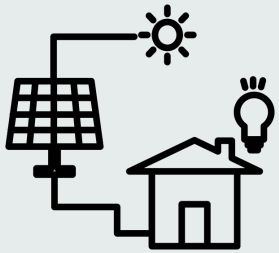
Use the User

Achieving energy reduction by activating pro-environmental behaviour of office users

Annabel Jansen
04-July-2019

What do you think of when you hear sustainability?

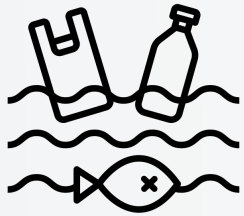


Solar panels

Wind turbines

Green energy

CO2 emissions



Plastic in the ocean

Court clears way for Enlight

Meet the ocean cleanup

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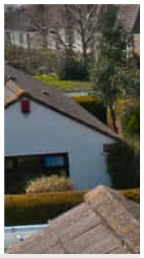

Dutch Climate Agreement sets ambitious targets for wind and CO_2 reductions

Mon 01 Jul 2019 by David Foxwell

this week to eliminate
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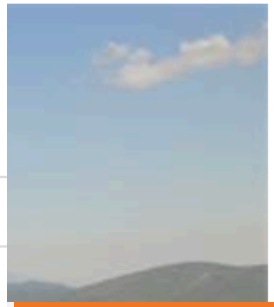
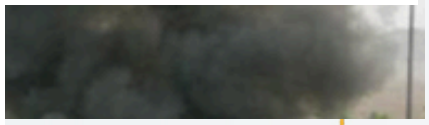
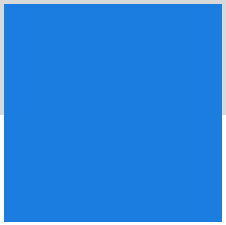


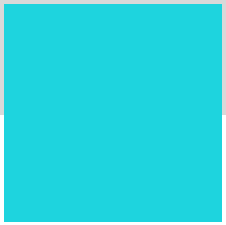


The vision of the Dutch Government



Sustainable Development Goals

2012 by the United Nations



Climate agreement

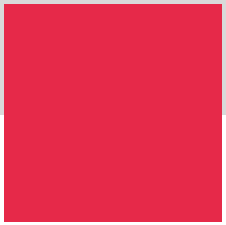
By 2050
Utility

Paris Proof

By 2050
Utility

Minimum energy label A

By 2030
Office building



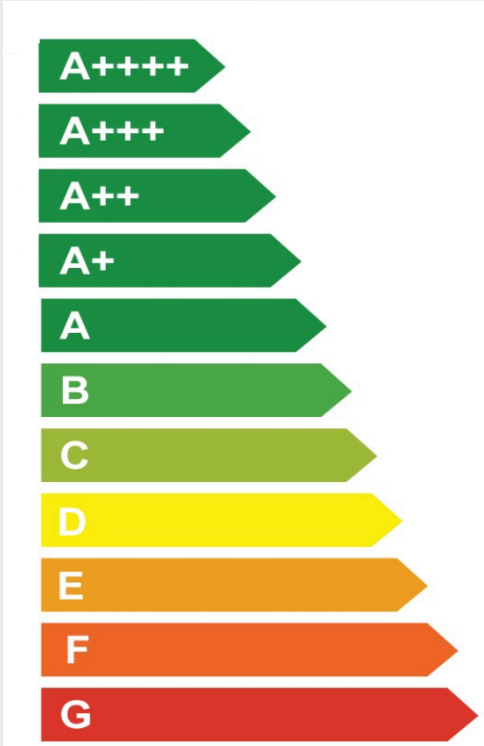
Minimum energy label C

By 2023
Office building

Energy performance gap

Phase 1

Office building with energy label E



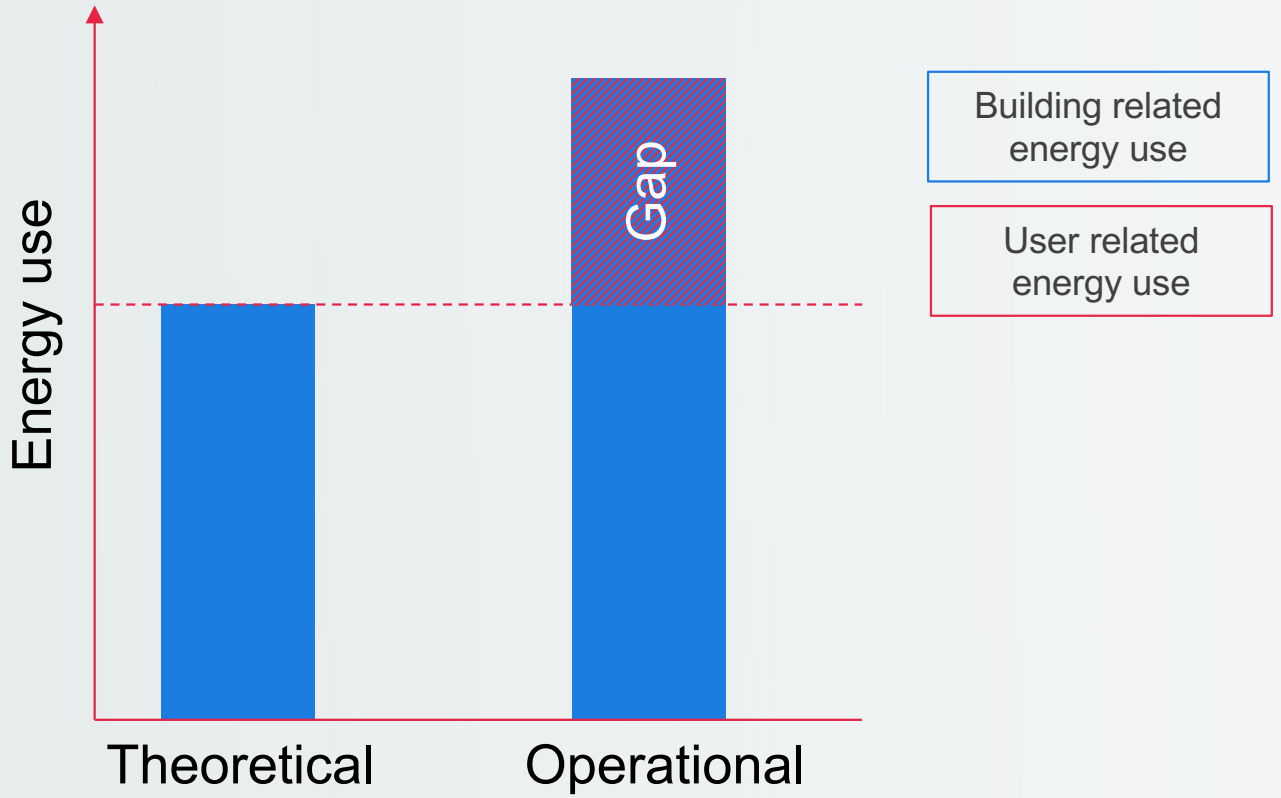
Phase 3

Operational energy use higher than expected

Phase 4

Mismatch between theoretical energy label and operational energy use

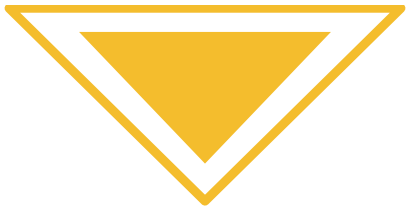
Energy performance gap



What do you think of when you hear sustainability?

Us: the user

How can the behaviour of office users be influenced in order to reduce the energy performance of office buildings in use?



