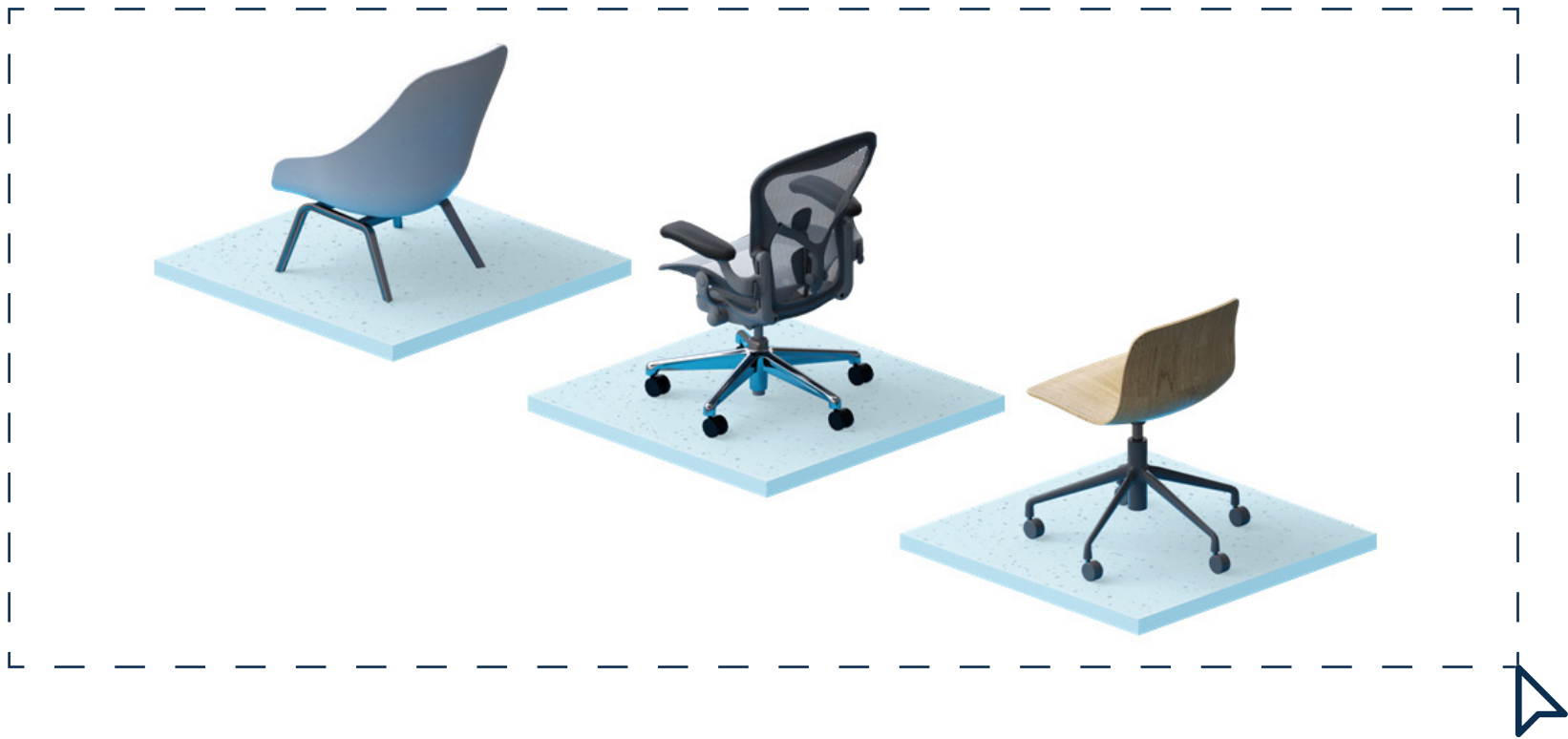


TOWARDS SMART FLEXIBILITY

A STUDY ON HOW IOT CAN IMPROVE EMPLOYEES' WELL-BEING IN FLEXIBLE OFFICES







Benefits of the flexible office environment:

- Reduction of m² and therefore cutting in costs
- Less waste of space and energy when desks are not used
- Increasing mobility and autonomy of employees
- Support of social interaction in general
- Stimulation of collaboration between departments

Challenges

Examples:

- *Available spots*
- *Privacy*
- *Findability*

Challenges



Well-being

Examples:

- *Available spots*
- *Privacy*
- *Findability*

Examples:

- *Satisfaction*
- *Engagement*
- *Stress*
- *Autonomy*



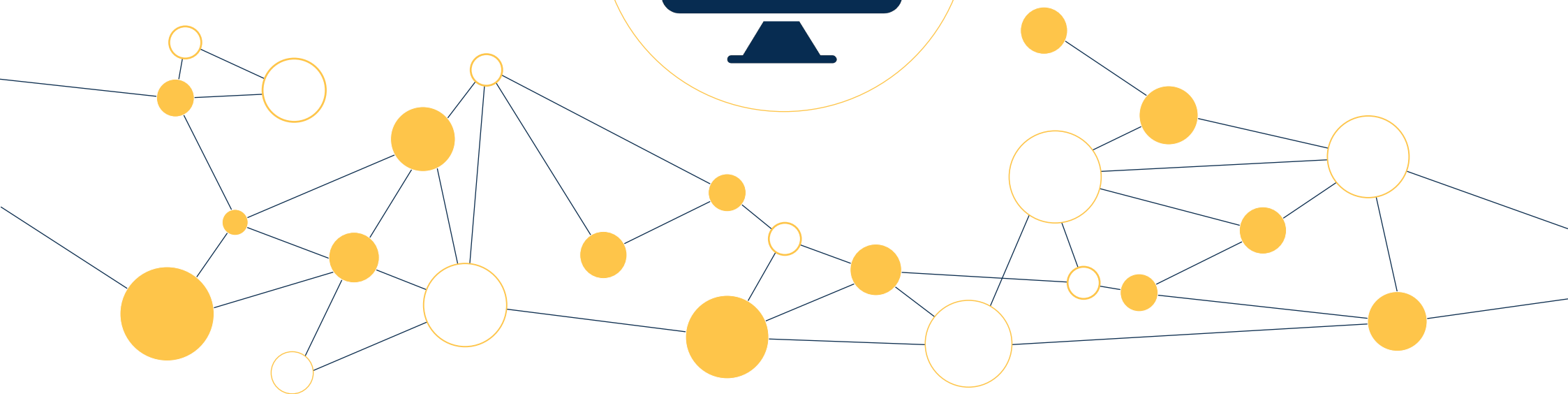
Examples:

- *Available spots*
- *Privacy*
- *Findability*

Examples:

- *Satisfaction*
- *Engagement*
- *Stress*
- *Autonomy*

- *Recognition*
- *Ambition*



PROBLEM STATEMENT

Corporate Real Estate Management (CREM)



Flexible offices



Well-being



Internet of Things

PROBLEM STATEMENT

Although the flexible office environment is rising in popularity, it also raises problems for the employees who are making use of the workplaces.

The Internet of Things may provide solutions to better facilitate employees and their well-being in flexible offices.



METHODS



DEMAND



SUPPLY



MATCH



CONCLUSION



RECOMMENDATIONS



DISCUSSION



METHODS



THE QUESTIONS

Main question:

How can the Internet of Things improve employees' well-being in flexible office environments?

- 1** What are the main challenges of flexible offices and how does it influence the well-being of employees?
- 2** Which opportunities does the Internet of Things provide to optimize the office environment?
- 3** How can Internet of Things applications support the challenges of the flexible office environment?



THE QUESTIONS

Main question:

How can the Internet of Things improve employees' well-being in flexible office environments?

Demand



1 What are the main challenges of flexible offices and how does it influence the well-being of employees?

Supply



2 Which opportunities does the Internet of Things provide to optimize the office environment?

Match



3 How can Internet of Things applications support the challenges of the flexible office environment?



METHODS

PART 1

Theoretical and empirical research

Demand

Supply



Literature study

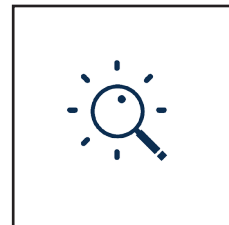


Interviews

PART 2

Operational research

Match



Explorative study



Evaluation



METHODS

PART 1

Theoretical and empirical research

Demand

Supply



Literature study

Insights on CREM,
flexible offices,
employees'
well-being
variables and
IoT applications
& tools

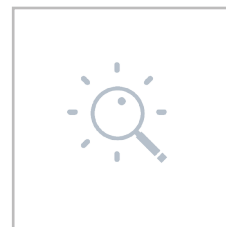


Interviews

PART 2

Operational research

Match



Explorative study



Evaluation



METHODS

PART 1

Theoretical and empirical research

Demand

Supply



Literature study



Interviews

21 interviews:

- 7 flexible office managers
- 6 workplace advisors & knowledge institutions
- 8 'smart' companies

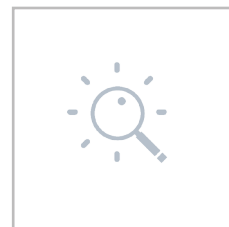
Demand: Insights on the impact of flexible offices on employees well-being in practice

Supply: Assessment of available data sources and outputs of smart tools and IoT applications & developments

