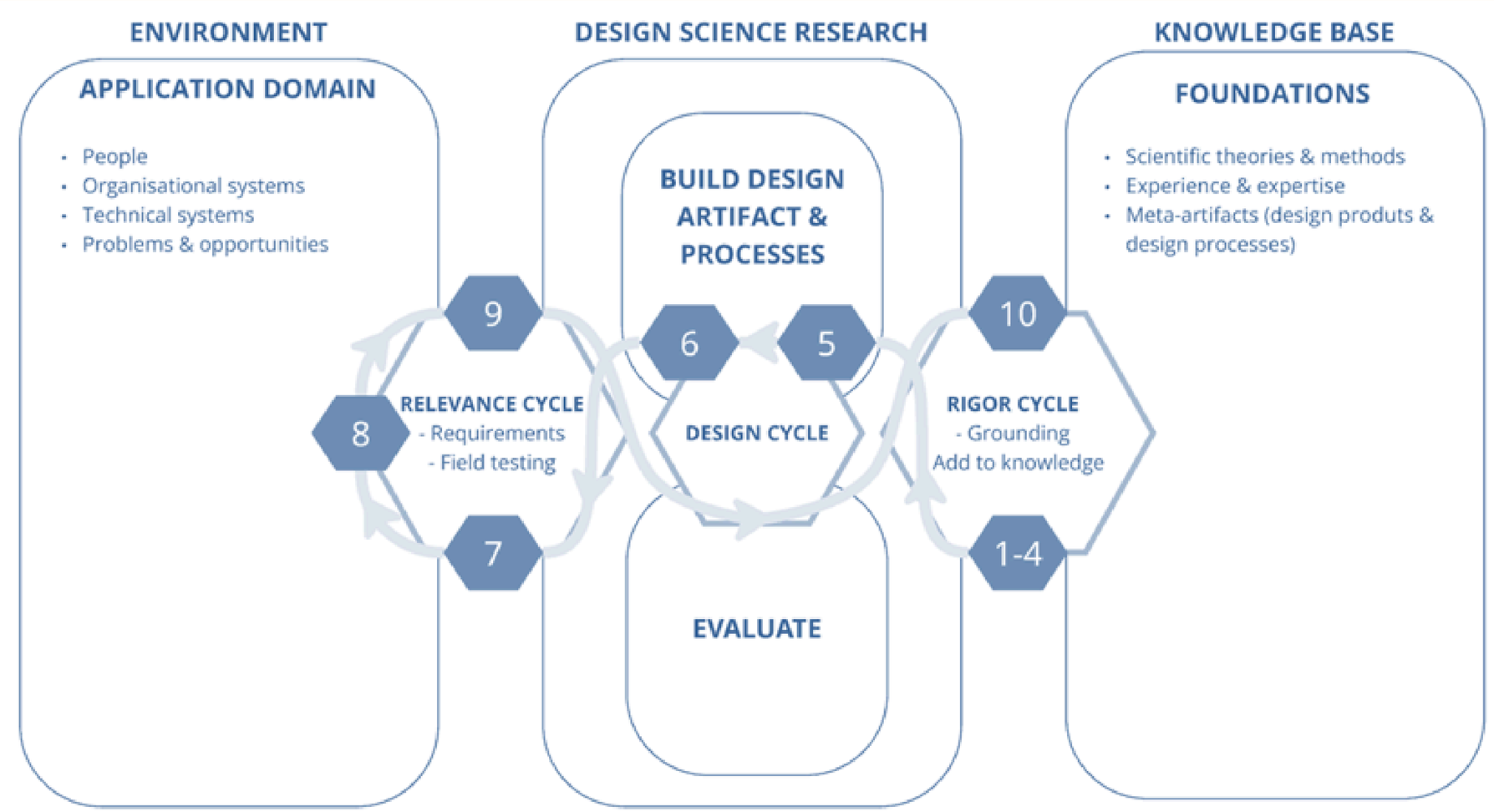
2. What is the relationship between the integrated **hybrid working demands** and the application of the **PAS design and decision-making method**?

3. How can the PAS model be **adapted**, and what needs to be changed to support a **fit-for-purpose** design and decision-making?



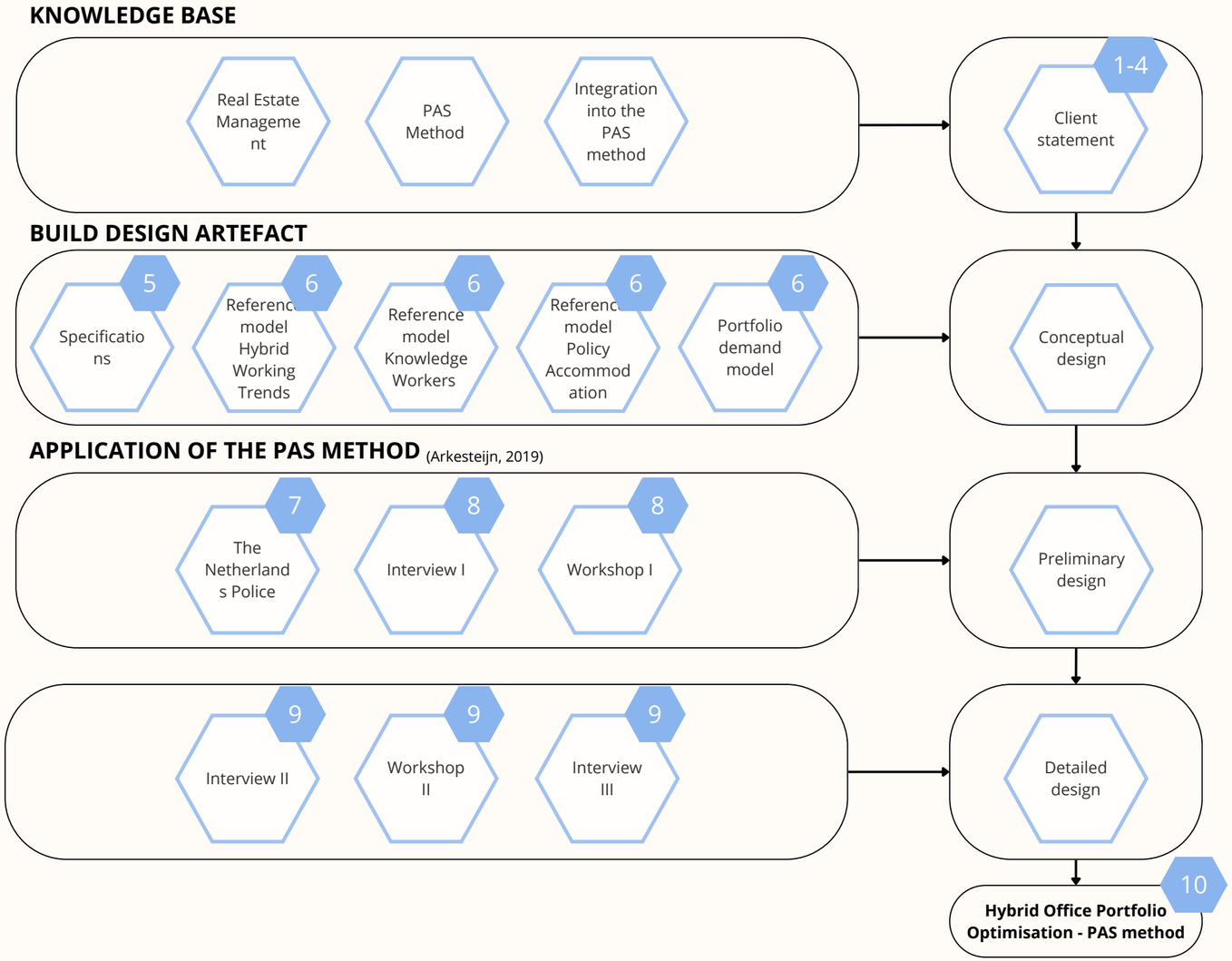
Conceptual model (inspired on Den Heijer, 2011)

RESEARCH METHOD



Design research cycles (inspired on Hevner et al., 2010; Dym & Little, 2004)

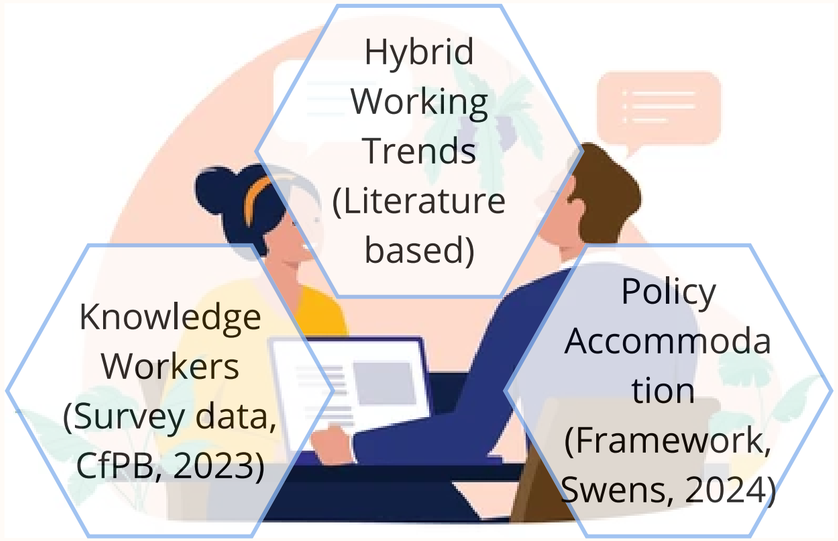
RESEARCH DESIGN



STEP 1 - 4 CLIENT STATEMENT

Reference models

- Capturing the conflicting values for comprehensive basis for formulating decision variables (De Leeuw, 2002)