Literature study

5 semi-structured interviews

2 types of Delphi panels

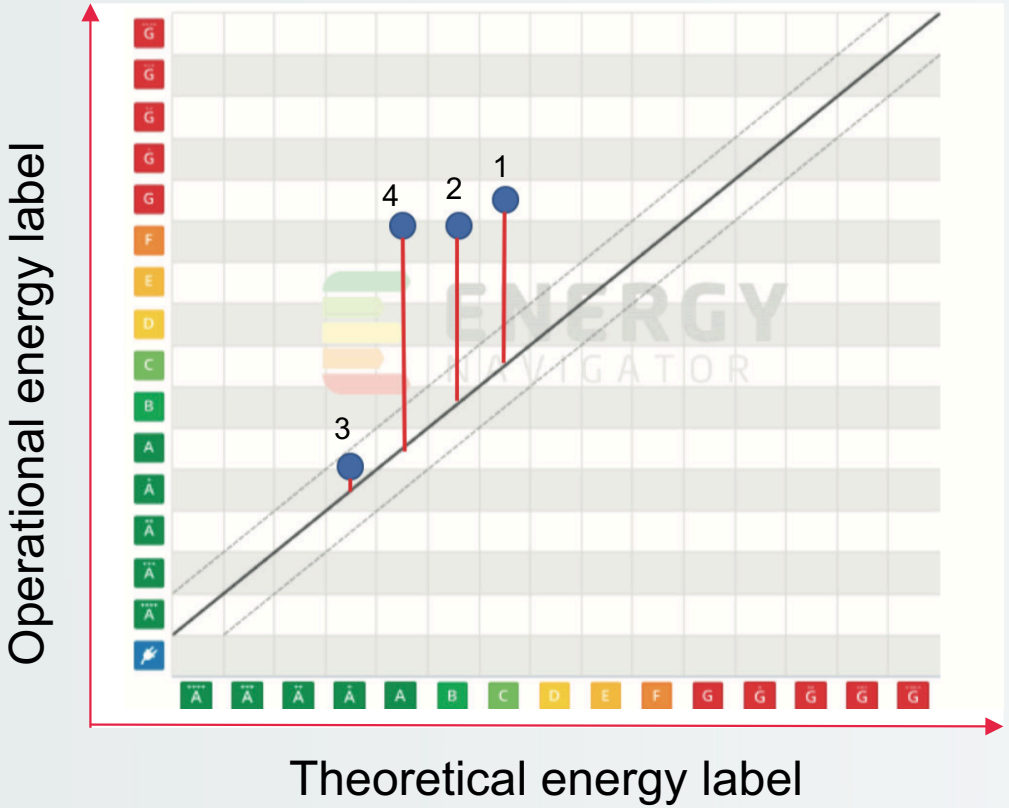
4 Case-studies

Research methods

Table of content

01 Energy performance gap - cases

The gap by case



02 Sustainable measures

Energy saving measures	Non-energy saving sustainability measures
Directly contribute to the energy reduction of the office building	Do not contribute directly to the energy use of the building, but contribute to the overall sustainability

Known effective measures

Printing less

Recycling

No plastic cups

Unnecessary light burn

Room temperature

Impact:	*Medium*	*High*	*Low*	*0,1%-1%*	*1%-2%*

(Un)known effective measures

Recycling office supplies

Food waste

Meat and Bio options

Activity based working

Computer use

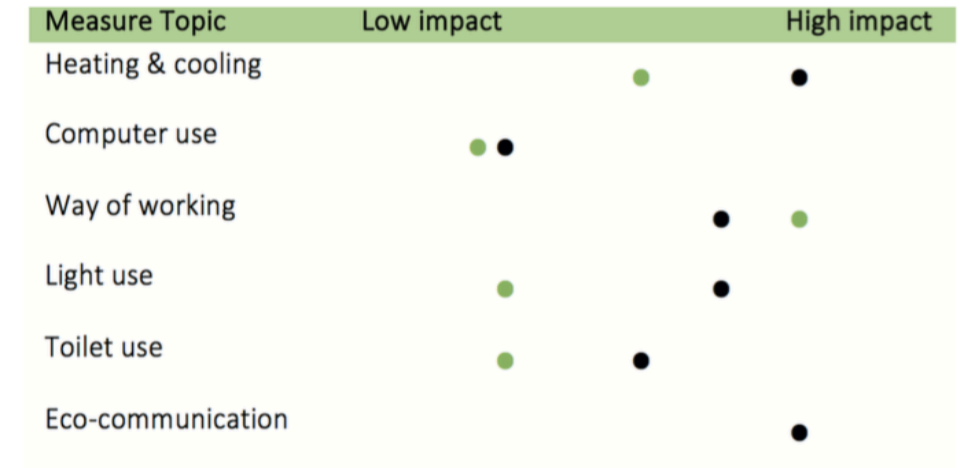
Impact:	*Low*	*Low*	*High*	*1%-10%*	*0,1%-2%*

Impact scale

1%- 2% reduction per year

14 – 28 households per year

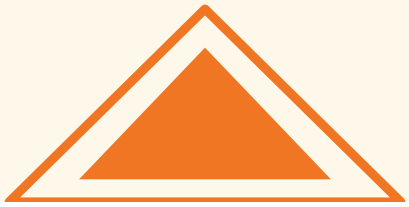
Impact literature & Facility managers



● According to the Facility managers
● According to literature

Computer use

Activity based working



03 Behaviour stimulation

Behaviour factors

Internal factors

- Institutional factors
- Economic factors
- Social Norms
- Leadership support

External factors

- Intention to act
- Environmental Knowledge
- Environmental Values
- Attitude towards PEB
- Environmental awareness
- Personal Norms
- Perceived behaviour control

Other factors

- Perceived organizational support to act environmental
- Eco-communication
- Changes by law