PART 2

Operational research

Match



Explorative study



Evaluation



METHODS

PART 1

Theoretical and empirical research

Demand

Supply



Literature study

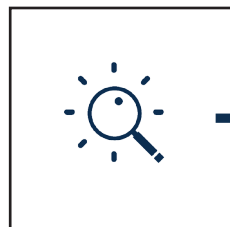


Interviews

PART 2

Operational research

Match



Explorative study

Comparing the demand derived from the offices with the identified possibilities of the supply of IoT



Evaluation



METHODS

PART 1

Theoretical and empirical research

Demand

Supply



Literature study

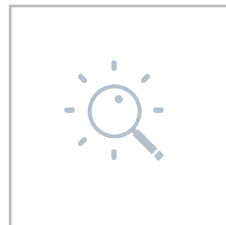


Interviews

PART 2

Operational research

Match



Explorative study



Evaluation

Member check:

A check towards the accurate use of the findings and the internal validation of the research due to personal reasoning



DEMAND



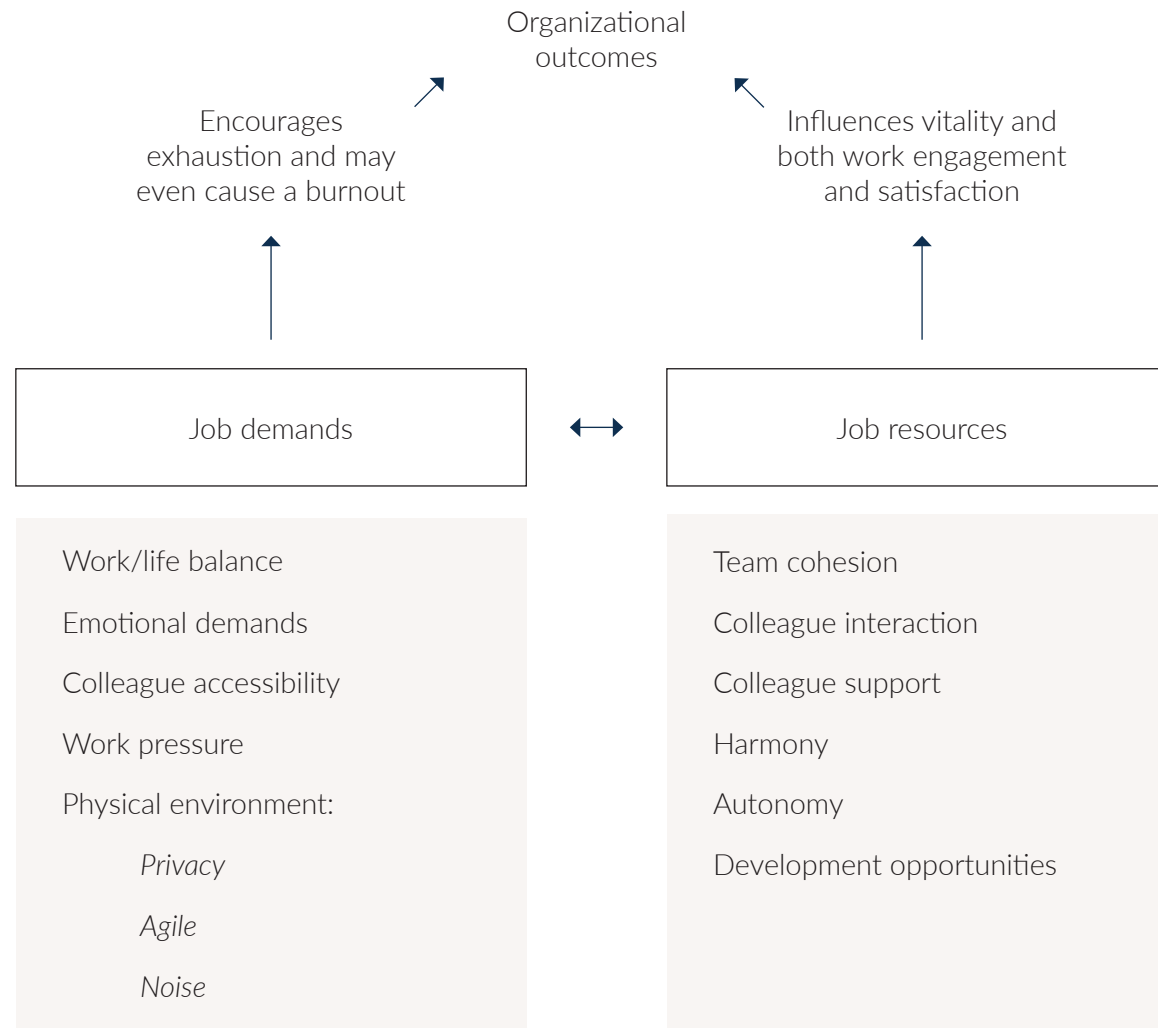
EMPLOYEES' WELL-BEING

Employees' well-being experience can be seen as: “the relative presence of positive effects, and the relative absence of negative effects in the work environment.”

Source: Wright and Bonett (2007). Job satisfaction and psychological well-being as nonadditive predictors of workplace turnover



JOB DEMANDS-RESOURCES MODEL



Source: Demerouti, Bakker, Nachreiner & Schaufeli (2001). *The Job Demands-Resources Model of Burnout*



EMPLOYEE EXPERIENCE - LITERATURE



Expectations

- Fear of not having a desk anymore after leaving
CfPB, 2018
- Lower level of territoriality
Wohlers & Hertel, 2017
- Not feeling comfortable to walk around with stuff
CfPB, 2018
- Having a feeling the office is overcrowded
CfPB, 2017
- Used to an own 'known' spot: the need for routine
CfPB, 2014
Wohlers & Hertel, 2017

Organisational dynamics

- Less group identification
Wohlers & Hertel, 2017
Volker & Van Der Voordt, 2005
- Lack of trust on management level

Process

- Lack of change management in the workplace change process
de Bruyne, 2007
- No involvement of employees (opinion) within the process
de Bruyne, 2007

Workplace

- Lack of personalisation possibilities
Elsbach, 2003
Leesman, 2018
- Technology is too complicated to quickly change desks
Brunia, De Been & van der Voordt, 2016
CfPB, 2018
- Concentration problems (noise and movements)
Bodin Danielsson, 2009
CfPB, 2014

Needs & preferences

- Trouble finding colleagues
CfPB, 2014
Wohlers & Hertel, 2017
- Preference for specific indoor climate/comfort
CfPB, 2017
Brunia, De Been & van der Voordt, 2016
- Preference to be close to people you know
CfPB, 2017
- Less privacy (especially for specific departments)
CfPB, 2014
Wohlers & Hertel, 2017
- Fear of not having a desk anymore after leaving
CfPB, 2018

Behaviours

- The need to sit next to colleagues: for short discussions
CfPB, 2017
Wohlers & Hertel, 2017
- Concentration problems due to not changing for different work activities
CfPB, 2014
Bodin Danielsson, 2009



EMPLOYEE EXPERIENCE - INTERVIEWS

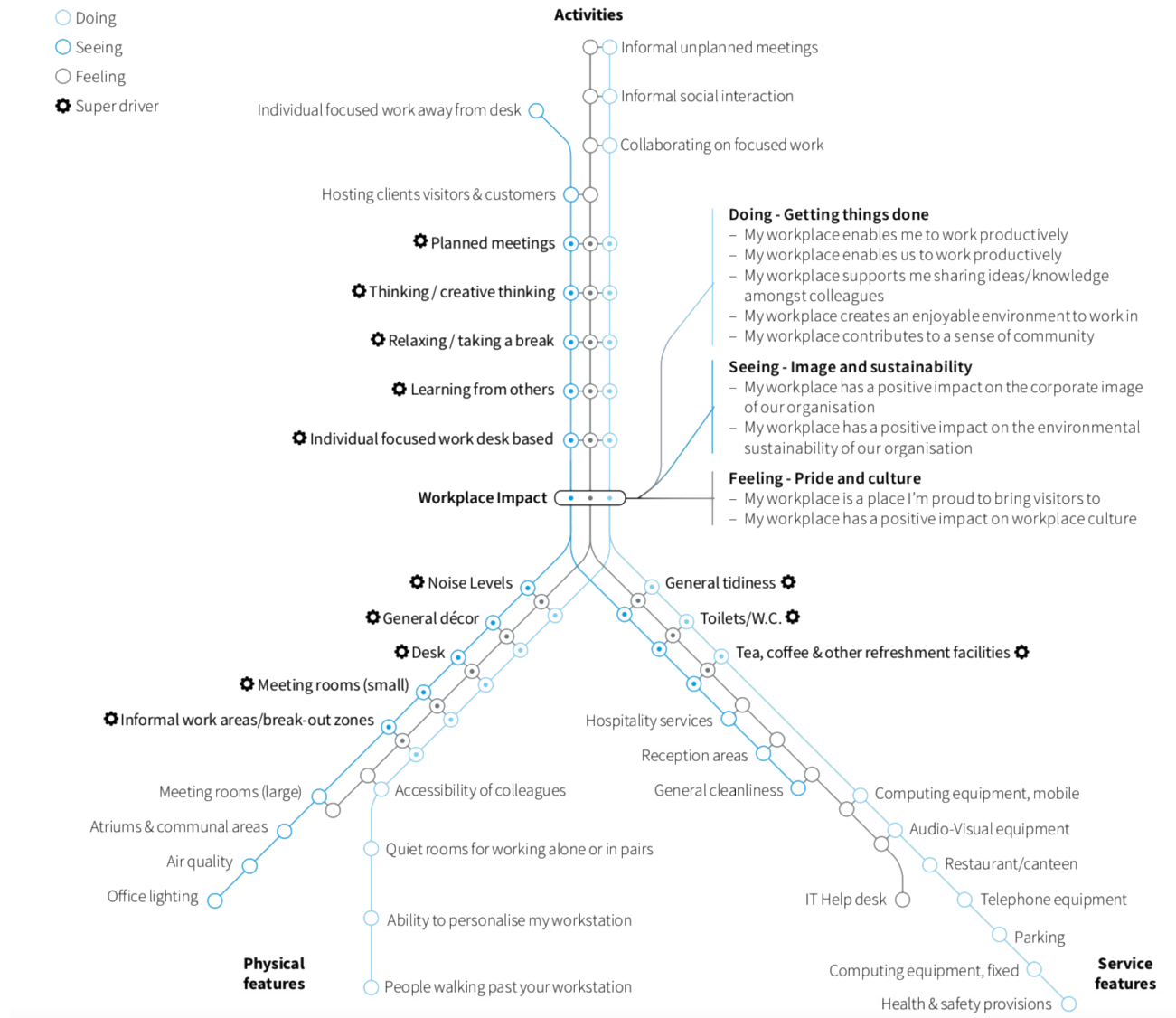
Challenges of facility and real-estate managers:

- Social cohesion
- Agile way of working
- 24/7 available
- Noise nuisance
- Lack of privacy



EMPLOYEE EXPERIENCE - USER SURVEY

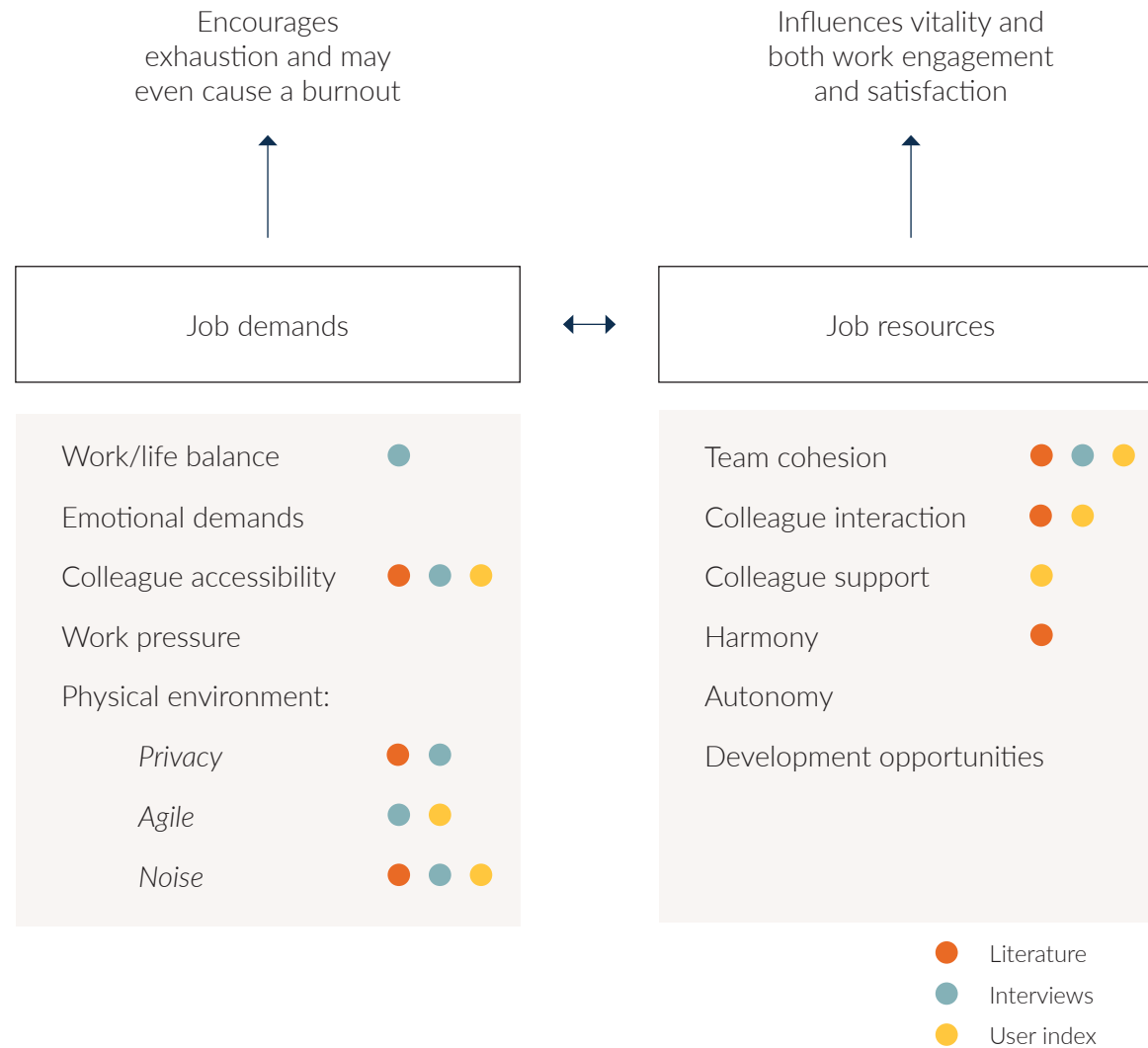
- Doing
- Seeing
- Feeling
- ⚙ Super driver



Source: Leesman (2018). *The Workplace Experience Revolution. Unearthing the real drivers of employee sentiment*

