Smart tools on campus

a literature study connecting real estate management objectives and positioning technologies

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Smart Campus Tools

Paper: connecting real estate management objectives and positioning technologies
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Smart Campus Tools

Universities:
- Continuous student growth
- Pressure on existing space and renovation plans

User:

"reserved but not in use"

CRE Manager:

"expensive and poorly utilized"

Therefore: measure real-time use

* - based on Eduroam, Wi-Fi tracking, Occupancy sensors etc.

https://www.youtube.com/watch?v=5JtHdchJ4o8&

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Problem: scale and scope (1)

Frequency: ⌄   *Occupancy:* 🪑

Teaching space

- Objective is 70 percent *frequency*

- Predicted (timetabled) frequency is 62 percent

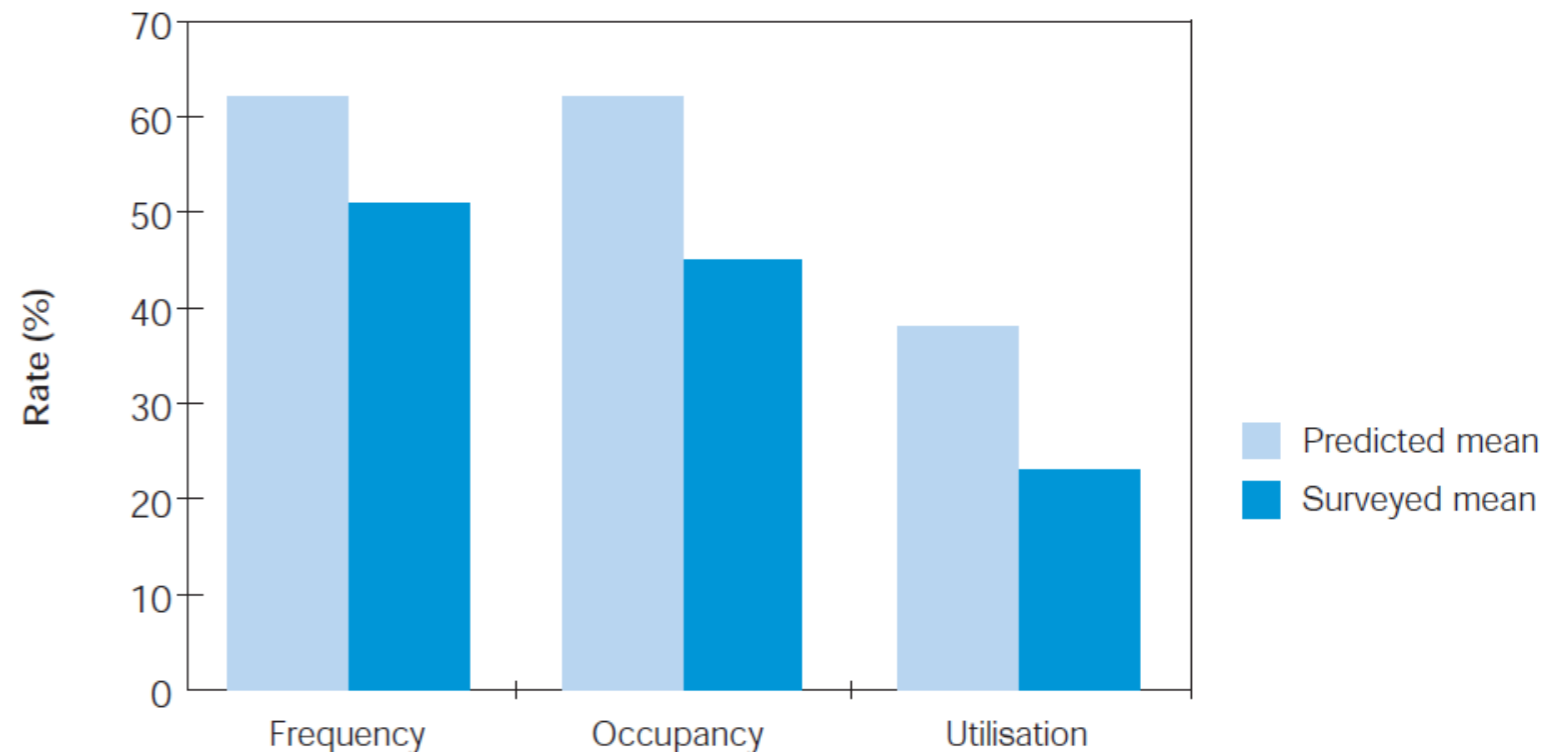- Surveyed frequency is 50 percent

Table 2: EMS predicted and surveyed mean utilisation data 2003-04

Data in this slide can be found in SMG (2006): Space Utilization, Performance, practice and guidelines

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Research project

Q

How can we align supply and demand in (educational) real estate as effectively and efficiently as possible?