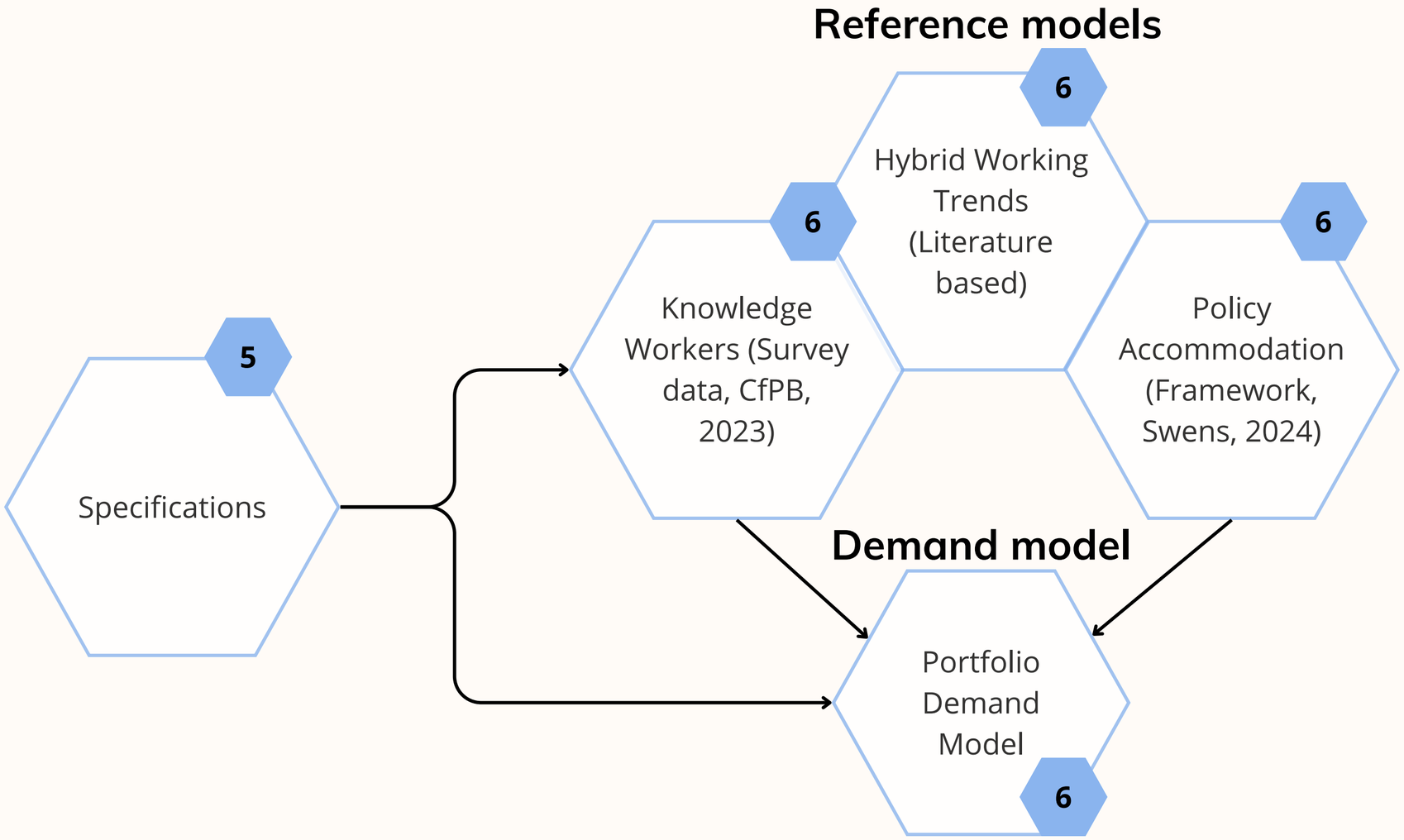
PAS: Interview Inputfactors (Arkesteijn, 2019)

Demand model

- Transform preferences of demand into portfolio demand to stimulate an optimisation (Cheng, 2022)

PAS: Workshops Portfolio alternatives (Arkesteijn, 2019)

CONCEPTUAL DESIGN



STEP 5 SPECIFICATIONS

Reference models

Performance indicators:

- Qualitative: providing clarity
- Quantitative: number of variables
- Both: the design

Level of implementation (variables)
1 – No implementation (0%)
2 – Very limited implementation (10 - 30%)
3 – Moderate implementation (around 50%)
4 – High implementation (more than 70%)
5 – Full implementation (at least 90%)

Demand model

Performance indicators:

- Qualitative: providing clarity
- Quantitative: accuracy
- Both: the design

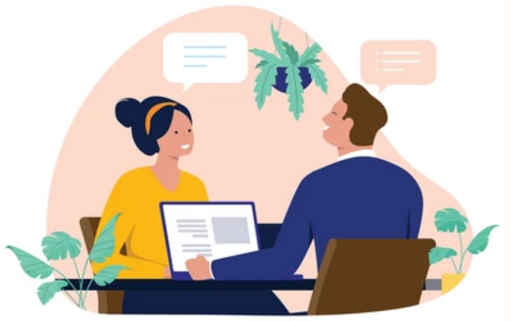
Level of implementation (outcome demand)
1 – No implementation (-)
2 – Very limited implementation (+/- 30%)
3 – Moderate implementation (+/- 20%)
4 – High implementation (+/- 10%)
5 – Full implementation (+/- 5%)

STEP 6 GENERATE ALTERNATIVES

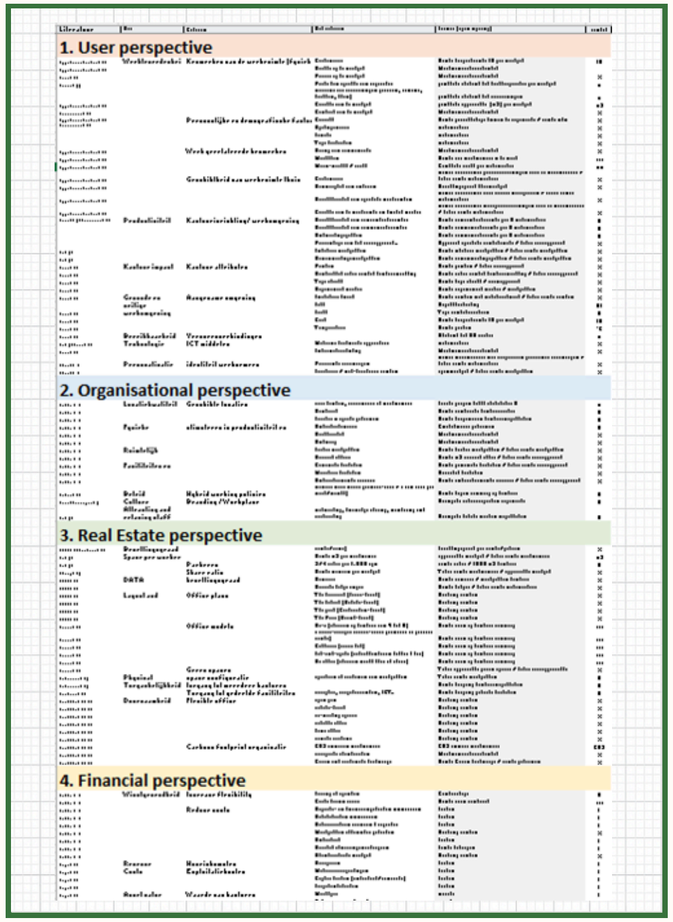
Reference model 1 - Hybrid Working Trends

User Perspective	Organisational Perspective
e.g.: Satisfaction level, Accessibility… (Appel-Meulenbroek et al., 2022; Mateescu et al., 2024; Voll et al., 2024)	e.g.: Culture, attracting and retaining talent… (Lindholm & Leväinen, 2006; Sokolic, 2006; Haynes & Nunnington, 2010)
Real Estate Perspective	**Financial Perspective**
e.g.: Adaptability, space utilisation… (CBRE, 2023; Sailer et al., 2023; Echeverri et al., 2021; Barath & Schmidt, 2022)	e.g.: Cost efficiency, Asset value… (Lindholm & Leväinen, 2006; Gupta et al., 2022; Verhoef, 2014)

Four perspectives of real estate management (Den Heijer, 2011)



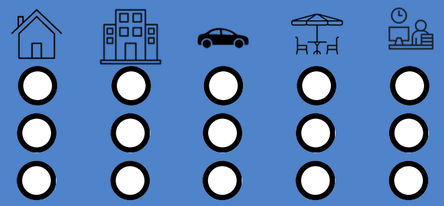
33 Variables:
- User
- Organisational
- Real Estate
- Financial