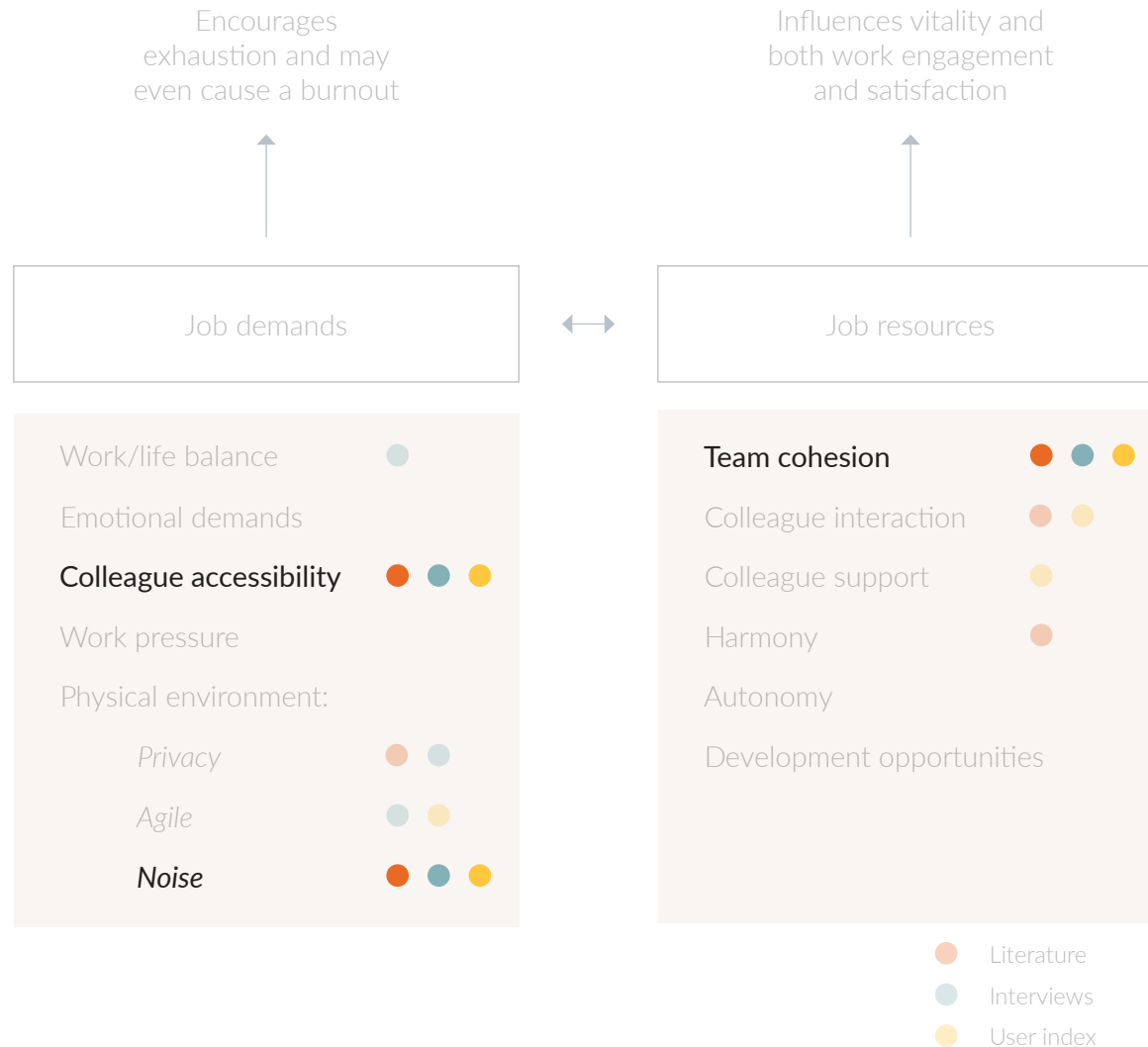


SELECTED CHALLENGES





SELECTED CHALLENGES





SUPPLY



THE INTERNET OF THINGS

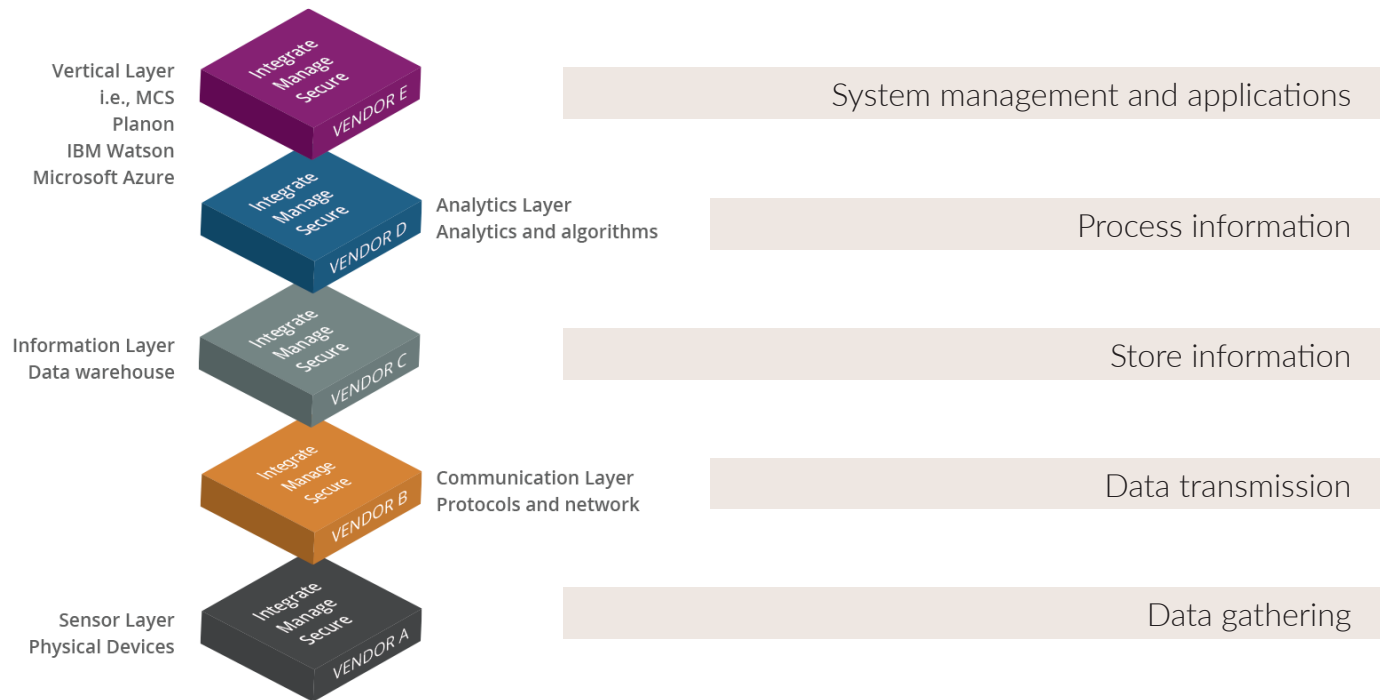
“The Internet of Things stands for the ability of things being connected to each other through the (existing) Internet, most of the time making connections from machine to machine.”

Source: Zafari, Papapanagiotou & Christidis (2016). Microlocation for Internet-of-Things-Equipped Smart Buildings



IOT LAYERS

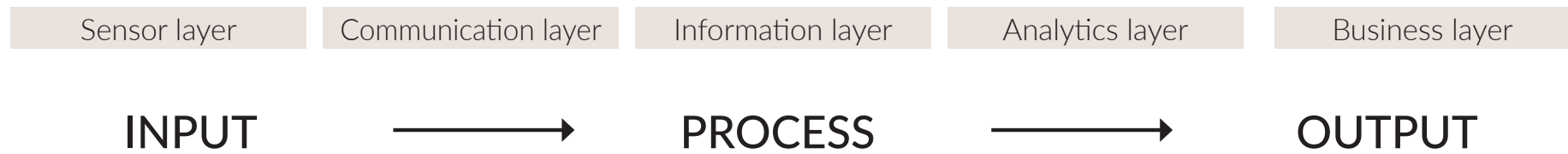
Today's complex ecosystem



Source: Disruptive Technologies (2019). Application-ready sensing solution



INPUT-PROCESS-OUTPUT





INPUT-PROCESS-OUTPUT

HARDWARE

APPLICATIONS

ADVICE

Sensor layer

Communication layer

Information layer

Analytics layer

Business layer

INPUT



PROCESS



OUTPUT



INPUT-PROCESS-OUTPUT

HARDWARE

APPLICATIONS

ADVICE

Sensor layer

Communication layer

Information layer

Analytics layer

Business layer

INPUT



PROCESS



OUTPUT





SMART TOOLS

Within buildings, data can be acquired by the implementation of smart tools and sensor technology.

Smart tools facilitate two important steps:

1. They measure something from the building and/or the user
2. They use this information to reach a specific goal

Source: Valks et al. (2016). Smart campus tools: Een verkenning bij Nederlandse universiteiten en lessen uit andere sectoren



SMART TOOLS

Available tools:

- Camera
- Wearable / GPS
- Wi-Fi connection
- CO₂ level
- Temperature
- RFID
- Noise level
- Light intensity
- Desk occupancy
- Outlook / messenger
- Experience tool
- Infra-Red
- Humidity



MATCH



FINDING THE MATCH

Demand

1

Noise
nuisance

2

Team
cohesion

3

Colleague
accessibility

Supply

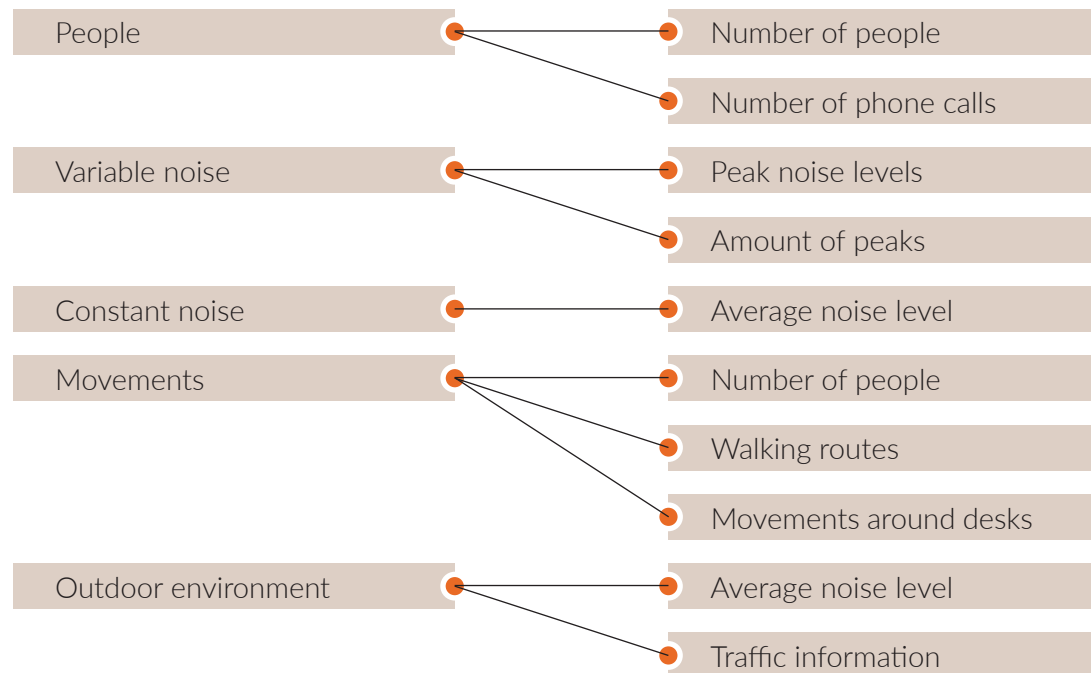
Data generated by smart tools



THE CHARACTERISTICS

Noise nuisance

Noise within the work environment is an important contributor to disturbances.