Behaviour factor diagram

Step 1
Based on literature

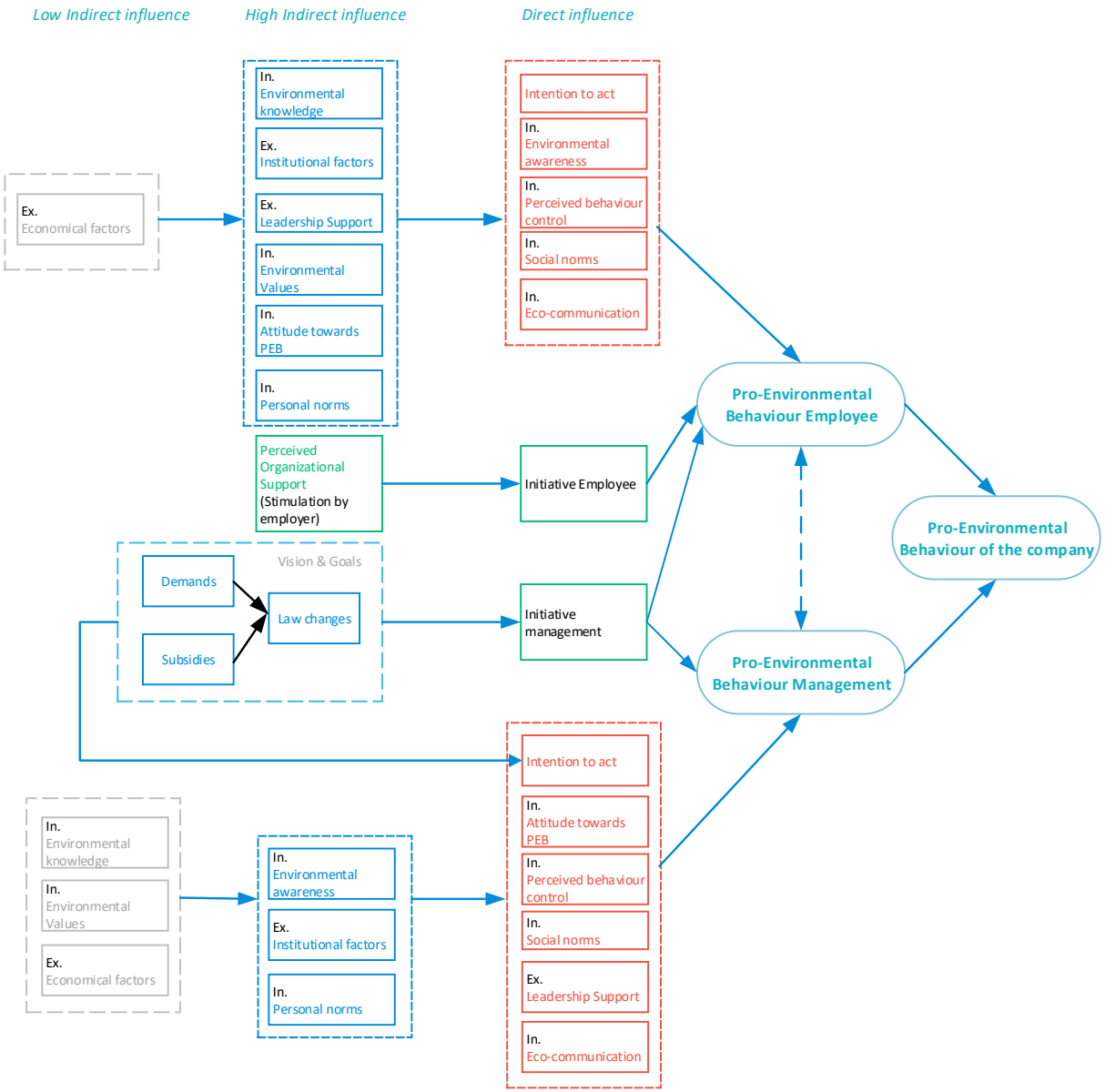
Step 2
Tested interviews

Step 3
Tested Delphi expert panel

Step 4
Tested Delphi user panel

Step 5
Tested on cases

Step 6
Concluding behaviour factor diagram

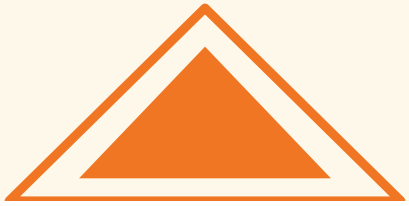

Low Indirect influence
High Indirect influence
Direct influence
Ex.
Economical factors
In.
Environmental knowledge
Ex.
Institutional factors
Ex.
Leadership Support
In.
Environmental Values
In.
Attitude towards PEB
In.
Personal norms
Intention to act
In.
Environmental awareness
In.
Perceived behaviour control
In.
Social norms
In.
Eco-communication
Pro-Environmental Behaviour Employee
Perceived Organizational Support (Stimulation by employer)
Initiative Employee
Vision & Goals
Demands
Subsidies
Law changes
Initiative management
Pro-Environmental Behaviour of the company
Pro-Environmental Behaviour Management
Intention to act
In.
Attitude towards PEB
In.
Perceived behaviour control
In.
Social norms
Ex.
Leadership Support
In.
Eco-communication
In.
Environmental knowledge
In.
Environmental Values
Ex.
Economical factors
In.
Environmental awareness
Ex.
Institutional factors
In.
Personal norms

Intention to act

Perceived behaviour control

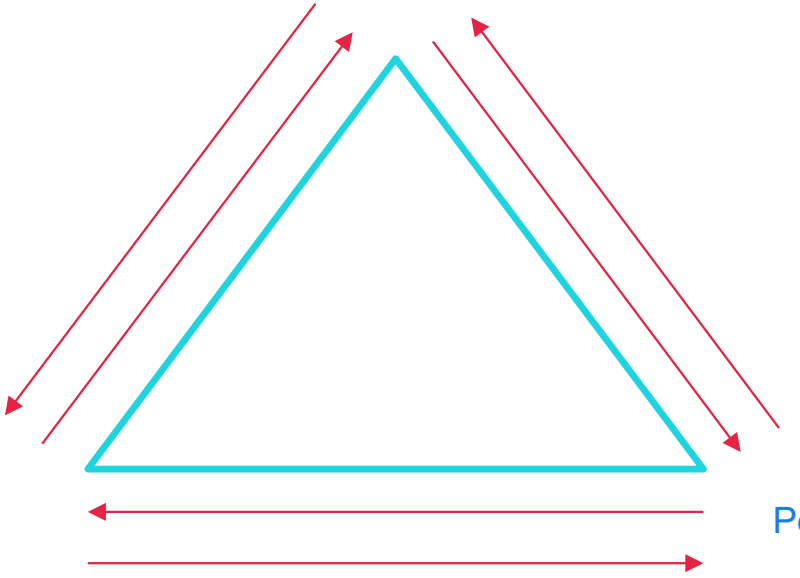
Social norms

Eco-communication



04 Effective methods

Effective methods



Sustainable measures

Computer use
Activity based working

Behaviour stimulation

Intention to act
Perceived behaviour control
Social norms
Eco-communication

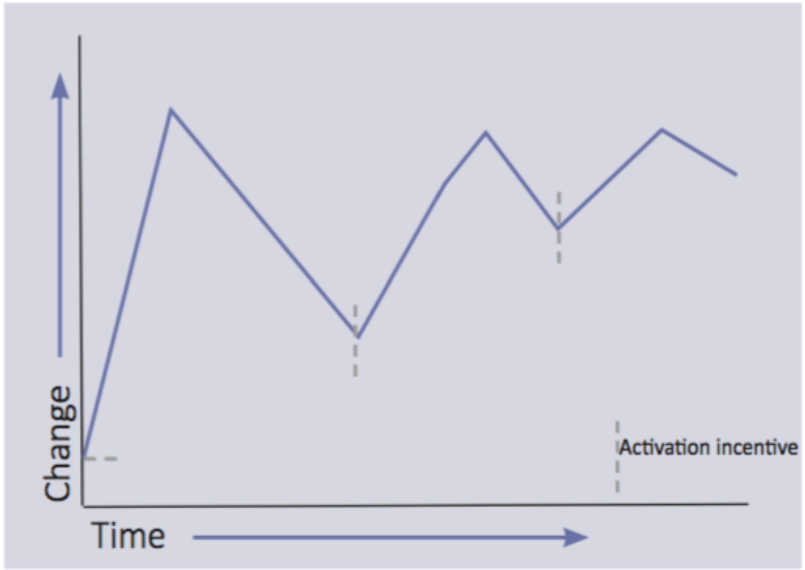
1. Pro-environmental behaviour guidelines

2. Eco-communication platform

3. Social incentives

Effective method

Social incentives



Sustainable measures

Computer use

Behaviour stimulation

Intention to act
Social norms
Eco-communication

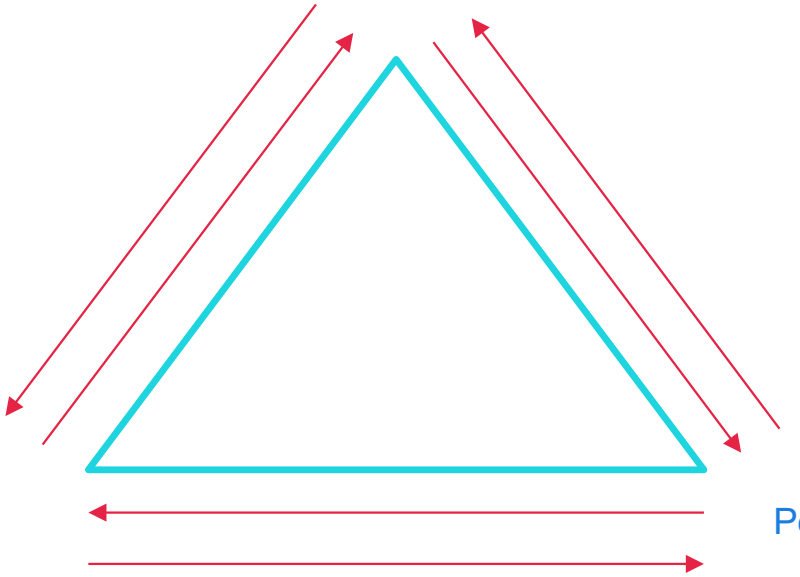
05 Conclusions & Recommendations

How can the behaviour of office users be influenced in order to reduce the energy performance of office buildings in use?