Reference model 1 - Hybrid Working

STEP 6 GENERATE ALTERNATIVES

Reference model 2 - Knowledge Workers

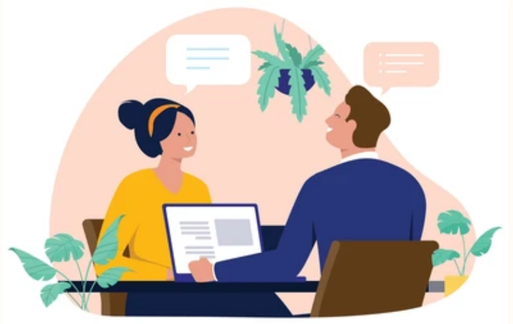


177 Survey Questions (CfPB, 2023)

Question on Commuting Time:

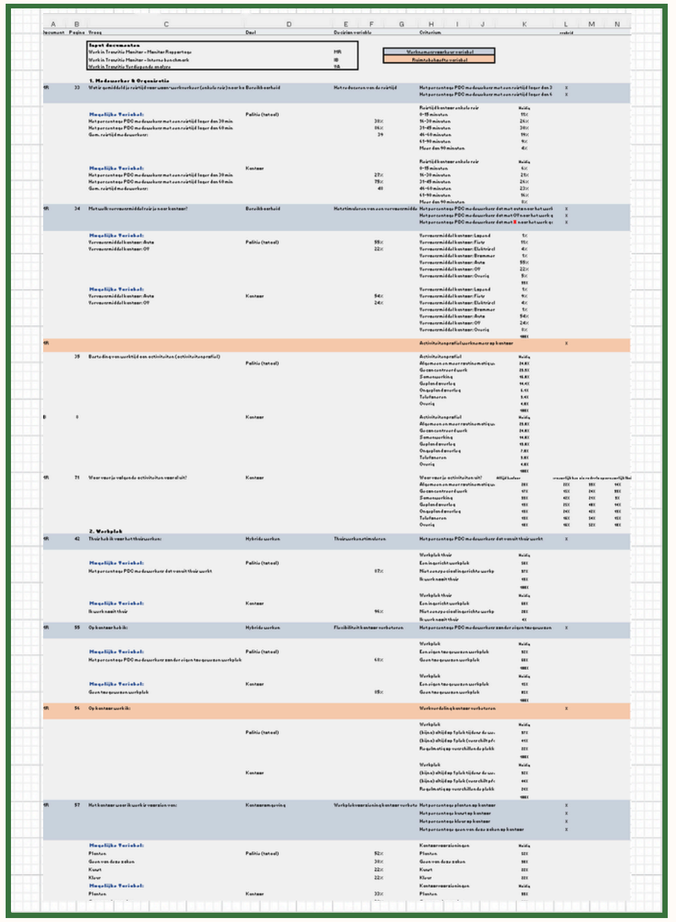
- 15 minutes
- 30 minutes
- 45 minutes
- 60 minutes
- 90 minutes

- Average: 39 min



16 Variables:

- Accessibility
- Hybrid Working
- Office Environment



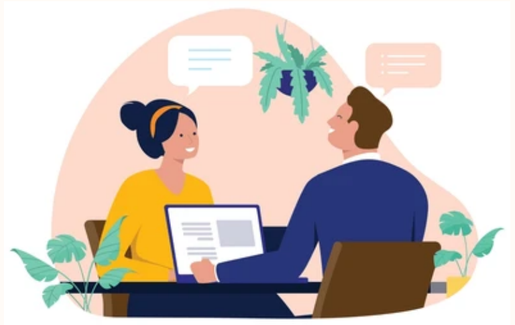
Reference model 2 - Knowledge Workers

STEP 6 GENERATE ALTERNATIVES

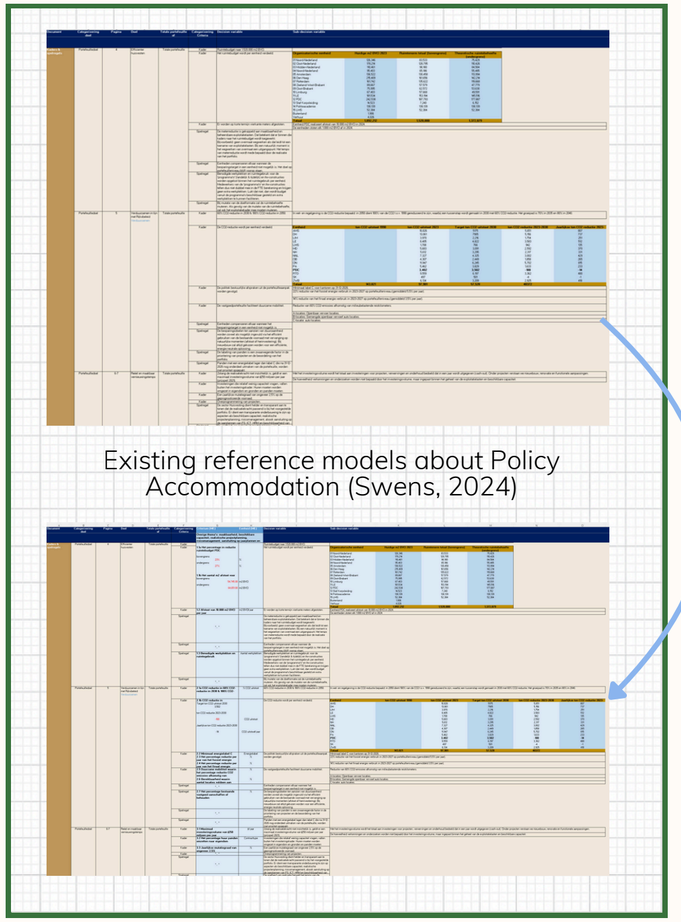
Reference model 3 - Policy Accommodation

- 93 decision variables of the complete accommodation strategy
- Overlapping, Abstract or too general

- Variables of the office portfolio
- Provide a deeper understanding of policy goals
- Effectively use in the interviews



20 variables:
- Accommodation
- Sustainability
- Realistic/Feasible
- Costs
- Quality



Existing reference models about Policy Accommodation (Swens, 2024)

Adapted

Reference model 3 - Policy Accommodation

STEP 6 GENERATE ALTERNATIVES

The demand model (Cheng, 2022)

$$D = \sum \Delta D = \sum \Delta\gamma \times \Delta\beta \times \Delta\theta$$

Where:

D = Total demand of office space
θ = The **employment headcount** classified by different employee groups
β = **1/share-ratio**
γ = **ABW implementation plan**

STEP 6 GENERATE ALTERNATIVES

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STEP 6 GENERATE ALTERNATIVES

Model building

- Demand model

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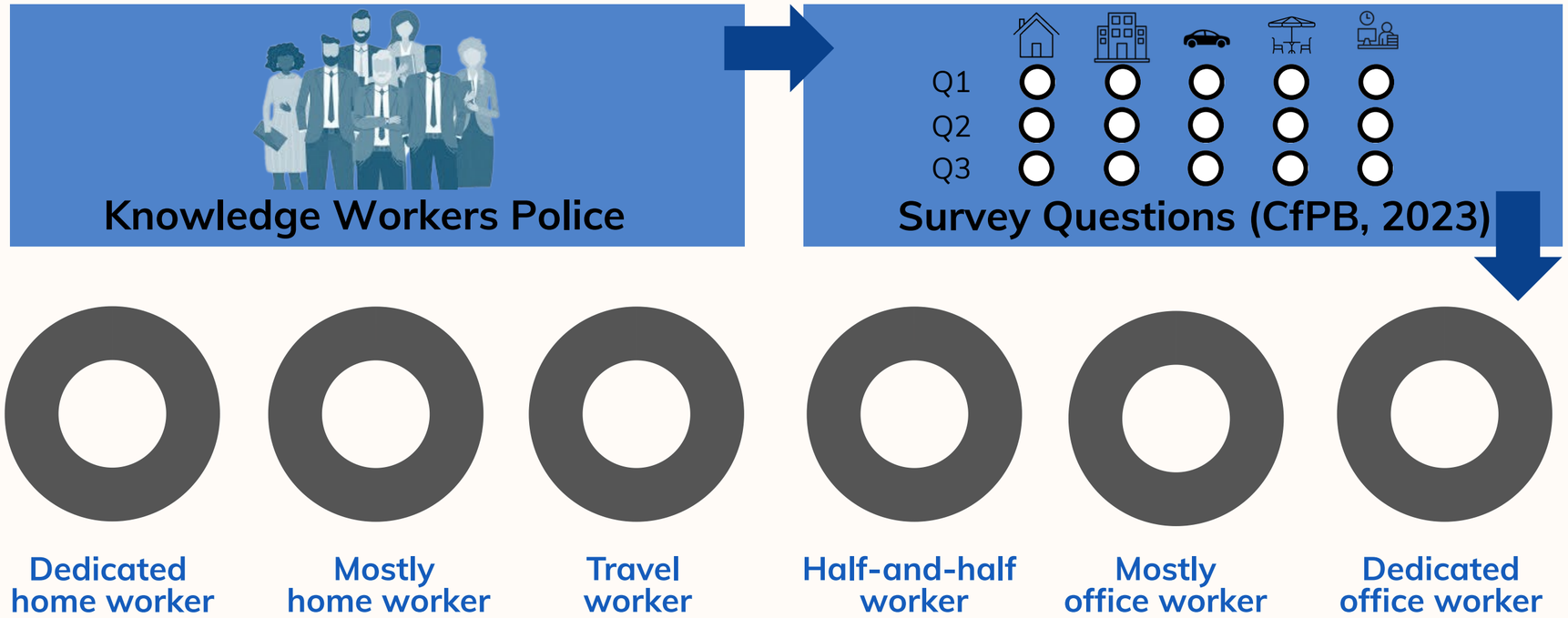