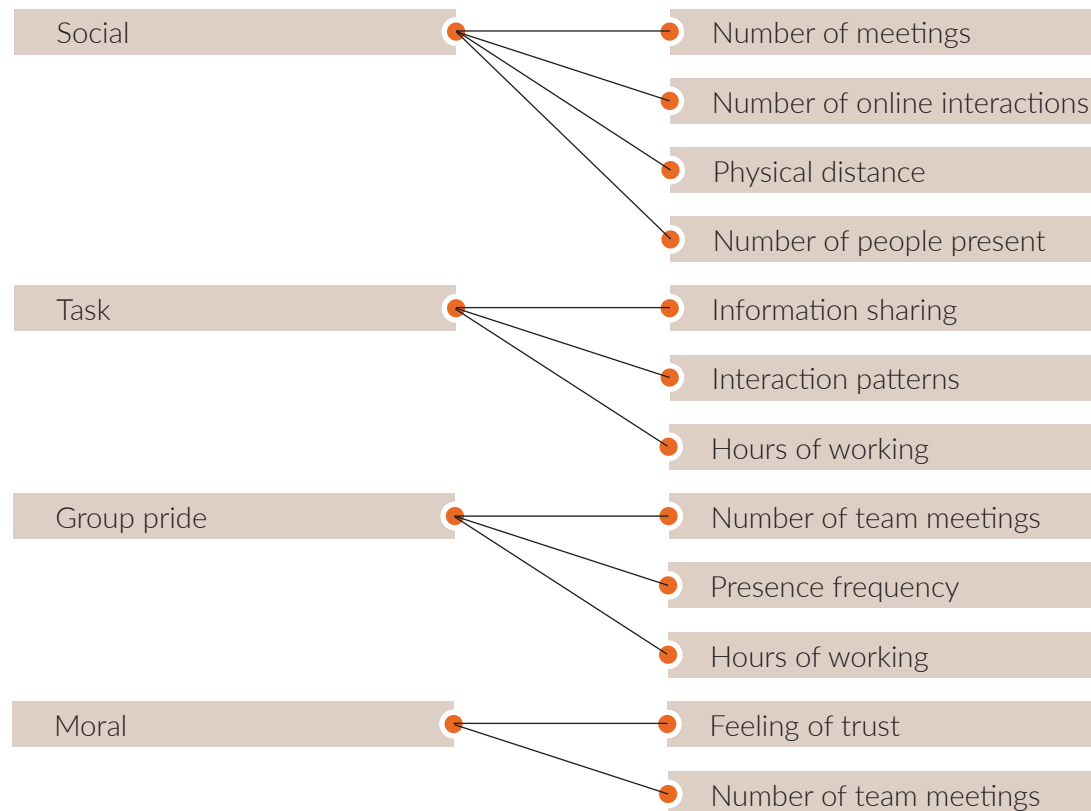




THE CHARACTERISTICS

Team cohesion

Working flexible can stimulate cohesion between teams, but most of the time harms cohesion within teams.

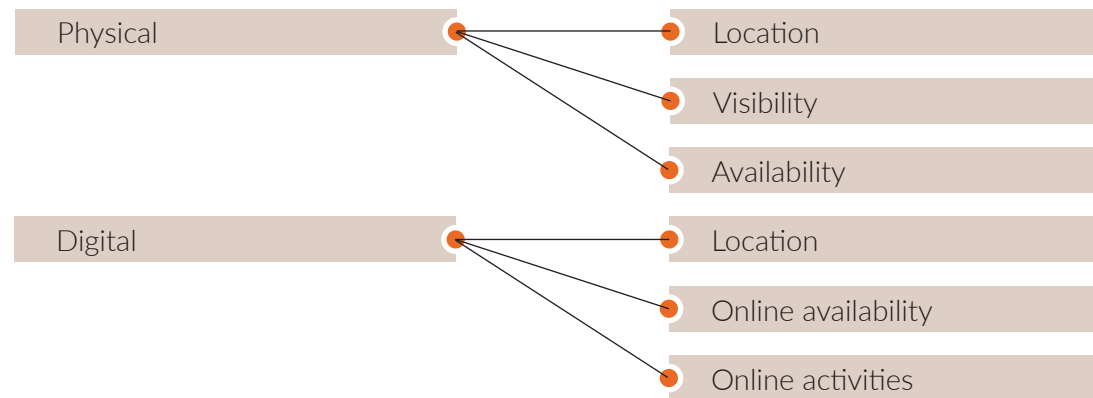




THE CHARACTERISTICS

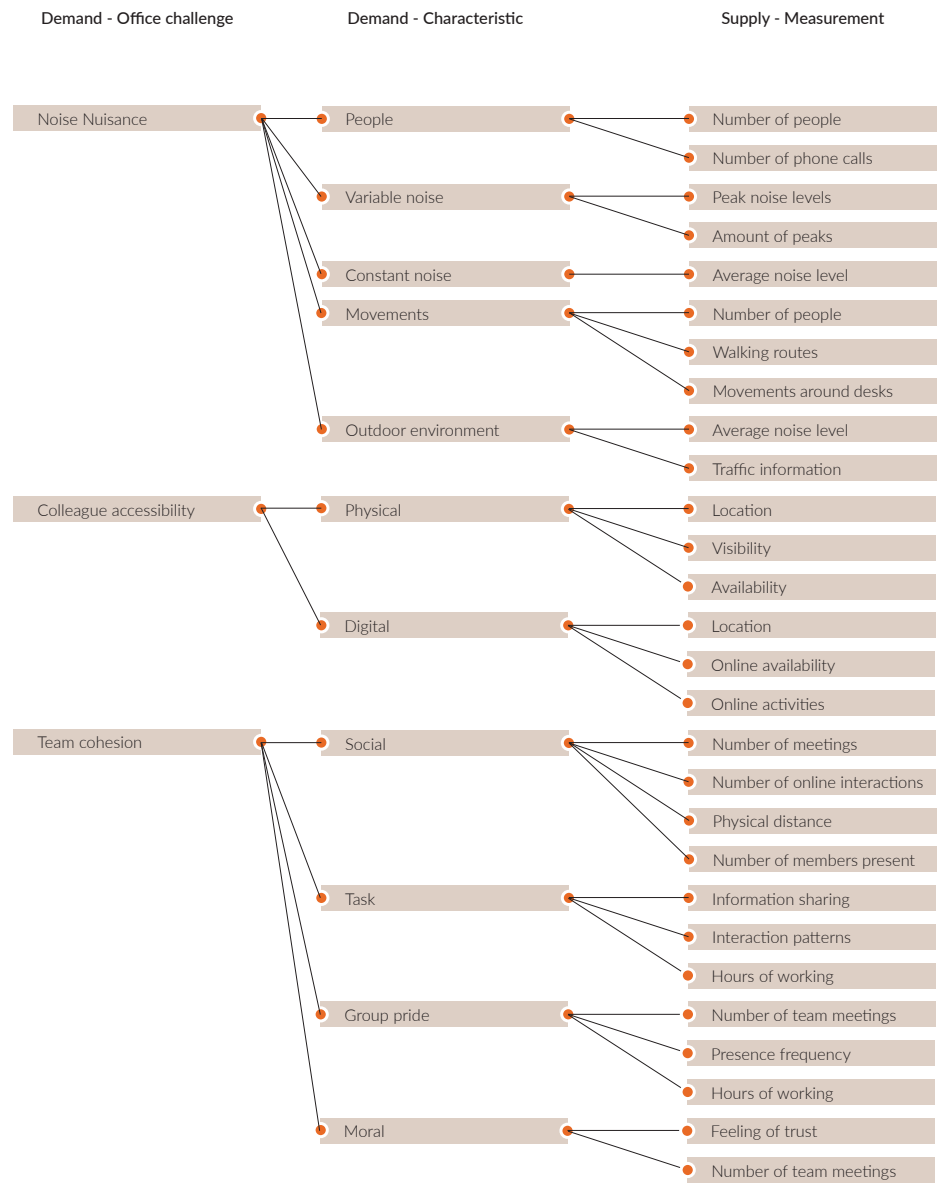
Colleague accessibility

Findability and accessibility of colleagues is of major importance for colleagues to successfully execute their work.