How can the behaviour of office users be influenced in order to reduce the energy performance of office buildings in use?

Effective methods

Pro-environmental behaviour guidelines
Eco-communication platform
Social incentives



Sustainable measures

Computer use
Activity based working

Behaviour stimulation

Intention to act
Perceived behaviour control
Social norms
Eco-communication

Goal =

acting pro-environmental at the workplace and at home

Recommendations

1. Testing the results in practice
    1. Case-option: No building-related gap
    2. Case-option: Data analyses before and after

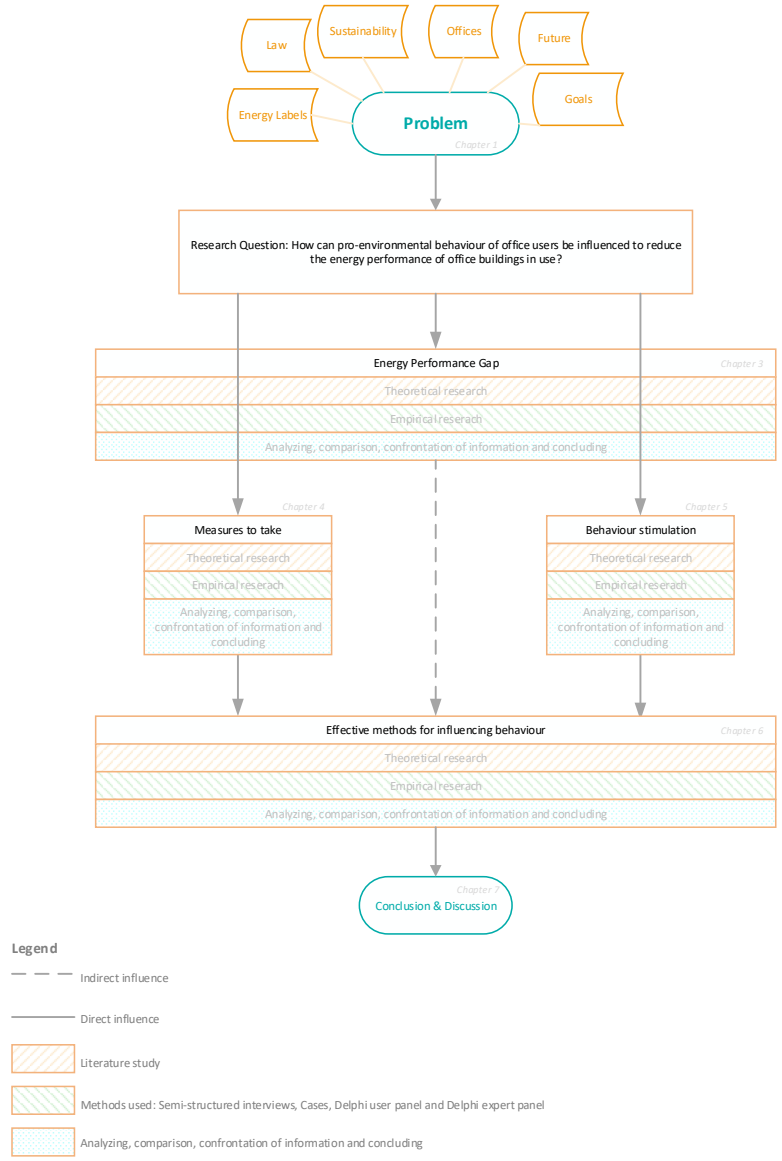
2. Do the cases and users experience the same?