STEP 6 GENERATE ALTERNATIVES

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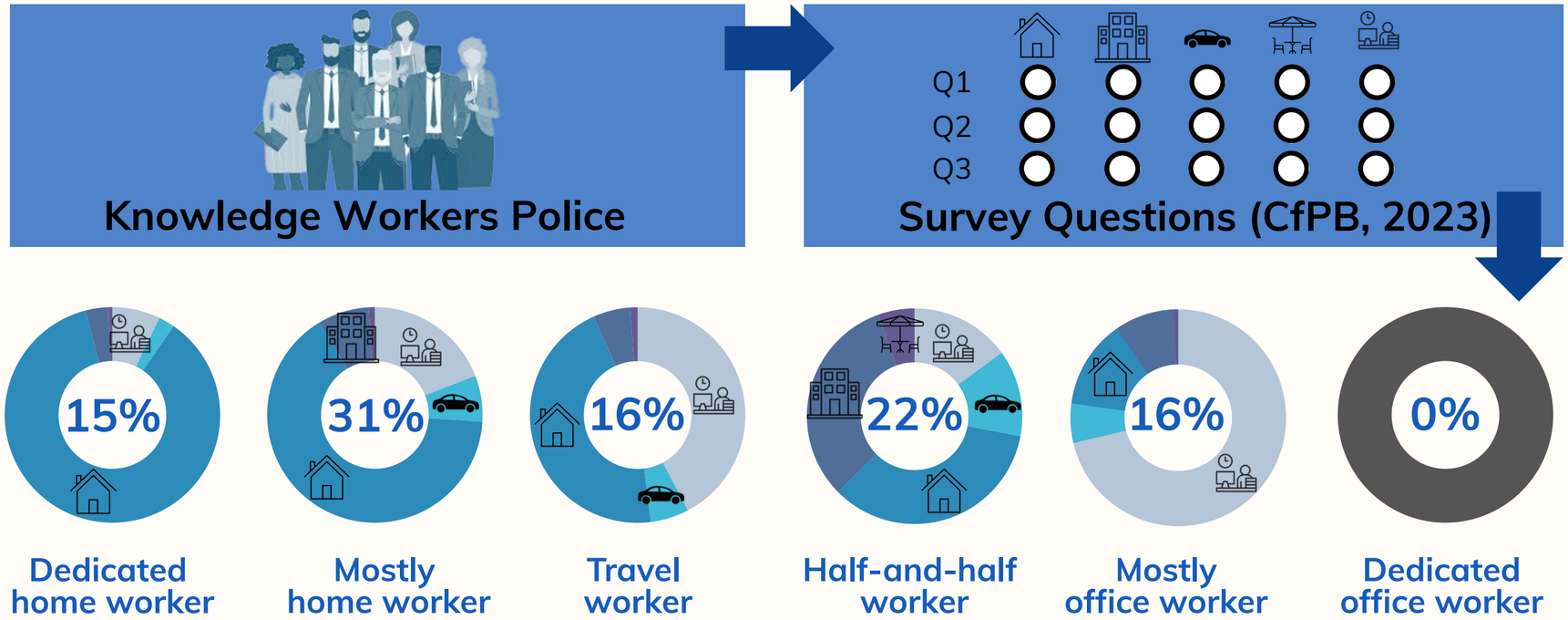

STEP 6 GENERATE ALTERNATIVES

Model building

- Demand model

$$D = \sum \Delta D = \sum \Delta\gamma \times \Delta\beta \times \Delta\theta$$

Where:

D = Total demand of office space
θ = The **employment headcount** classified by different employee groups
β = **1/share-ratio**
γ = **ABW implementation plan**

The modified share-ratio is $\frac{5\delta * \eta}{\alpha}$.

Where:

δ = share-ratio (sheerly based on ABW, differs per persona group)
α = number of days employees working in the office in a week,
η = desk occupancy rate
($0< \alpha \leq 5$, $0< \eta \leq 100\%$)

STEP 6 GENERATE ALTERNATIVES

Model building

- Demand model

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Knowledge Workers Police

	<8	8-16	16-24	24-32	>32	Hours
Q1	○	○	○	○	○	
	4.5	3.5	2.5	1.5	1.5	Day(s)

Survey Questions (CfPB, 2023)

$$\frac{\sum \text{number of respondents x Average number of days}}{\text{Total number of respondents}} = 2.58$$

STEP 6 GENERATE ALTERNATIVES

Model building

- Demand model

The modified share-ratio is $\frac{5\delta * \eta}{\alpha}$.

Where:

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α = number of days employees working in the office in a week,

η = desk occupancy rate

($0< \alpha \leq 5$, $0< \eta \leq 100\%$)

Knowledge Workers Police

	Mon	Tue	Wed	Thu	Fri
Q1	38%	53%	34%	48%	18%

Survey Questions (CfPB, 2023)

$$\frac{\sum \text{sum up percentage of days}}{5} = 38.2\ \%$$

STEP 6 GENERATE ALTERNATIVES

Model building

- Demand model

The modified share-ratio is $\frac{5\delta * \eta}{\alpha}$.

Where:

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α = number of days employees working in the office in a week,
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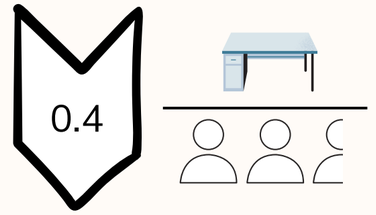
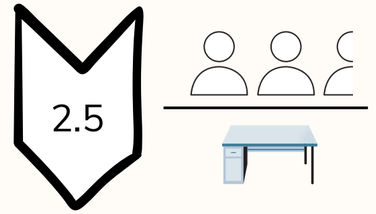
($0< \alpha \leq 5$, $0< \eta \leq 100\%$)

Work location profiles / Police profilles	Dedicated home worker	Mostly home worker	Travelling worker	Half-and-half Worker	Mostly office worker	Dedicated office worker
1. Hybrid work	2.5	2.5				
2. On the road or elsewhere			2.5			
3b. Primary work at the police location (80%-20%)				2.0	2.0	
3a. Primary work at the police location (80%-20%)						0.7

Flex space ratio



Share ratio



STEP 6 GENERATE ALTERNATIVES

Model building

- Demand model

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Where:

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β = 1/share-ratio

γ = **ABW implementation plan**

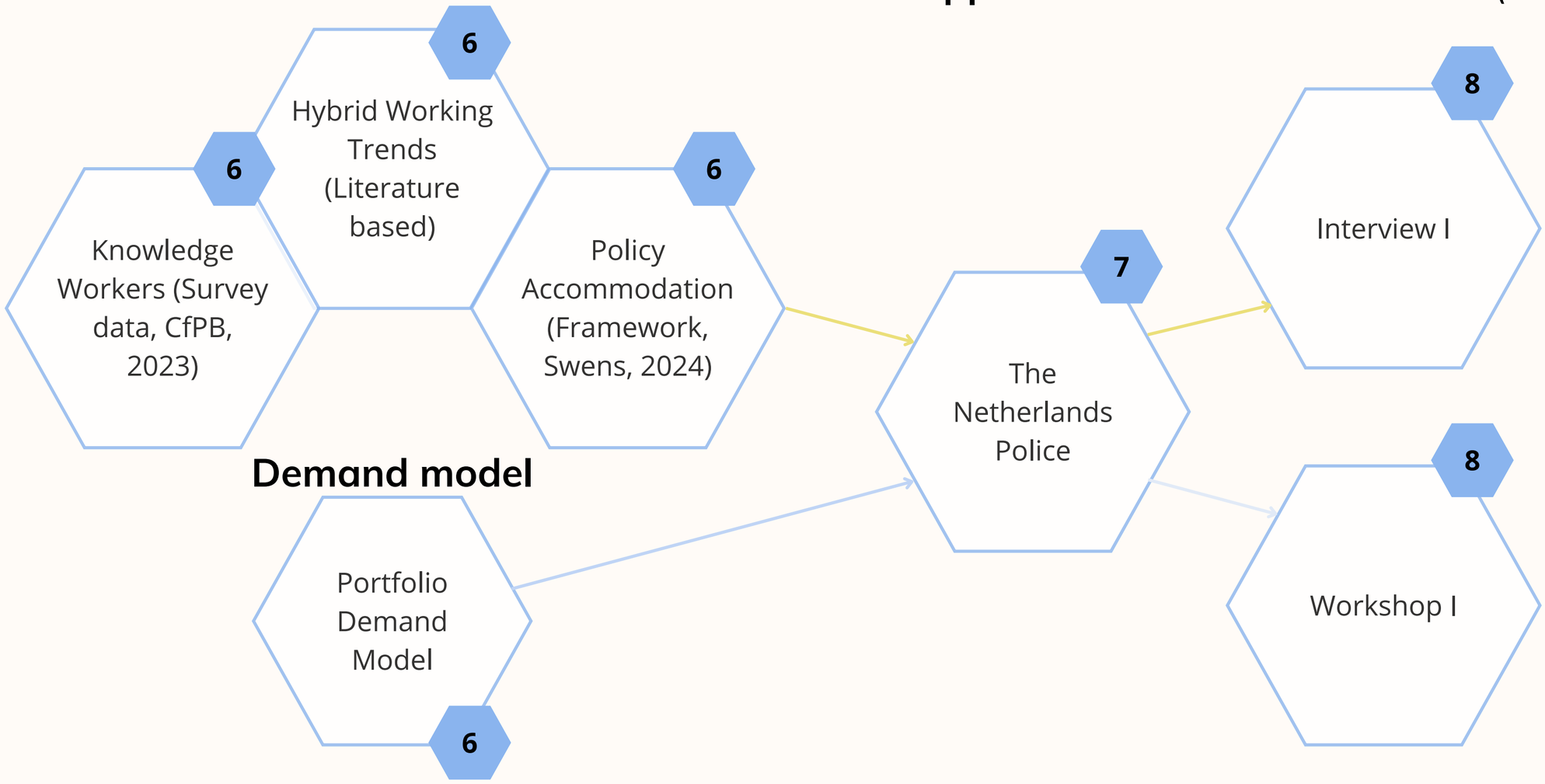
	Dedicated home worker	Mostly home worker	Travelling worker	Half-and-half Worker	Mostly office worker	Dedicated office worker	
θ	15%	31%	22%	16%	16%	0%	
β	2.5	2.5	2.5	2.0	2.0	1.4	
γ	21.5	21.5	21.5	21.5	21.5	21.5	m² GFA per work desk
D	4,347	8,984	6,376	4,637	4,637	0	m²

TOTAL office portfolio demand **28,982 m²** (Based on 3.585 employees)

PRELIMINARY DESIGN

Reference models

Application of the PAS Method (Arkesteijn, 2019)



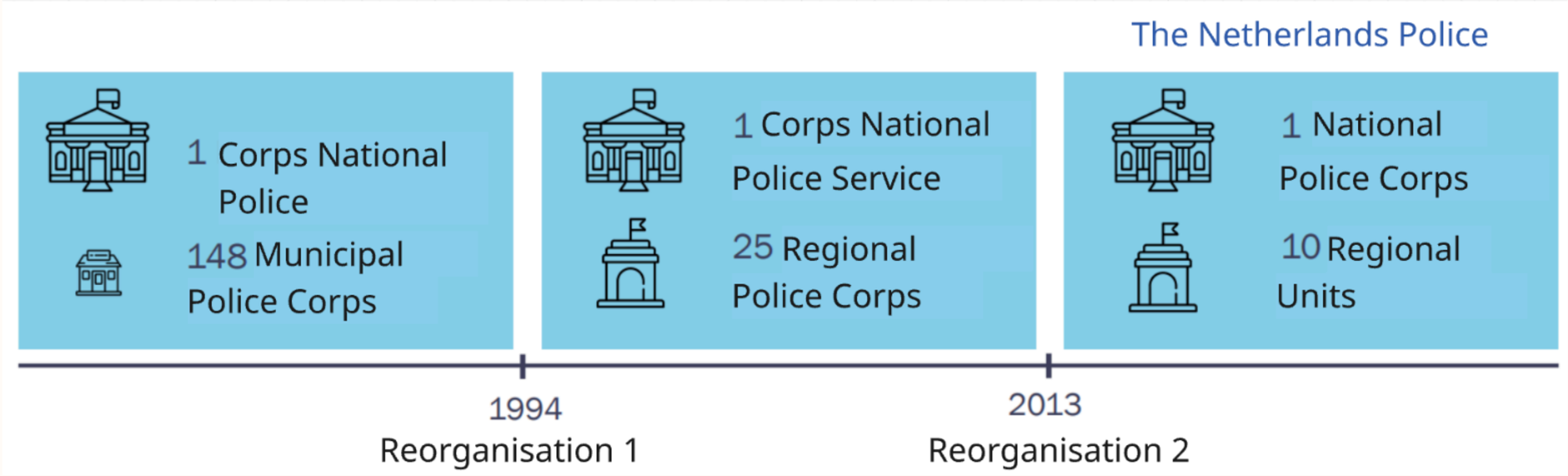
THE NETHERLANDS POLICE

How many buildings are included in the real estate portfolio of the Netherlands Police?

- Less than 150
- Around 450
- Around 800
- More than 1.200

(Politie.nl, n.d.)

STEP 7 ANALYSING THE CLIENT



(Inspectie der Rijksfinanciën, 2015).

STEP 7 ANALYSING THE CLIENT

813 buildings consisting of 1.9 million m2 GFA (Police, 2023)

Cell complex

(Sweegers and de Bruijn, 2015)

Control room

(Politie, 2023)

District buildings

(Politie, 2024)

Offices

(Politie, 2024)

STEP 7 ANALYSING THE CLIENT

813 buildings consisting of 1.9 million m2 GFA (Police, 2023)

Office Real Estate Portfolio of the Police Service Centre (PDC)

Dynamic working style

Cell complex

(Sweegers and de Bruijn, 2015)

Control room

(Politie, 2023)

District buildings

(Politie, 2024)

Offices

(Politie, 2024)

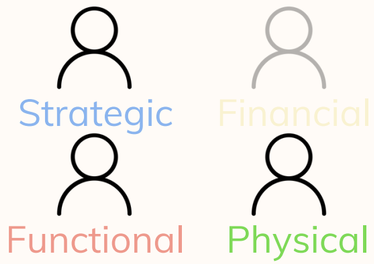
STEP 7 ANALYSING THE CLIENT

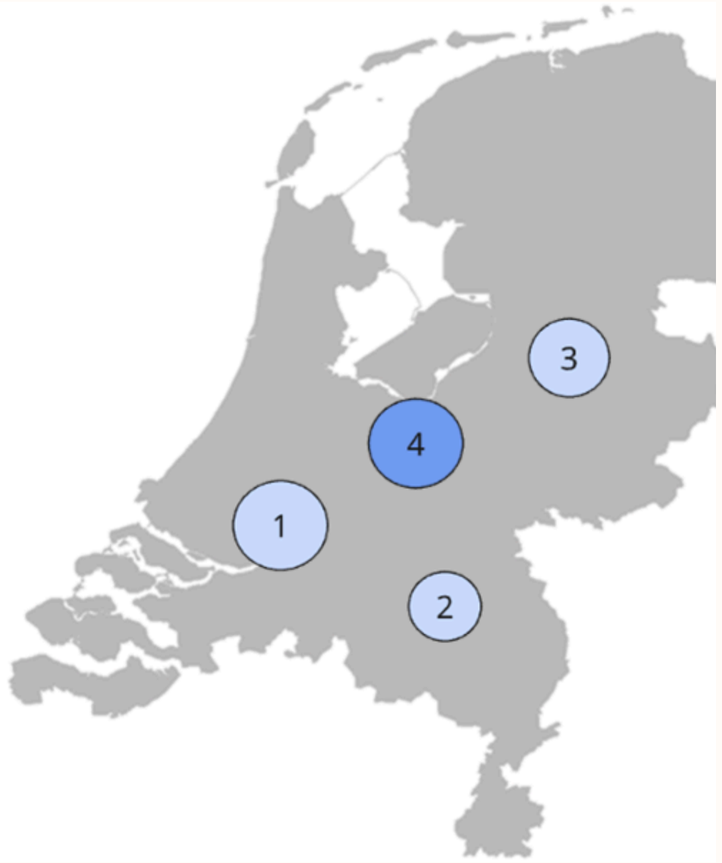
- 3 main office locations and 1 office HUB50

Office Building	Status	Gross floor area	FTE
(1) PDC Rotterdam	Contract	18.816	1.544
(2) PDC Eindhoven	Contract	3.654	250
(3) PDC Zwolle	Contract	11.255	976
(4) HUB50 Utrecht	Ownership	20.902	417

→ Spatial surplus leading to inefficient use of space

- 3 Stakeholders in the application of the PAS





PDC office portfolio police (own work, 2025)