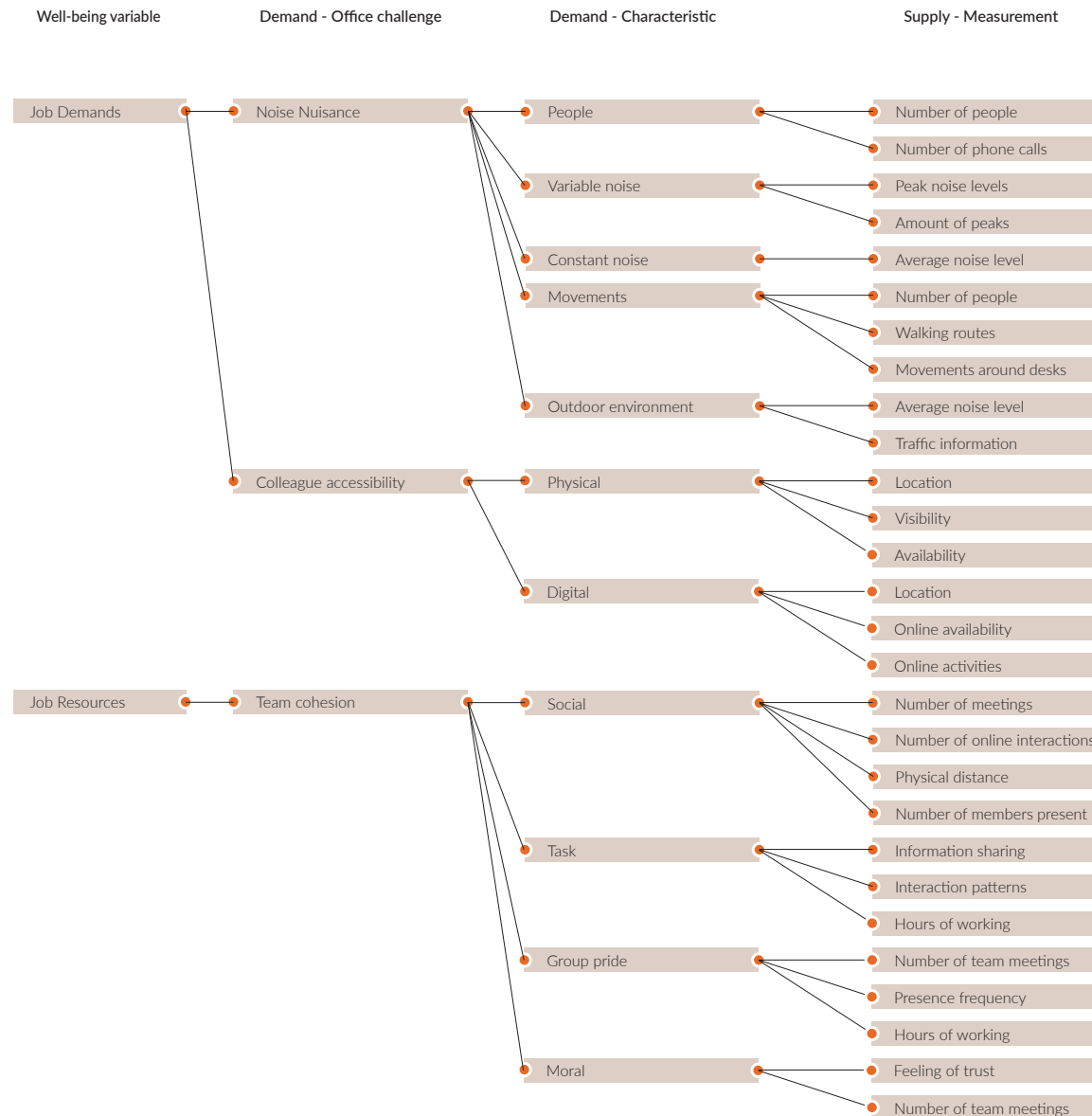


THE OVERVIEW



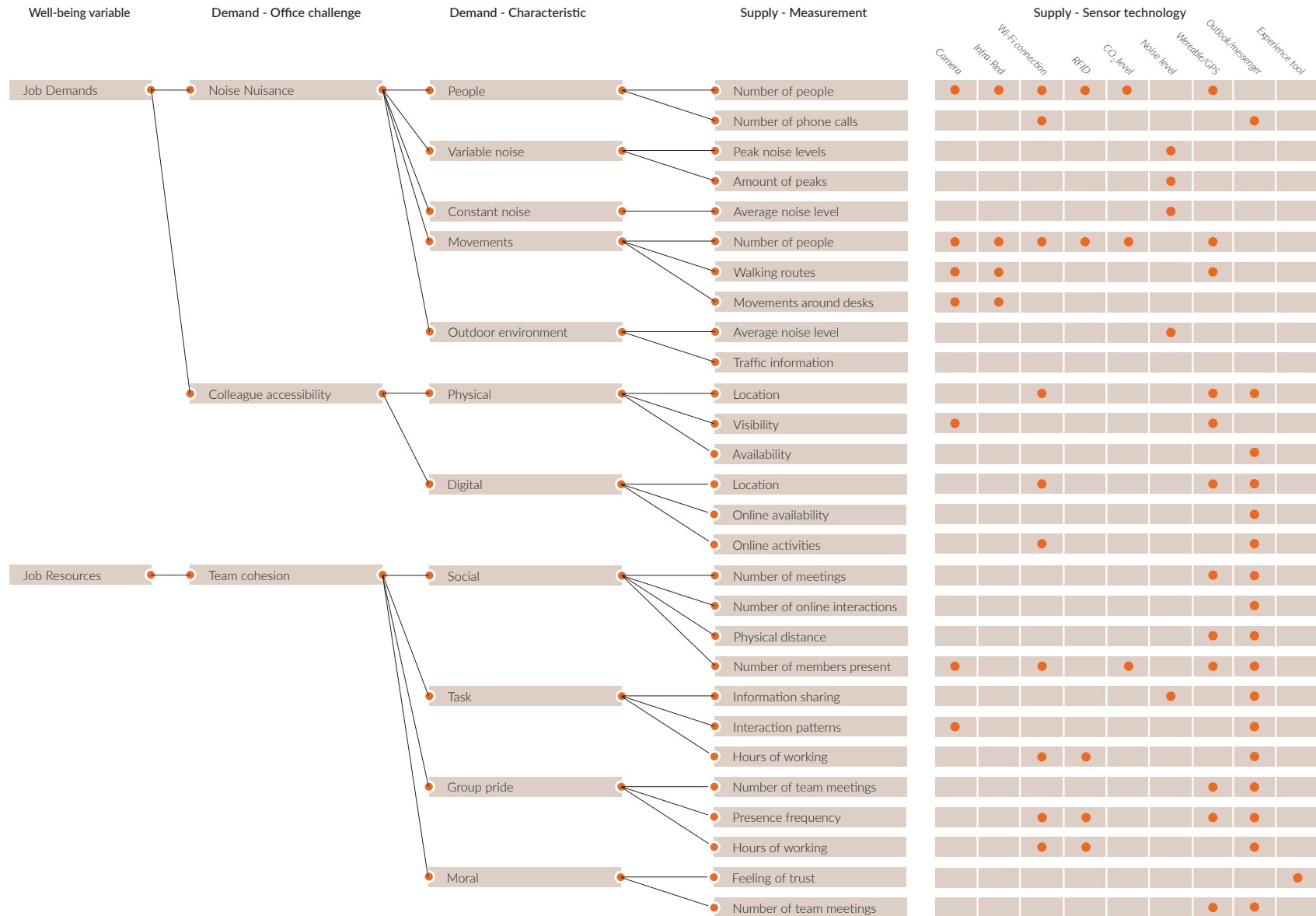


THE OVERVIEW





THE OVERVIEW



TACKLING THE CHALLENGES



Tako Werts (member check): “most of the measured components only become relevant when the generated data is analysed and used in the right way”.

Data should be analysed and combined with other information in order to become meaningful.



Measure



Combine



Create insights

Managers have two options to apply the knowledge:

1. Informing about certain circumstances
2. Adapting the office environment



CONCLUSION



DEMAND

1 What are the main challenges of flexible offices and how does it influence the well-being of employees?

Well-being

Challenges

Job demands



Noise nuisance



Colleague accessibility

Job resources



Team cohesion



SUPPLY

2 Which opportunities does the Internet of Things provide to optimize the office environment?

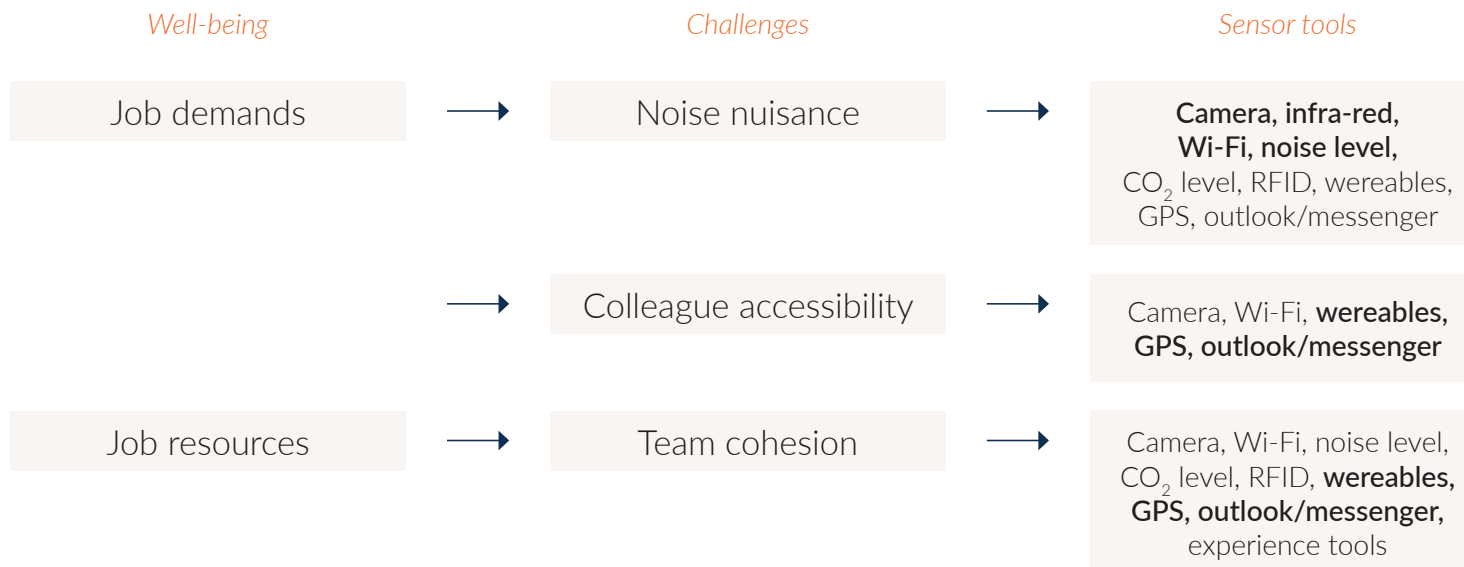
Sensor tools

Camera, infra-red,
Wi-Fi connection,
noise level,
CO₂ level, RFID,
wearables, GPS,
outlook/messenger,
experience tools