3. Is the change in the workplace effective at home

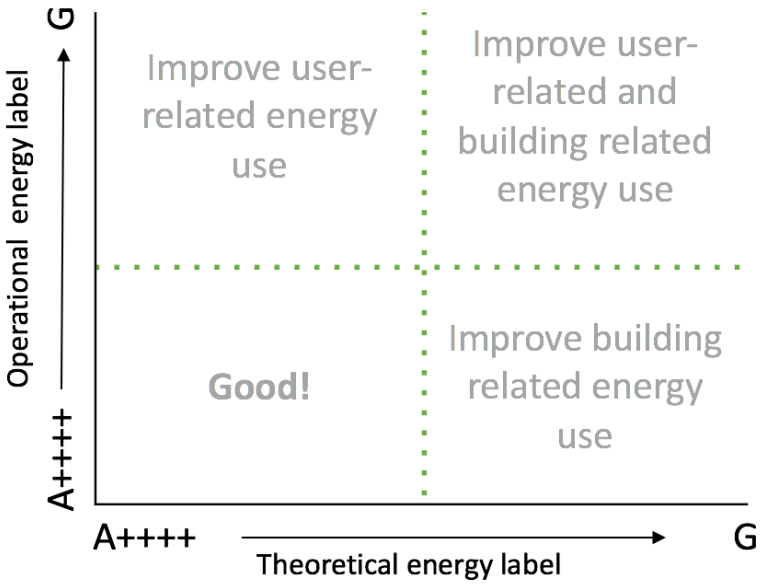
Thank you for your attention

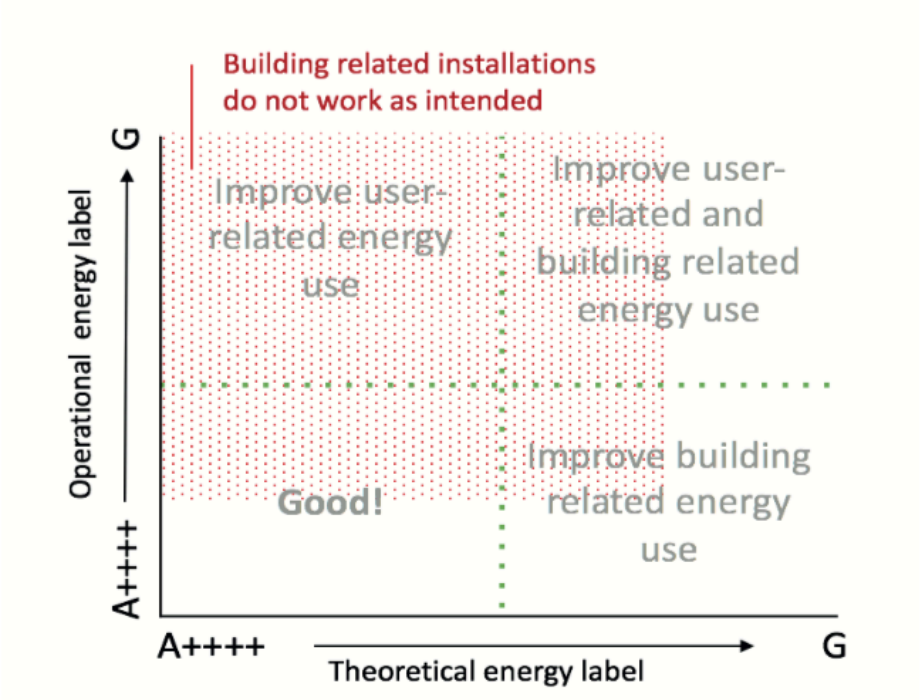
Back-up slides

Research design



Energy performance diagram



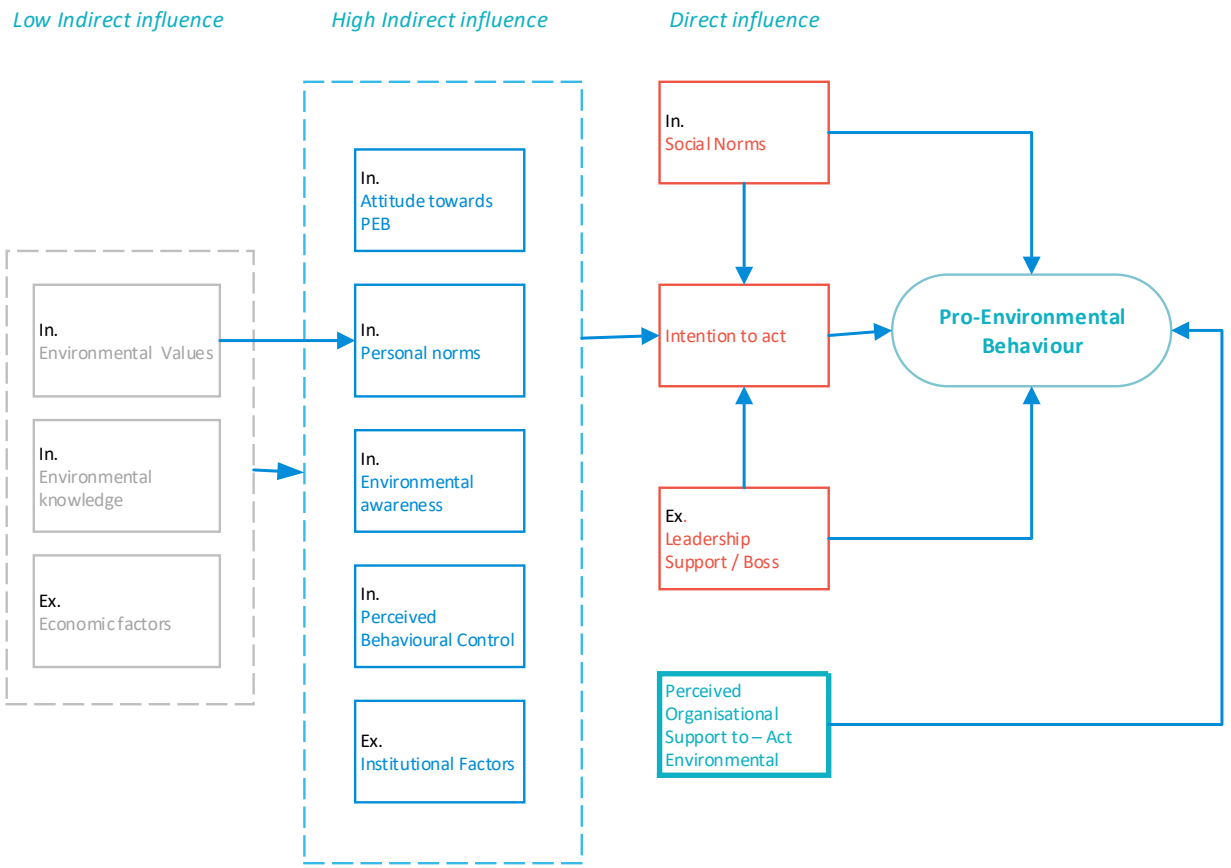


Topic measure	Stages	Measurements	Office trends	Erkende maatregelen lijst	19 Tips Milieubewust op kantoor, 2016	Blok et al, 2015	Blom et al. 2011	Gatersleben et al. 2002	van den Adel & van Luttervelt, n.d	Vlees, Vis & Vega, n.d.	Cutora, 2012	Own knowledge
Heating	Technical	Temperature regulated per room	X	X		X	X	X				
		Reducing the heating in unused rooms	X	X		X	X	X				
	Behavioural	Dressing warmer, instead of heating up the room	X	X		X	X	X				
Printing & Copying	Technical	Energy efficient (Energy star – GEEA-label) printers		X	X	X			X			
	Behavioural	Print & copy Recto verso, black and white		X		X			X			
		No printing: Paperless office		X		X			X			
		Recycled Paper		X		X			X			
Material use	Organisational	FSC or recycled office supplies			X							
	Behavioural	Recycle used office supplies			X							X
Drinking	Behavioural	Use mugs or recycled paper cups; no plastic cups			X	X						
Sustainable shopping	Organisational	Purchases of sustainable services			X						X	
		Provide bio food options and less meat				X				X	X	
	Behavioural	Choose No meat options, less environmental impact				X				X	X	
		Choose bio or local options, less environmental impact				X				X	X X	
Computer use	Technical	Energy efficient ICT	X	X	X							
	Behavioural	Turn off screen				X	X					
		Unplug laptop adapter				X	X					
		Turn of Laptop/Computer				X	X					
Way of working	Organisational	Implement Activity based working	X		X							
	Behavioural	Implement Activity based working	X		X							
Electronic devices	Behavioural	Un-plug every night, no stand-by modus				X	X					
Light use	Behavioural	Unnecessary burning of lights (breakroom, toilet, at night & places where nobody comes)		X	X	X						
Recycling	Behavioural	Recycling of paper, glass, plastic, batteries, chemical office waste & kitchen and garden waste			X	X						
Food waste	Organisational	Reducing the food waste by actions or marketing strategies									X	
Transport	Organisational	Stimulating carpooling, cycling and public transport	X		X			X	X			
	Behavioural	Use carpooling, cycling, public transport.	X		X			X	X			
Toilet use	Technical	Using wastewater as a flush solution.	X									X