STEP 8 - TEST AND EVALUATE

Application of the reference models during Interview I

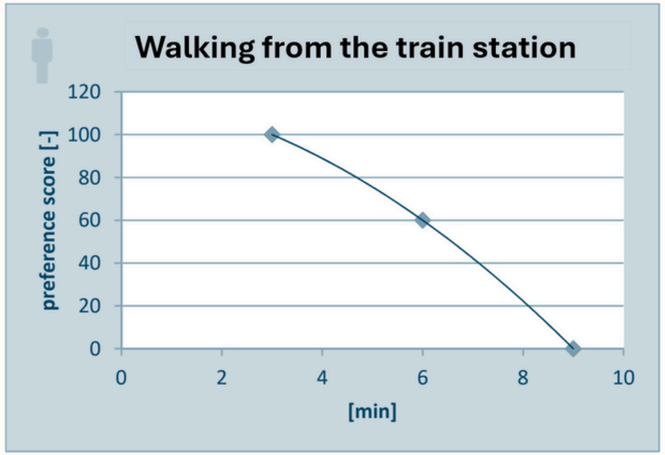
- The reference models were developed/adapted based on my interpretation
- No ranking or steering
- Responsibility remains with the stakeholders

PAS method (Arkesteijn, 2019)

- Step 1. Defining the Decision Variables with open exploration → unbiased input
- Step 1a: Introducing the reference models
- Step 2. Stakeholders Score Their Preference
- Step 3. Assign Weights to the Decision Variables
- Step 4. Define Design Constraint(s)

Possible Objective?
Accessibility

PAS method step 1 (Arkesteijn, 2019)



PAS method step 2 (Arkesteijn, 2019)

STEP 8 - TEST AND EVALUATE

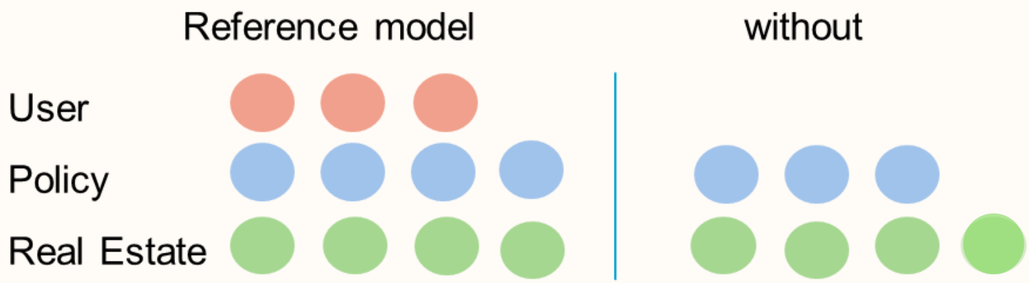
Interview I

PAS method step (Arkesteijn, 2019)	Reference model 1 - Hybrid Working	Reference model 2 - Knowledge Workers	Reference model 3 - Policy Accommodation
1. Defining Decision Variables	✖	- 2x Hybrid Working Variables but later DELETED	✖
2. Stakeholders Score Their Preferences	✖	- 2x Satisfaction level - 2x Occupancy rate - *1x Commuting time*	- 2x Reduction percentage portfolio - 2x Reduction percentage CO_2 emissions - *1x Accessibility* - *2x Energy label*

STEP 8 - TEST AND EVALUATE

Evaluation - Interview I

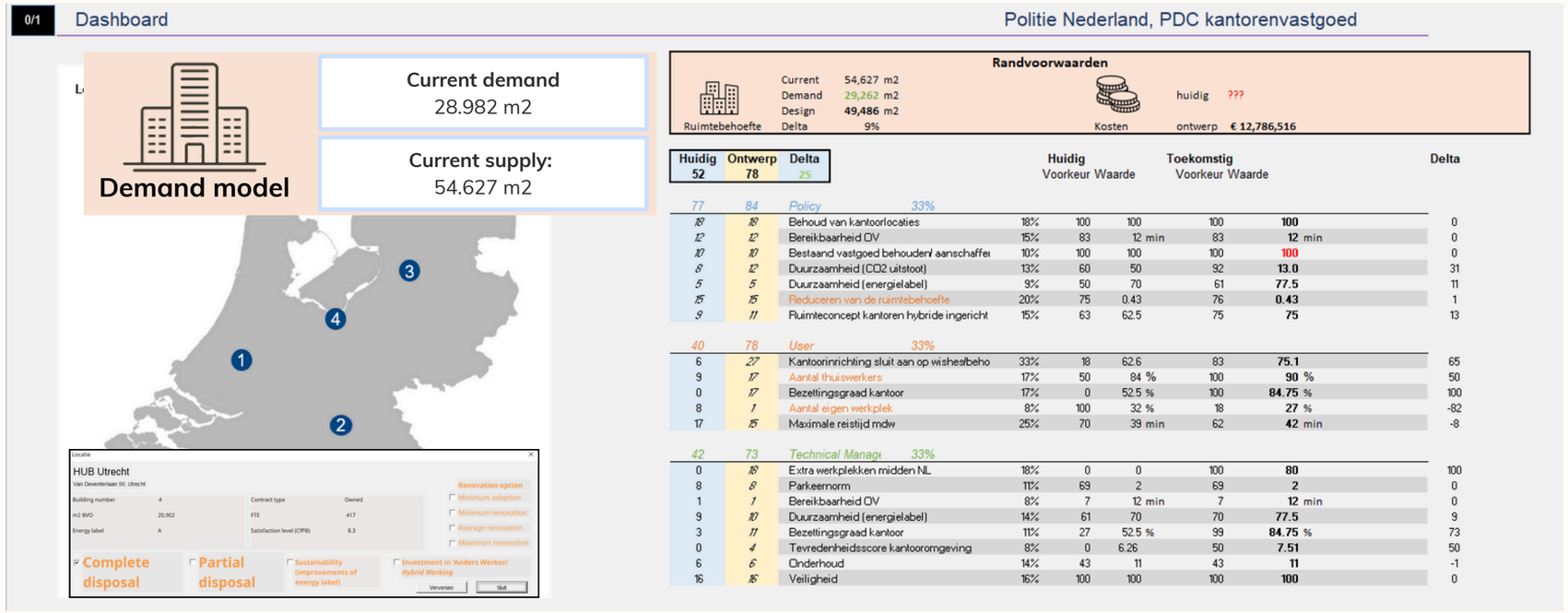
- Without the need to use the reference models
- Decision variables either didn't align with the perspective, to detailed or were already incorporated
- Added the most value in scoring the decision variables
- PAS method proves to translate abstract variables from the models into concrete and measurable criteria



STEP 8 - TEST AND EVALUATE

Application of the Demand model during Workshop I

- The dashboard of the PAS method (Arkesteijn, 2019)

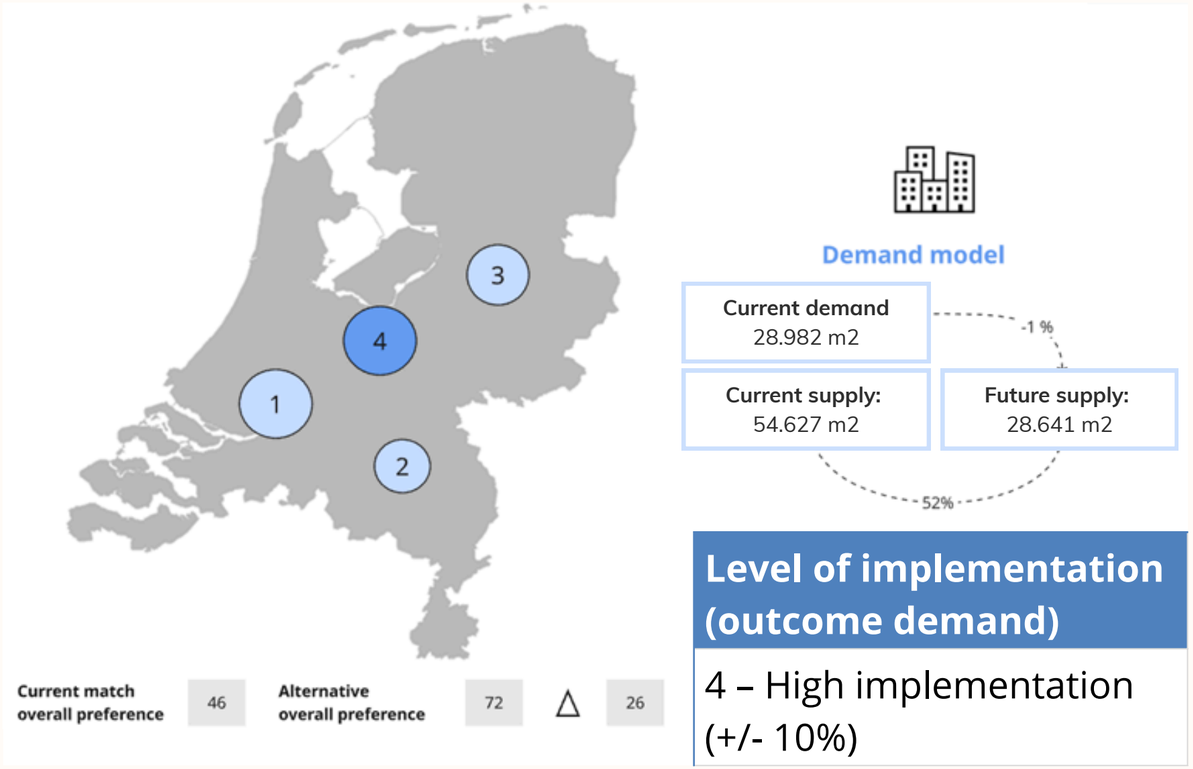


STEP 8 - TEST AND EVALUATE

Workshop I

- Only a simplified version of the share ratio
- Align design portfolio to demand model