MATCH

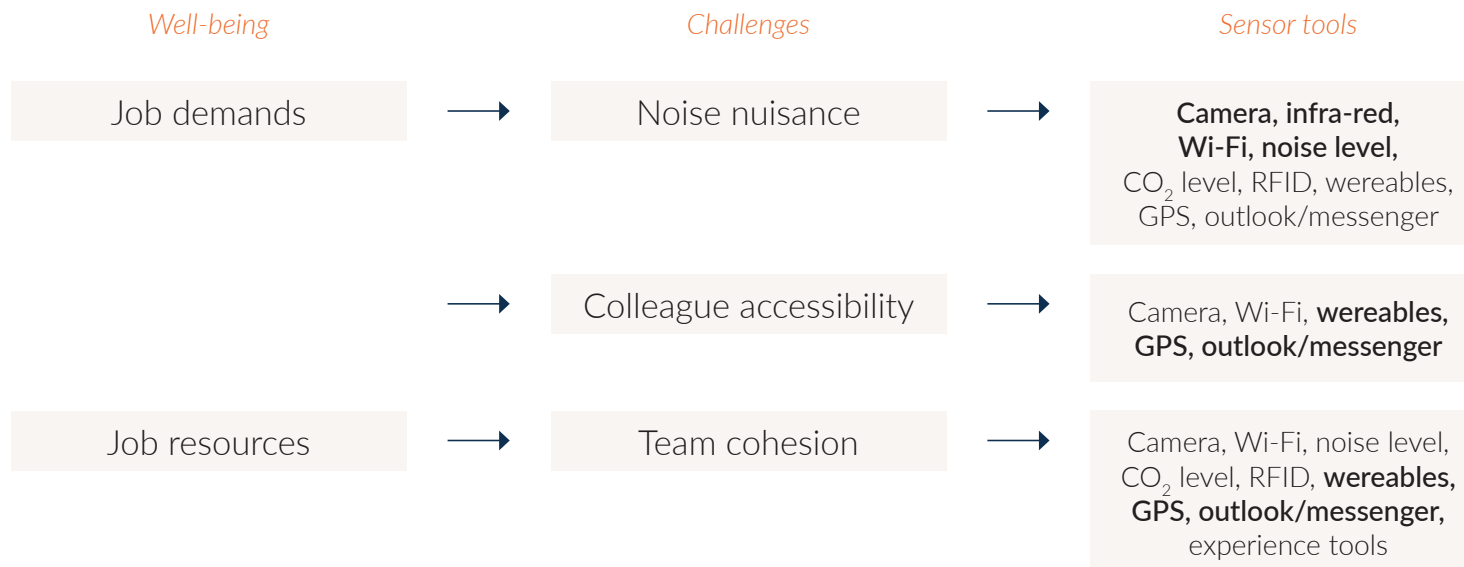
3 How can Internet of Things applications support the challenges of the flexible office environment?





MAIN QUESTION

How can the Internet of Things improve employees' well-being in flexible office environments?



Measure



Combine



Create insights



RECOMMENDATIONS



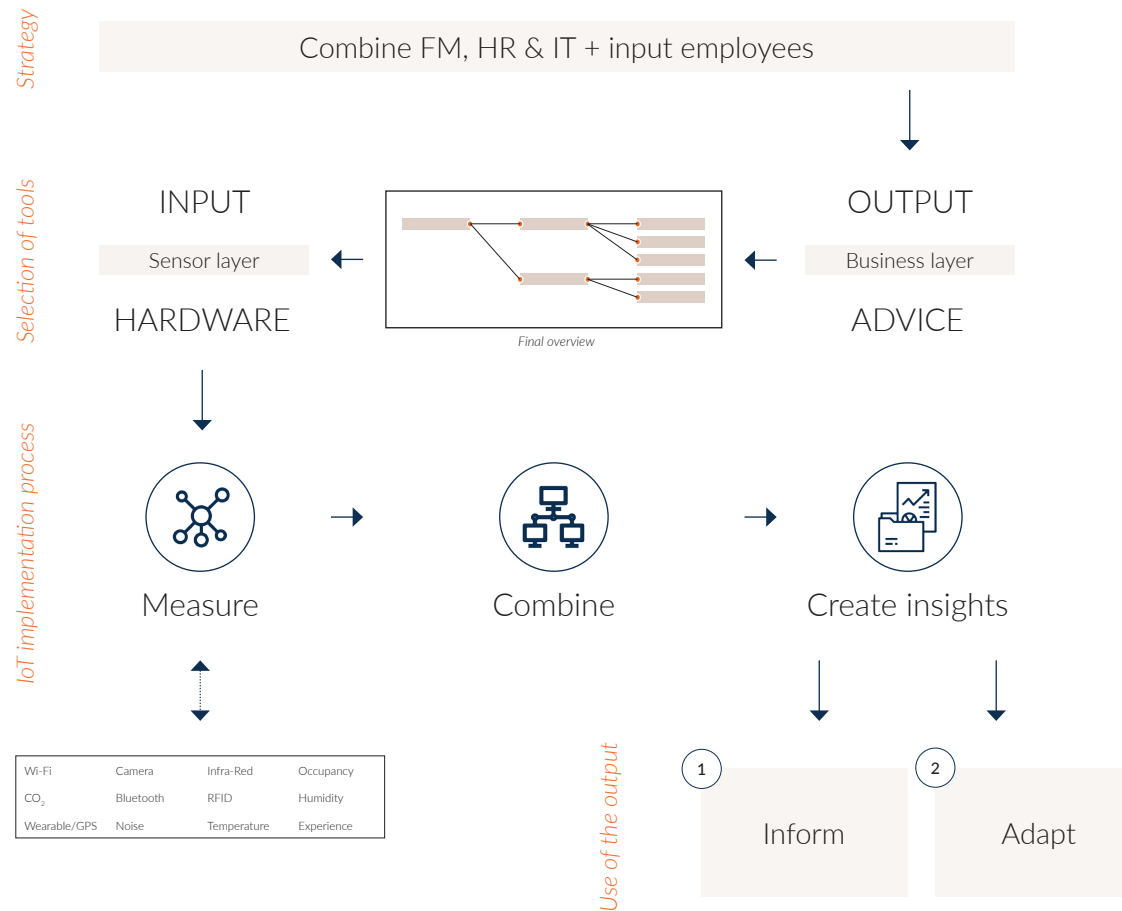
REAL ESTATE MANAGERS

Recommendations for facility and real-estate managers:

- Integrate the disciplines of Human Resources (HR), Facility Management (FM) and Information Technology (IT)
- Involve the final users / employees within the process
- Create a clear goal and select the right smart technology



PROCESS





GUIDELINES





SMART COMPANIES

Recommendations for companies operating in the smart sector:

- Align products to the well-being focus of companies
- Combine tools in the offer
- Focus on new technology (e.g. haptic gloves or headsets)
- Develop intelligent interfaces and applications



DISCUSSION



LIMITATION & FURTHER RESEARCH

Limitations

1. Feasibility is depending on the scale of companies:
 - Relevance
 - Financial possibilities
2. People's personal preferences towards office conditions
3. Multiple factors influencing the well-being level

Further research

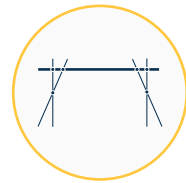
1. Create the complete overview
2. Prepare the future office
3. Investigating the optimal work environment