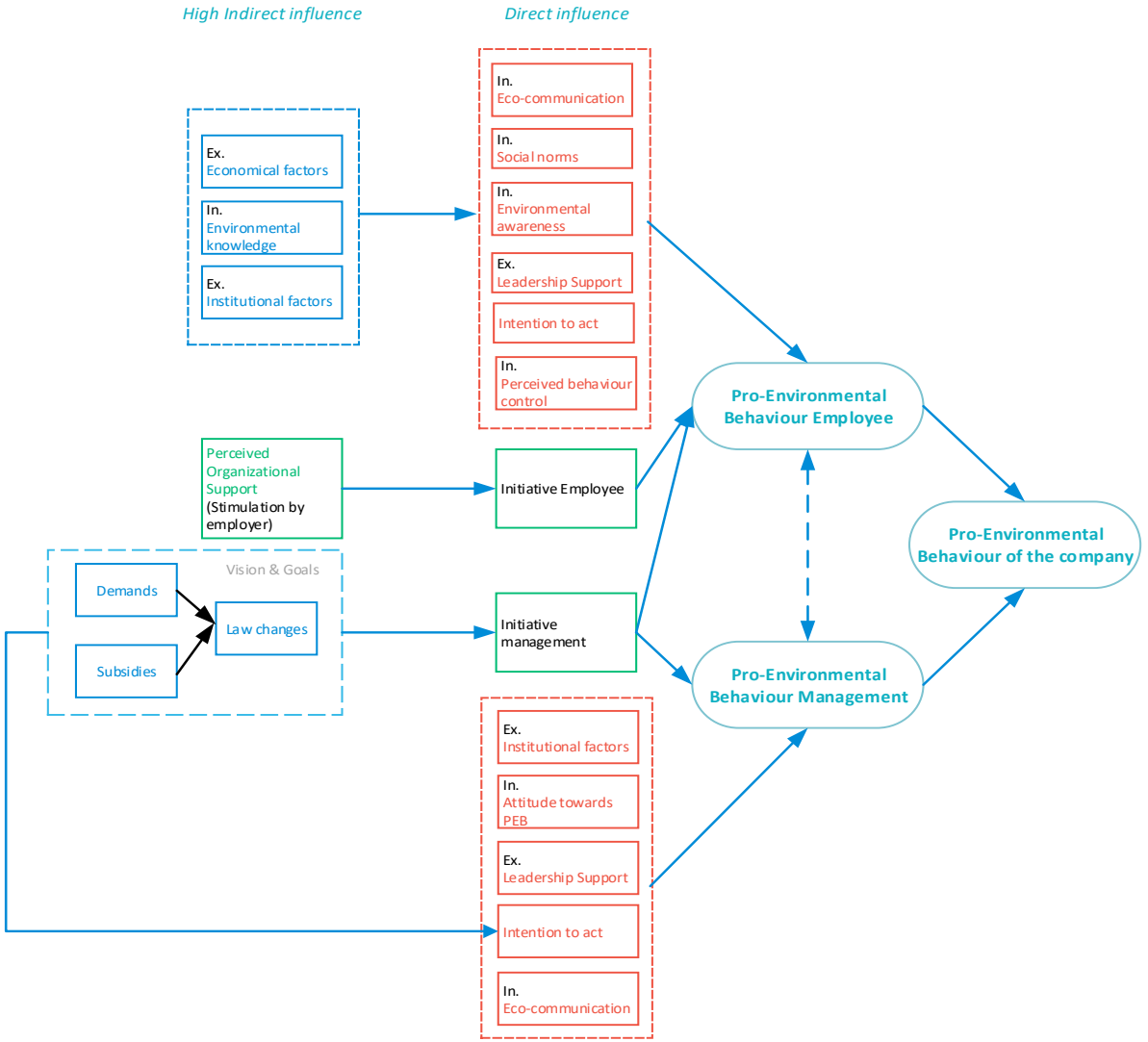
Topic measure	Stages	Measurements	Office trends	Erkende maatregelen lijst	19 Tips Milieubewust op kantoor, 2016	Blok et al, 2015	Blom et al. 2011	Gatersleben et al. 2002	van den Adel & van Luttervelt, n.d	Vlees, Vis & Vega, n.d.	Csutora, 2012	Own knowledge
Heating	Technical	Temperature regulated per room	X	X		X	X	X				
		Reducing the heating in unused rooms	X	X		X	X	X				
	Behavioural	Dressing warmer, instead of heating up the room	X	X		X	X	X				
Printing & Copying	Technical	Energy efficient (Energy star – GEEA-label) printers		X	X	X			X			
	Behavioural	Print & copy Recto verso, black and white		X		X			X			
		No printing: Paperless office		X		X			X			
		Recycled Paper		X		X			X			
Material use	Organisational	FSC or recycled office supplies			X							
	Behavioural	Recycle used office supplies			X							X
Drinking	Behavioural	Use mugs or recycled paper cups; no plastic cups			X	X						
Sustainable shopping	Organisational	Purchases of sustainable services			X						X	
		Provide bio food options and less meat				X				X	X	
	Behavioural	Choose No meat options, less environmental impact				X				X	X	
		Choose bio or local options, less environmental impact				X				X	X X	

Computer use	Technical	Energy efficient ICT	X	X	X							
	Behavioural	Turn off screen				X	X					
		Unplug laptop adapter				X	X					
		Turn of Laptop/Computer				X	X					
Way of working	Organisational	Implement Activity based working	X		X							
	Behavioural	Implement Activity based working	X		X							
Electronic devices	Behavioural	Un-plug every night, no stand-by modus				X	X					
Light use	Behavioural	Unnecessary burning of lights (breakroom, toilet, at night & places where nobody comes)		X	X	X						
Recycling	Behavioural	Recycling of paper, glass, plastic, batteries, chemical office waste & kitchen and garden waste			X	X						
Food waste	Organisational	Reducing the food waste by actions or marketing strategies									X	
Transport	Organisational	Stimulating carpooling, cycling and public transport	X		X			X	X			
	Behavioural	Use carpooling, cycling, public transport.	X		X			X	X			
Toilet use	Technical	Using wastewater as a flush solution.	X									X

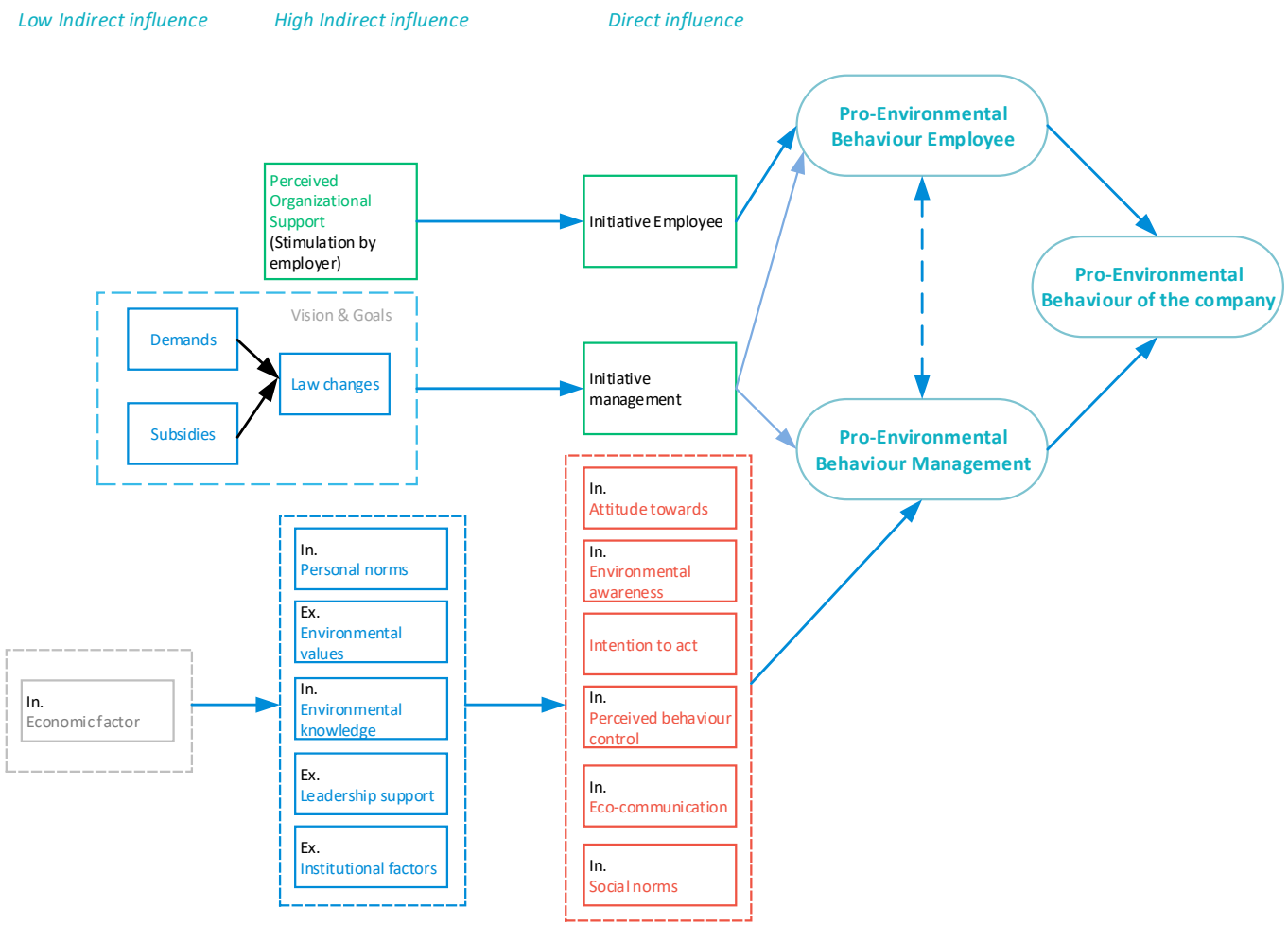
Pro-environmental behaviour diagram based on literature