Modified Share-ratio (Cheng, 2022)	Share-ratio	Desk Occupancy Rate	Office days / week	TOTAL DEMAND
Demand	2.5	✖	✖	**28.982 m²**



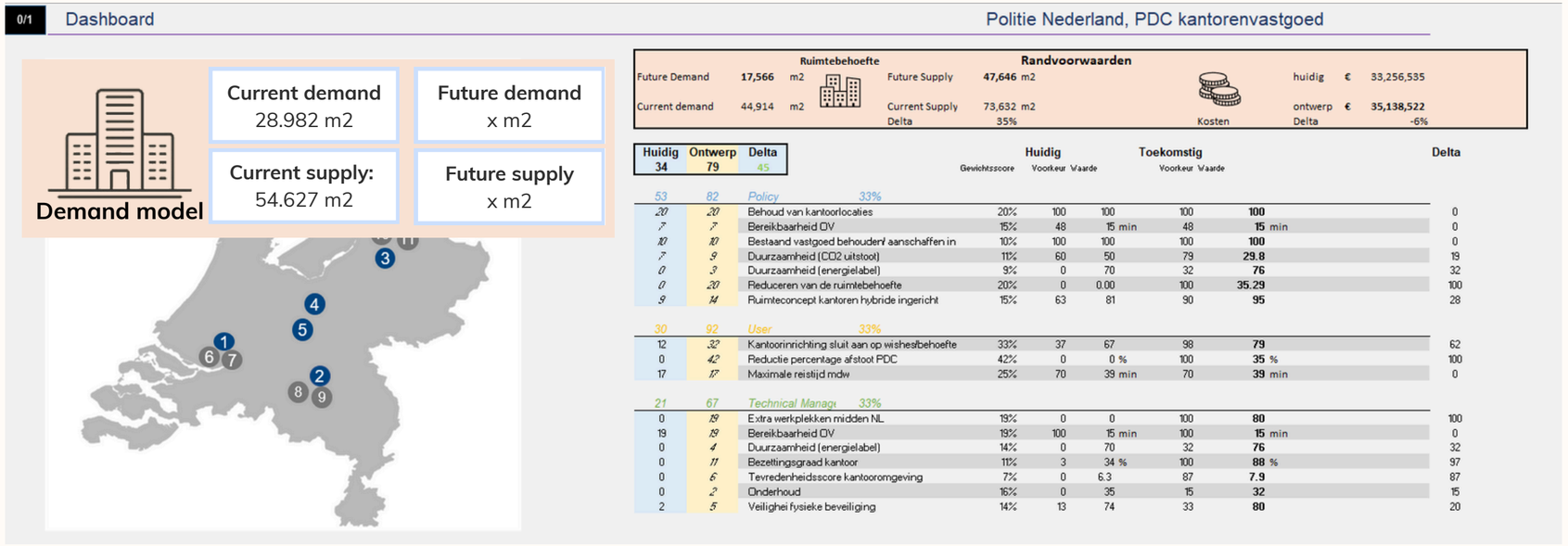
Level of implementation (outcome demand)

4 – High implementation (+/- 10%)

STEP 8 - TEST AND EVALUATE

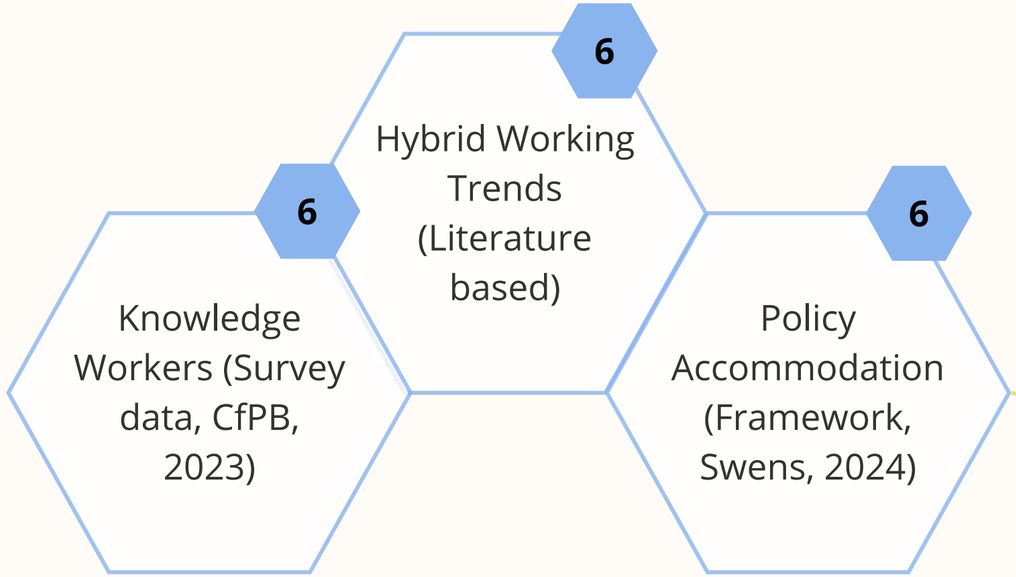
Evaluation – Workshop I

- Improvement in terms of visibility and portfolio size

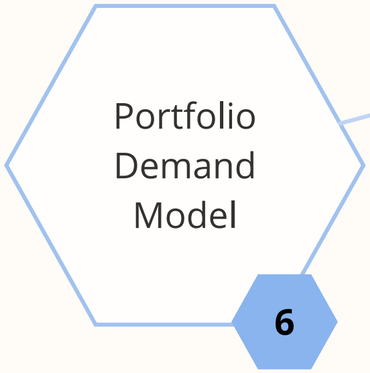


DETAILED DESIGN

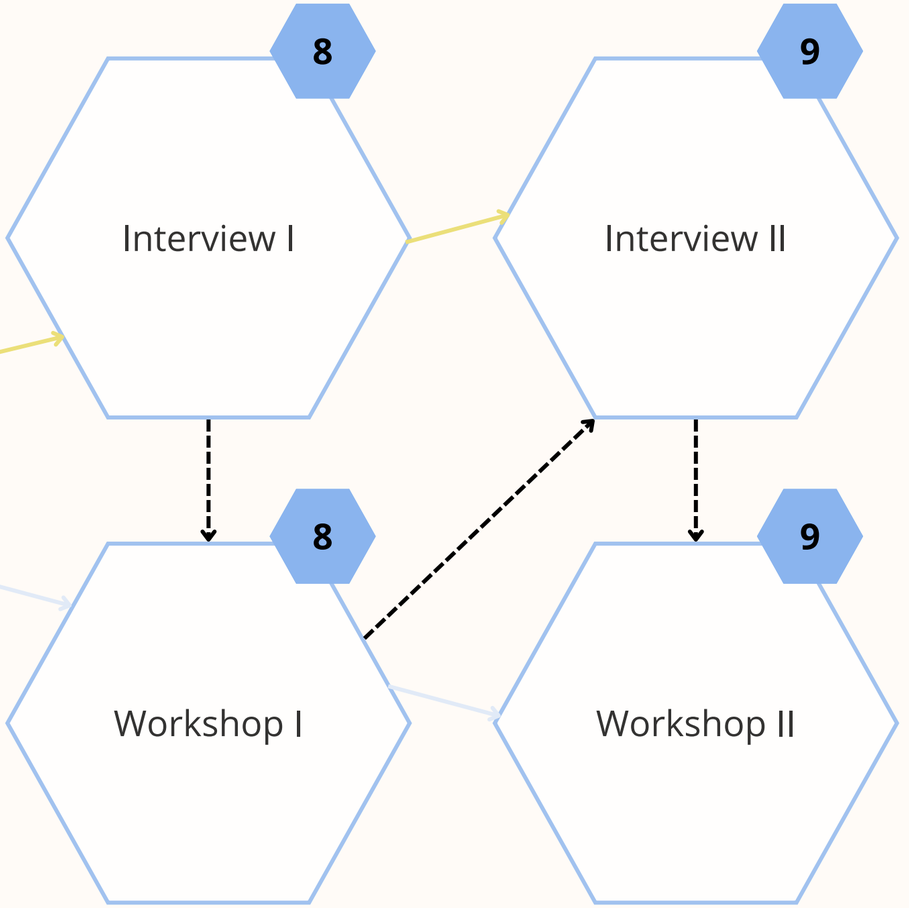
Reference models



Demand model



Application of the PAS Method (Arkesteijn, 2019)



STEP 9 - REFINE AND OPTIMISE

Interview II

- Primarily useful during the interview I

1. The expertise of the stakeholders
2. The timing of the reference models
3. The quality and completeness of the reference models

Level of implementation (variables)
1 – No implementation (0%)

Reference model 1

Level of implementation (variables)
2 – Very limited implementation (10 - 30%)

Reference model 2

Level of implementation (variables)
2 – Very limited implementation (10 - 30%)