BROADER CONTEXT

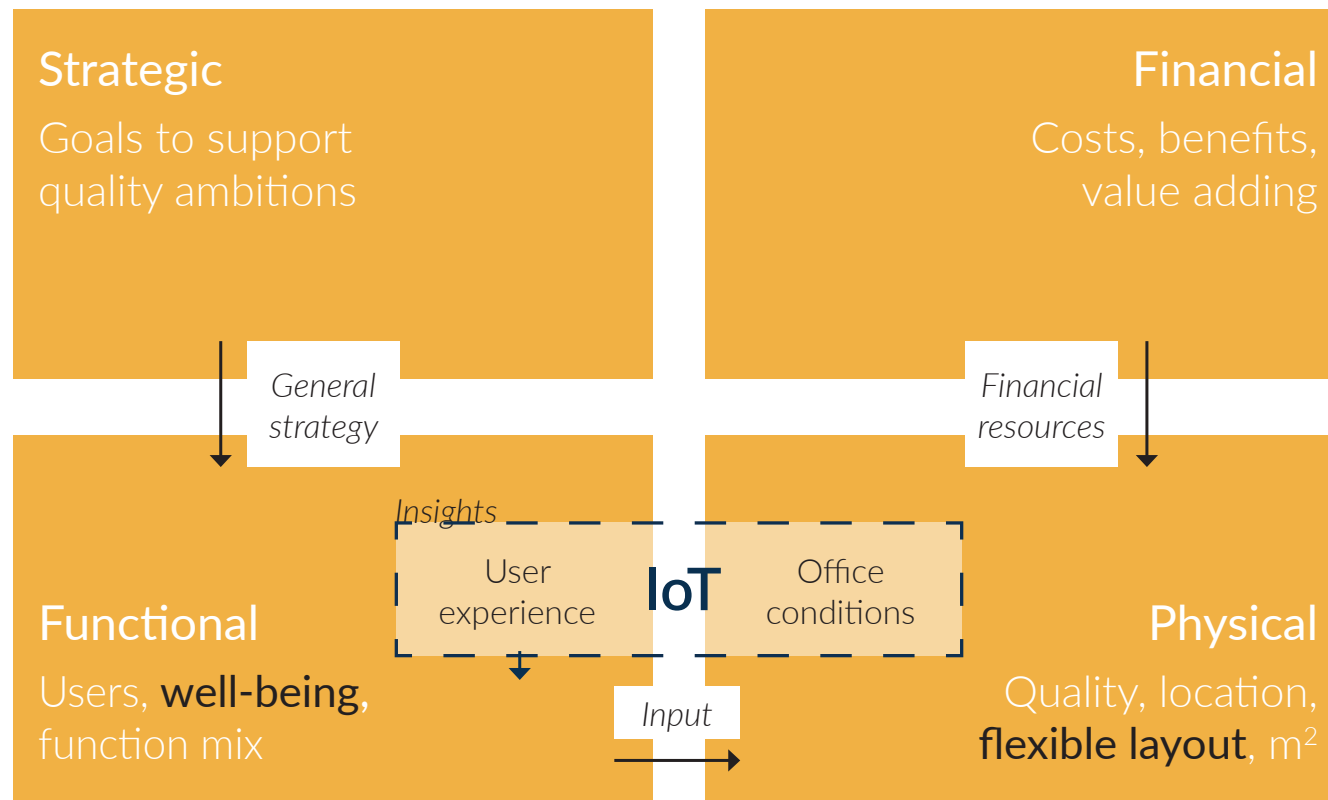


“The digital environment has the ability to complement the physical work environment, but will never completely replace it. Therefore we need to find the balance, so that IoT can provide the best support to our daily businesses in the office.”

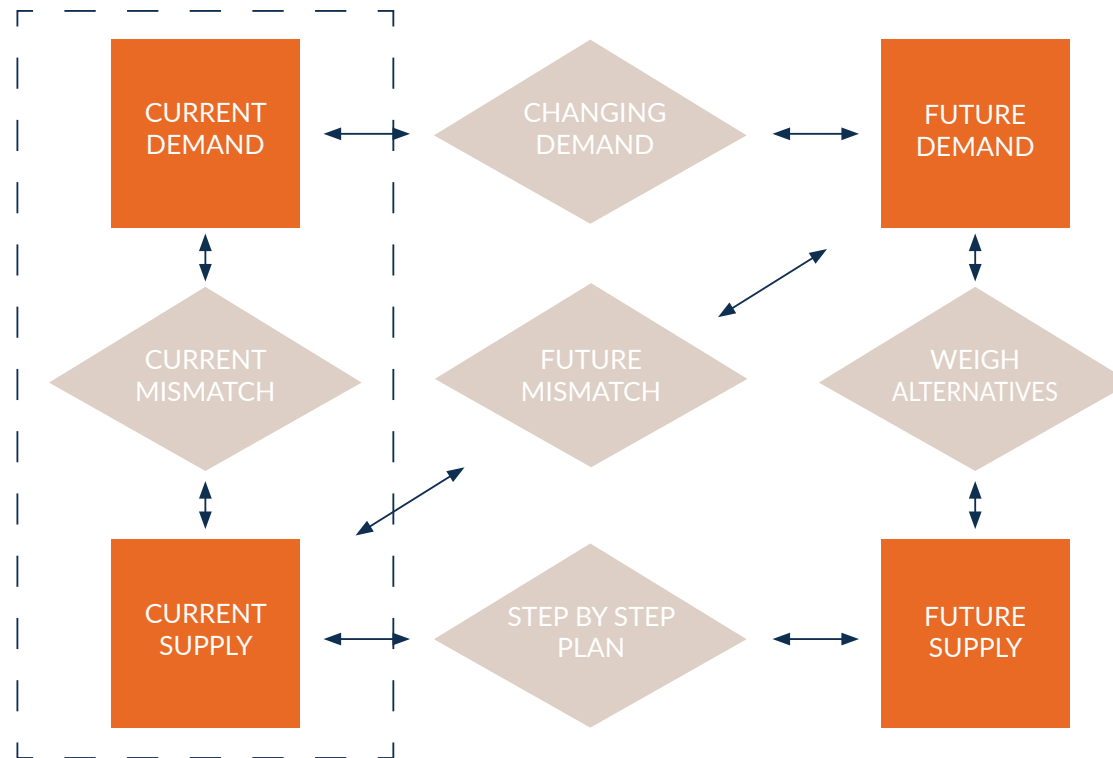


**THANK YOU
ANY QUESTIONS?**

APPENDIX



APPENDIX



APPENDIX

1

Vivat
Leaseplan
Microsoft
Philips
Rabobank
Essent
VGZ

2

Center for People and Buildings
Hospitality Group
Kees Froeling
Workwire
Funckey
Leesman

3

Healthy Workers
bGrid
EDGE Technologies
OfficeVitae
Spacewell
Octo
VodafoneZiggo
IBM

APPENDIX



Methodology: strong aspects

Literature study

- Adjustments and additions to the literature study during the empirical study; going back and forth within the process
- The literature provided good starting points for the empirical output

Empirical study (interviews)

- Interviews with different parties, looking at multiple perspectives
- Semi-structured interviews gave enough space for extra input such as the index from Leesman

Explorative study

- Member check to review the results with an expert from practice
- Using literature to define the characteristics of the identified flexible office challenges



Methodology: weak aspects

Literature study

- The lack of a clear goal for the literature study in the beginning: too much information was taken into account

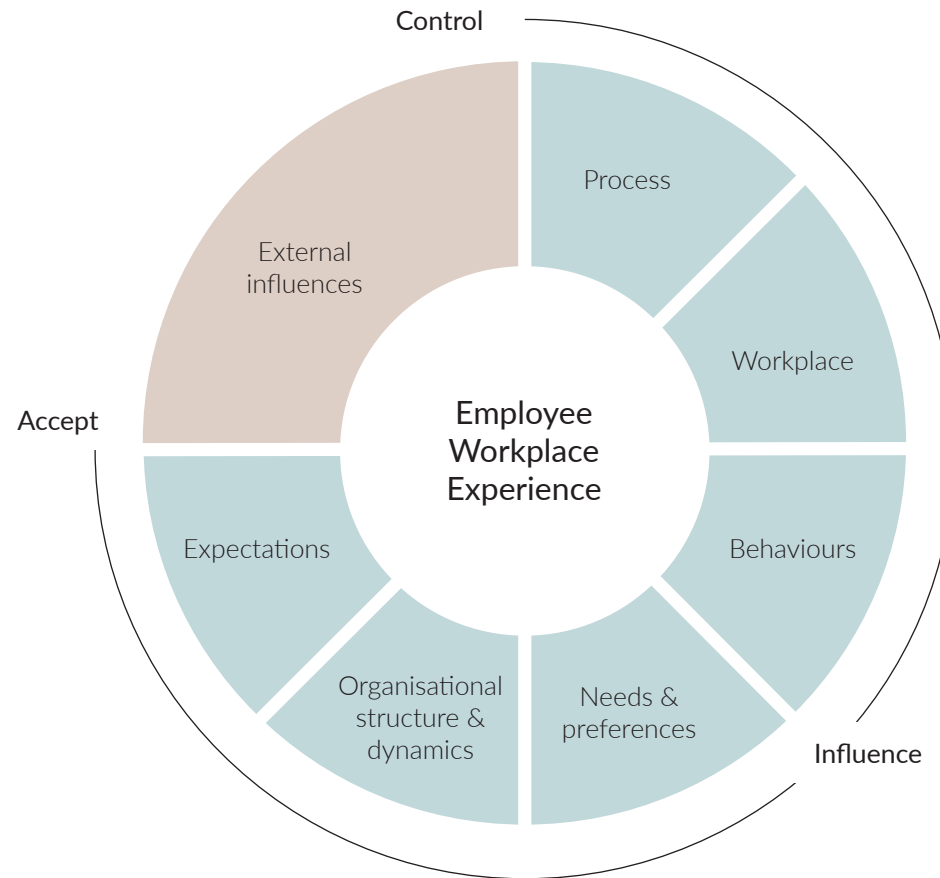
Empirical study (interviews)

- Lack of a clear company selection criteria for the interviews
- Results are not quantitative; could have been done by ranking the office challenges

Explorative study

- If the supply interviews were done before the demand interviews, matches could have already been explored and discussed with the experts from the flexible offices

APPENDIX



Source: Leesman (2018). *The Workplace Experience Revolution. Unearthing the real drivers of employee sentiment*