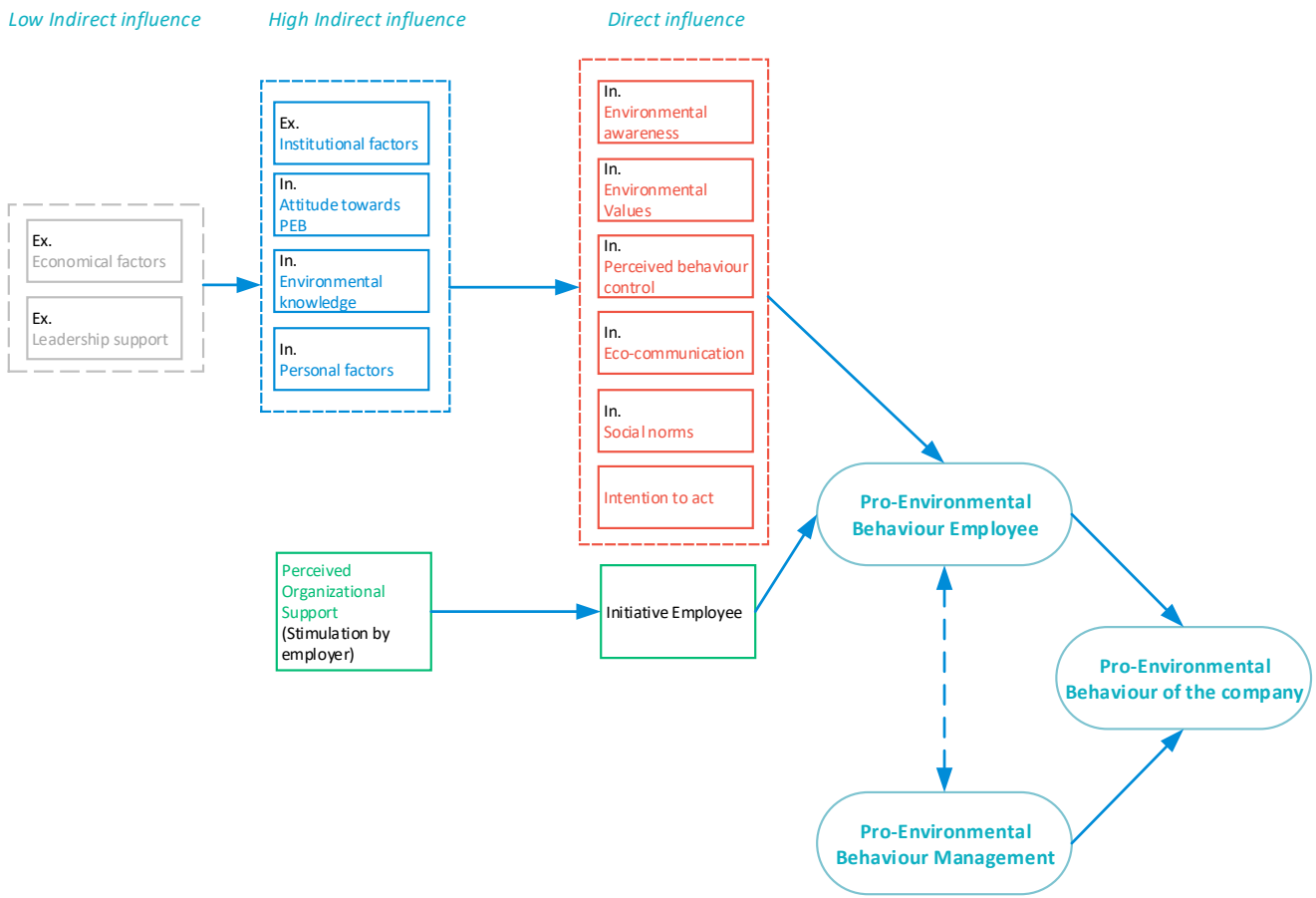
Pro-environmental behaviour diagram based on interviews



Pro-environmental behaviour diagram based on Delphi expert



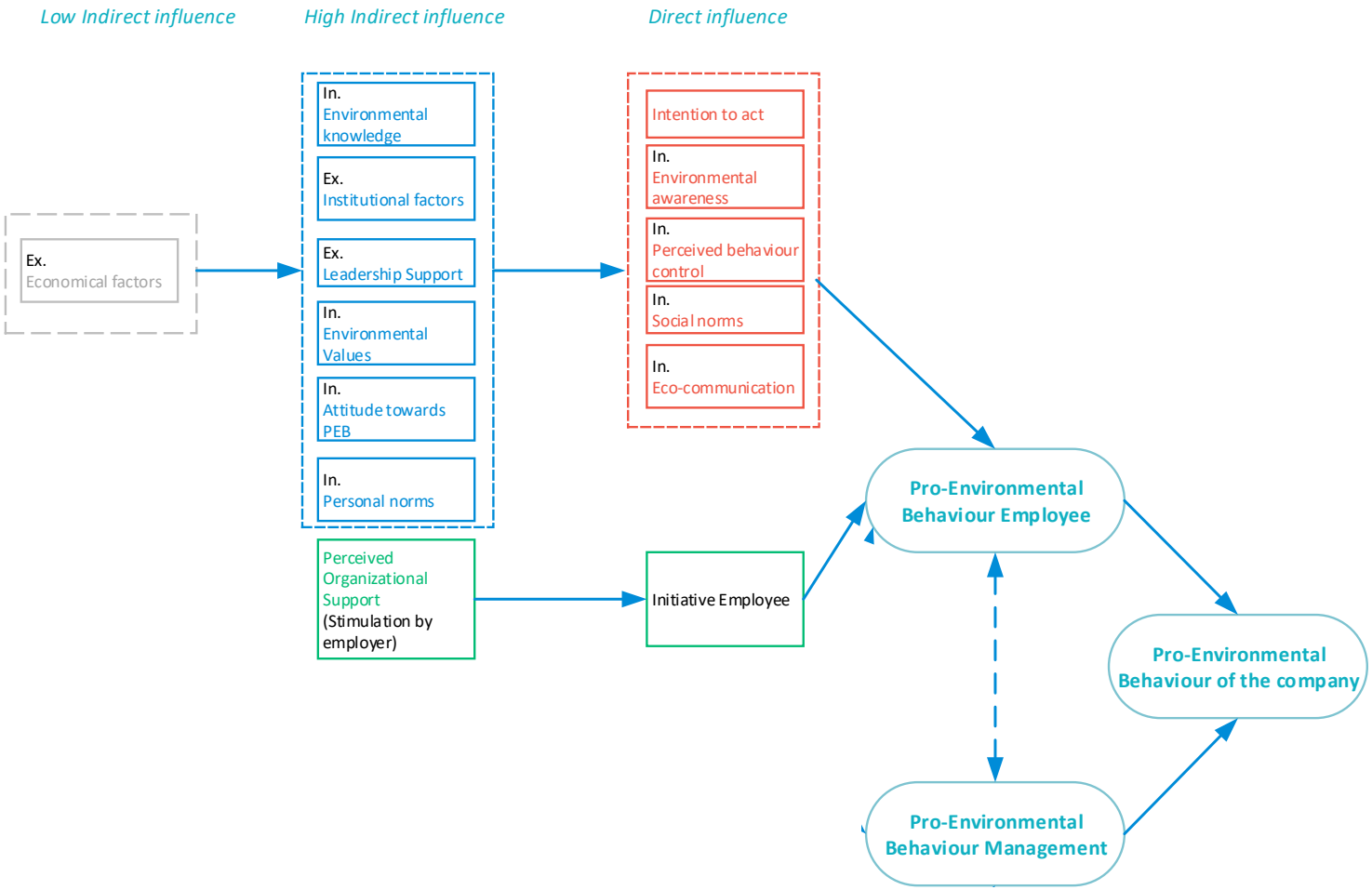
Pro-environmental behaviour diagram based on Delphi user