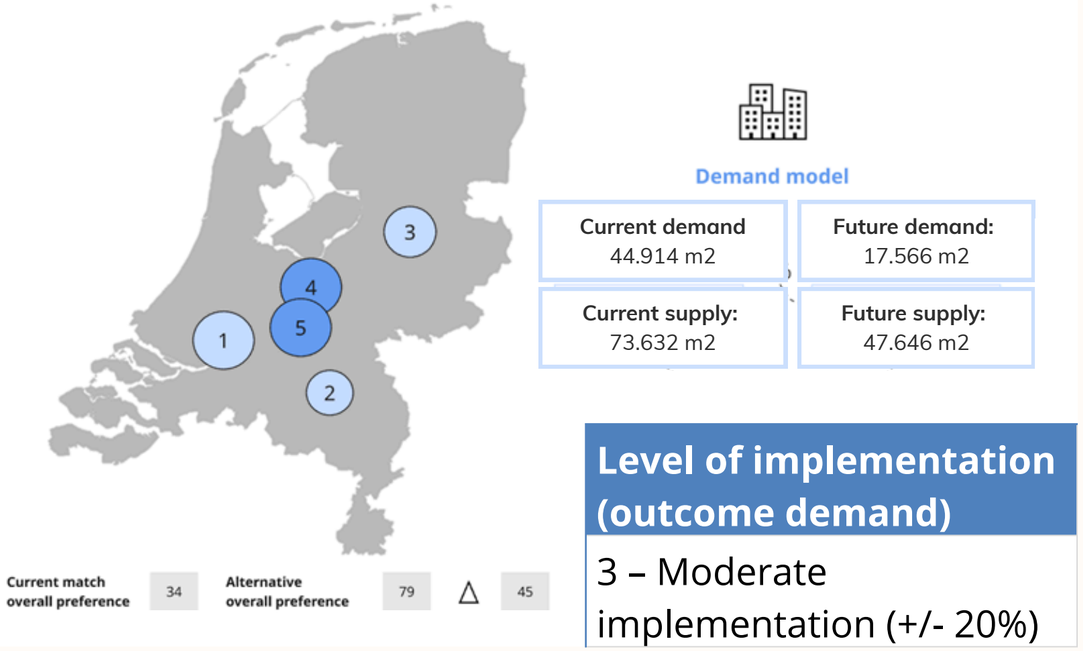
Reference model 3

STEP 9 - REFINE AND OPTIMISE

Workshop II

- Modified share ratio shows complexity, leading to unexpected and extreme outcomes
- Stakeholders paid less attention to optimising the portfolio based on this output

Modified Share-ratio (Cheng, 2022)	Share-ratio	Desk Occupancy Rate	Office days / week	TOTAL DEMAND
Current Demand	2.5	38%	2.58	**44.914 m²**
Future Demand	2.5	75%	2	**17.566 m²**



Level of implementation (outcome demand)

3 – Moderate implementation (+/- 20%)

STEP 9 - REFINE AND OPTIMISE

The modified share-ratio is $\frac{5\delta * \eta}{\alpha}$.

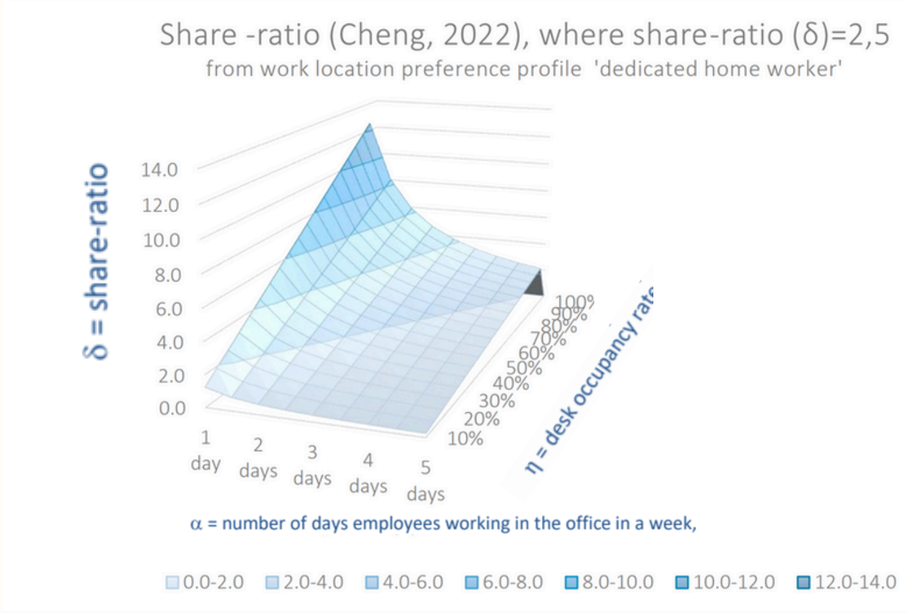
Where:

δ = share-ratio (sheerly based on ABW, differs per persona group)
α = number of days employees working in the office in a week,
η = desk occupancy rate
($0< \alpha \leq 5$, $0< \eta \leq 100\%$)

Evaluation – Workshop II

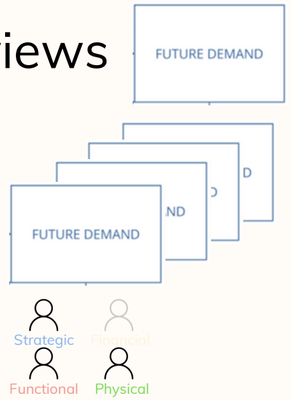
- The variable Desk Occupancy is difficult to use in the formula

Modified Share-ratio (Cheng, 2022)	Share-ratio	Desk Occupancy Rate	Office days / week	TOTAL DEMAND
Current Demand	2.5	38%	2.58	**44.914 m²**
Future Demand	2.5	75%	2	**17.566 m²**
Workshop I	2.5	100%	5	**32.917 m²**



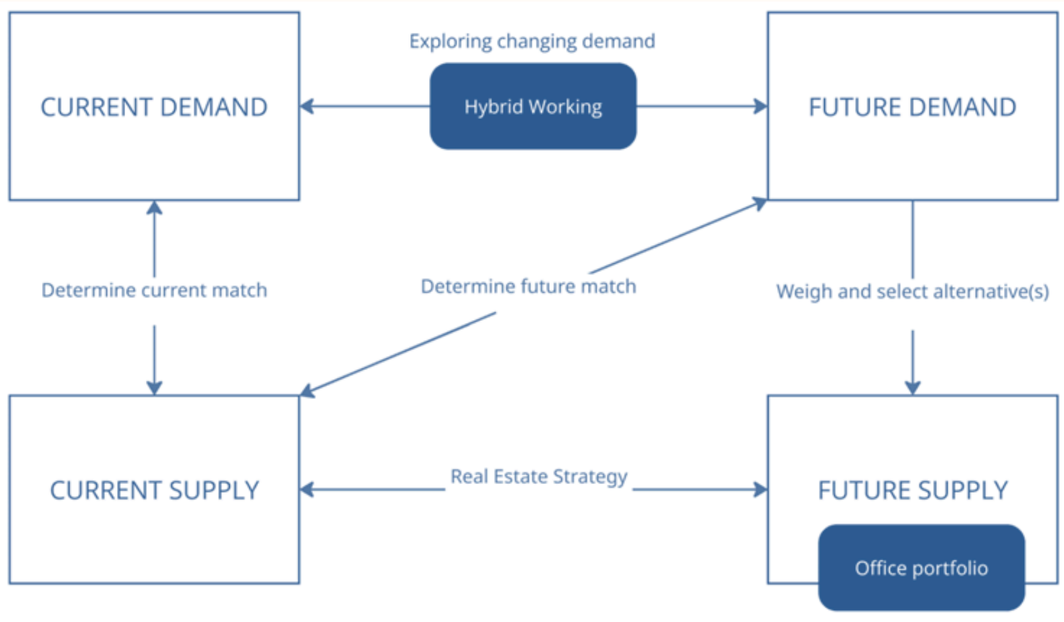
DISCUSSION

- The reference models during the interviews



- Demand model during the workshops
- Involvement of three stakeholders
- Integrated Office Portfolio

- Support Hybrid working



Conceptual model (inspired on Den Heijer, 2011)

CONCLUSION

How can the PAS design and decision-making method be **adapted** into a **fit-for-purpose** design and decision-making model that **integrates** hybrid working demands for optimising office real estate portfolios?

The three Reference models added almost no value

The research shows the potential of using them as supportive instruments

The Demand model added limited value

The research shows the potential of using it as supportive instrument

WHAT MATTERS MOST IS NOT HOW MUCH SPACE WE HAVE, BUT HOW WE USE IT TO SUPPORT HYBRID WORKING

Presented by Martijn Eversdijk - 5945925

Master of Science Thesis

THANK YOU

Hybrid office portfolio optimisation - PAS method

Martijn Eversdijk - 5945925

Management in the Built Environment

First mentor: Dr. Ir. (Monique) Arkesteijn - TU Delft
Second mentor: Dr. Ir. (Vitalija) Danivska - **TU Delft**
Third mentor: Dr. Ir. (Hedieh) Arfa - TU Delft
Company mentor: Ir. (Casper) Bovy - **The Netherlands Police**

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