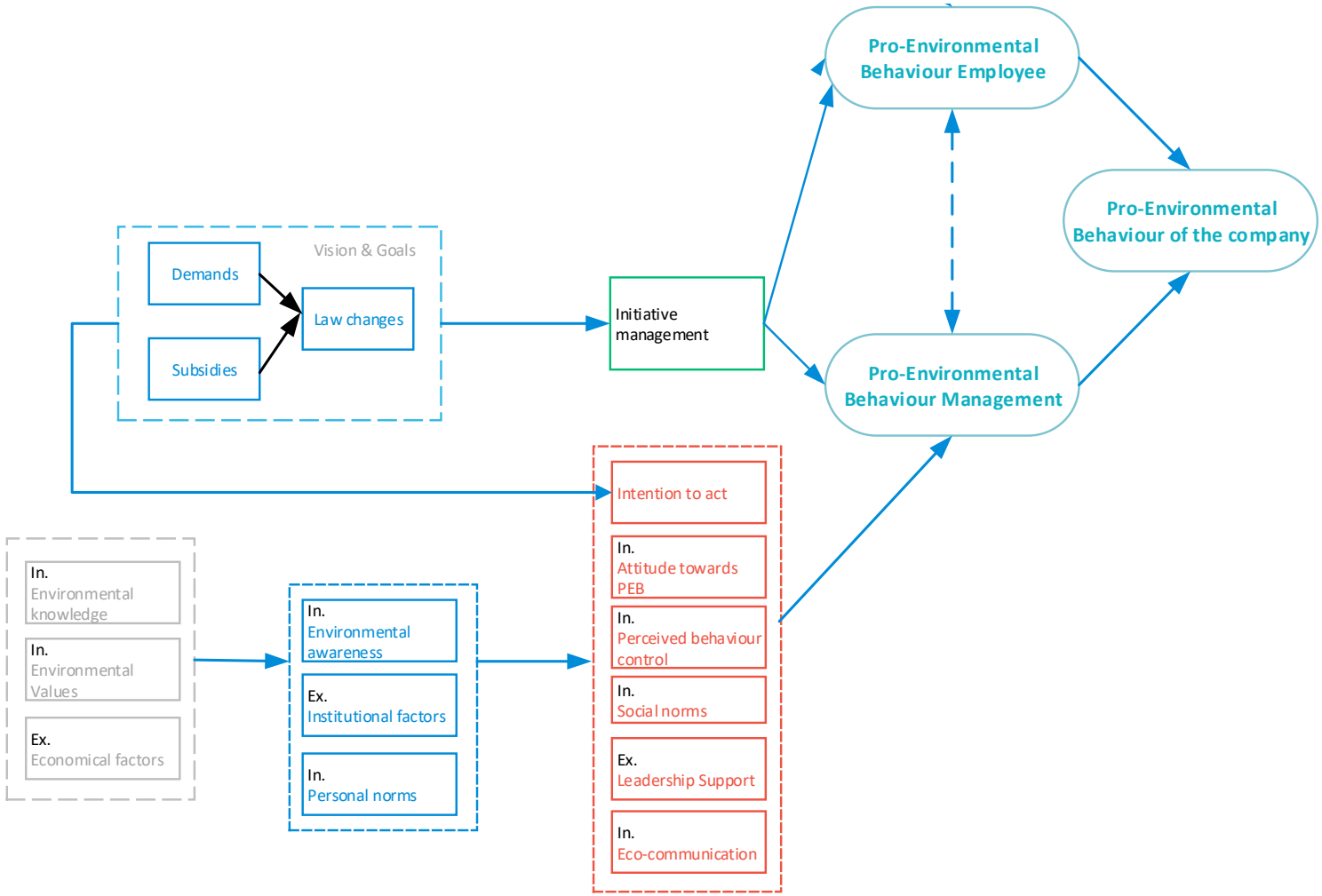
Pro-environmental behaviour diagram Cross-analysis

	Employee					Management			
	Literature	Interviews	Delphi Users	Concluded		Literature	Interviews	Delphi Experts	Concluded
Internal factors									
Intention to act	1	1	1	1		1	1	1	1
Environmental knowledge	3	2	2	2		3	-	3	3
Environmental values	3	-	1	2		3	-	2	3
Attitude towards PEB	2	-	2	2		2	1	1	1
Environmental awareness	2	1	1	1		2	-	1	2
Personal norms	2	-	2	2		2	-	2	2
Perceived behaviour control	2	1	1	1		2	-	1	1
External factors									
Institutional factors	2	2	-	2		2	1	2	2
Economic factors	3	2	3	3		3	3	3	3
Social norms	1	1	1	1		1	-	1	1
Leadership support	1	1	2	2		1	1	1	1
Other									
Perceived organizational support	1	1	1	1		1	-	1	1
Law	-	-	-	-		-	1	1	1
Eco-communication	-	1	-	1		-	1	1	1

Pro-environmental behaviour diagram results zoomed in



Pro-environmental behaviour diagram results zoomed in



Topic	Facility Manager 1	Energy performance gap specialist	Facility manager 2	Pro-environmental behavior specialist	Behavioural workplace specialist
Eco Feedback	There is not enough eco-feedback.	Communication about sustainable changes may trigger sustainable change. This may have benefits for the short or long-term perspective.		Communicating on organisational and managerial level with feedback can be effective	Communicating helps to make energy usage visible.
Awareness by communicating	Companies should communicate more about the sustainability within their company with their users to create more awareness.	Keep communicating about the energy use makes it personal.	Communication about the progress is important to motivate users.	I think partly by pointing them out and partly by the playful or nudging-like stimulation, communication can be effective. The internal motives of users should be stimulated. There should be less rules from a management perspective, but more communication and initiative from the user and stimulation thereof.	It needs to be made clear how much waste there is.

Communication	Facility manager 1	Energy performance gap specialist	Facility manager 2	Pro-environmental behaviour specialist	Behavioural workplace specialist
Eco-feedback.	X	X	X	X	X
Communicating more to create awareness.	X	X	X	X	X
Point of contact.					
The person who pays the bill should be responsible.	X		X	-	-
Knowledge					
Knowledge influences decisions.	(X)			X	X
Knowledge about sustainability should be increased.	X			X	X
Monitoring Energy					
By monitoring energy, the company will be more aware of their energy use and where the problem is.	X	X			
Technical					
Technology should be a supporting role not leading role.		X	(X)	X	X
Implementing competition & targets.	X	X	X	X	X

Research method information

Interviews
- Facility manager 1
- Facility manager 2
- Energy performance gap specialist
- Implementation of Pro-environmental behaviour specialist
- Behaviour workplace management specialist

Delphi user panel
- 10 office users

Delphi expert panel
- 11 facility managers

Research method information - cases

Case 1 : C

	Total	Per m²	Households per year*
2018			
Gas consumption	323.267 m^3	4,56 m^3	215
Electricity consumption	5.179.422 kWh	138,67 kWh	1523
2011			
Gas consumption	478.961 m^3	12,82 m^3	319
Electricity consumption	7.298.452 kWh	195,40 kWh	2146

Case 3 : A+

	Total	Per m²	Households per year*
2018			
Gas consumption	10.706 m^3	0,43 m^3	7
Electricity consumption	2.553.814 kWh	103,18 kWh	75

Case 2: B

	Total	Per m²	Households per year*
2018			
Gas consumption	169.846 m^3	5,27 m^3	113
Electricity consumption	3.361.248 kWh	104,20 kWh	988

Case 4 : A

	Total	Per m²	Households per year*
2017			
Gas consumption	81.402 m^3	7,95 m^3	54
Electricity consumption	1.030.110 kWh	100,68 kWh	30

Reference

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