Smart tools

A

Short term: real-time information helps users to better use space "right here, right now"

Long term: real-time information provides a richer picture which improves decision-making in real estate

Smart buildings and smart tools

Buckman et al. (2014) -> What is a smart building

(1) the methods by which building operation information is gathered and responded to (intelligence);
(2) the interaction between the occupants and the building (control);
(3) the buildings physical form (materials and construction)
(4) the methods by which building use information is collected and used to improve occupant performance (enterprise).
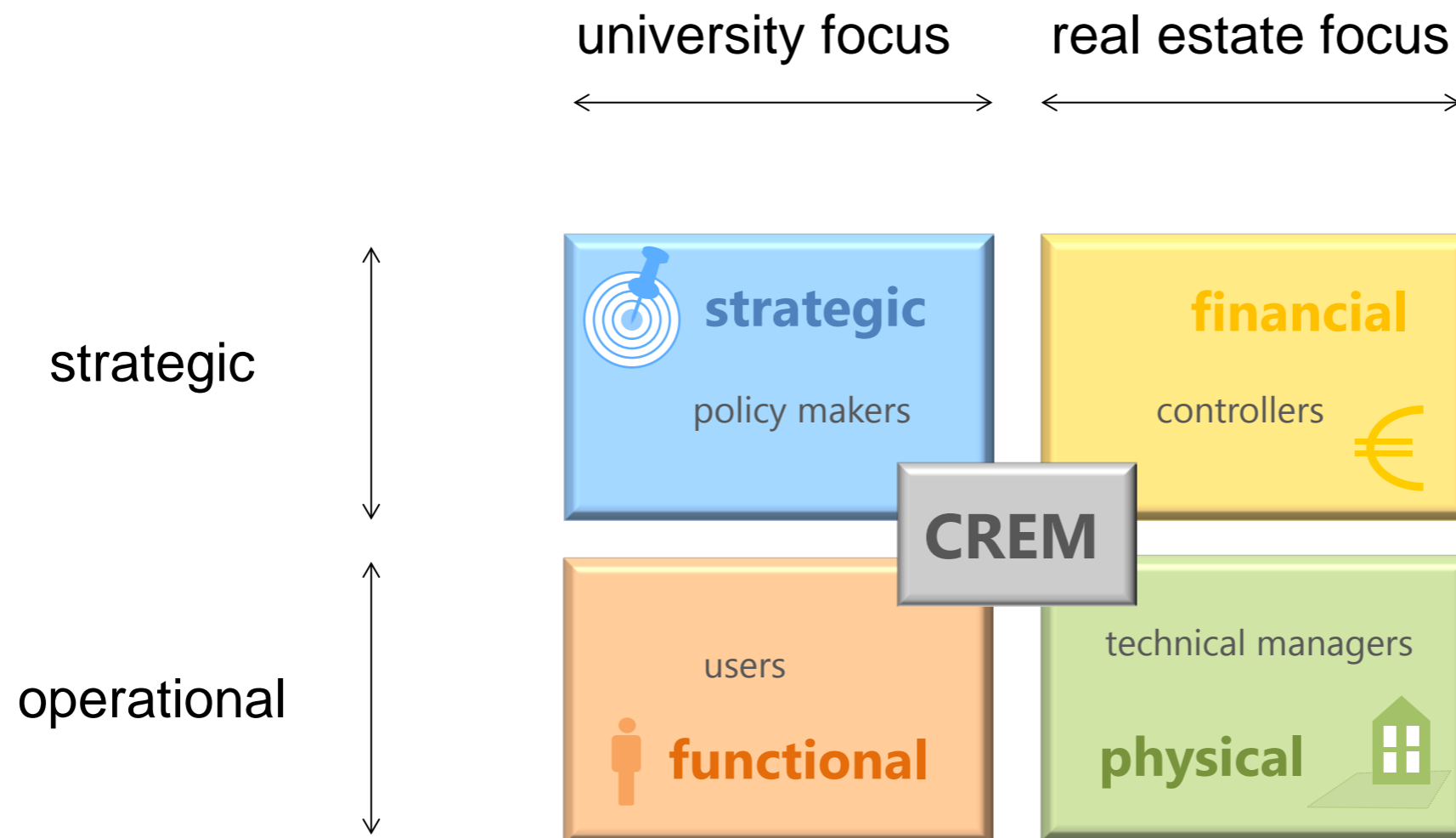
+ adaptability
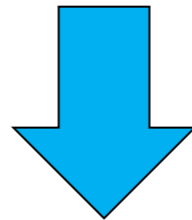
! a 'smart tool' is a tool that collects **real-time** data about **space use** and provides **actionable** information about space use to real estate managers and/or users

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Objectives (1/3)

! a 'smart tool' is a tool that collects real-time data about space use and provides **actionable** information about space use to real estate managers and/or users

university focus   real estate focus

strategic

operational

strategic — policy makers

financial — controllers

CREM

users — functional

technical managers — physical

Den Heijer (2011): four stakeholder perspectives to connect in CREM
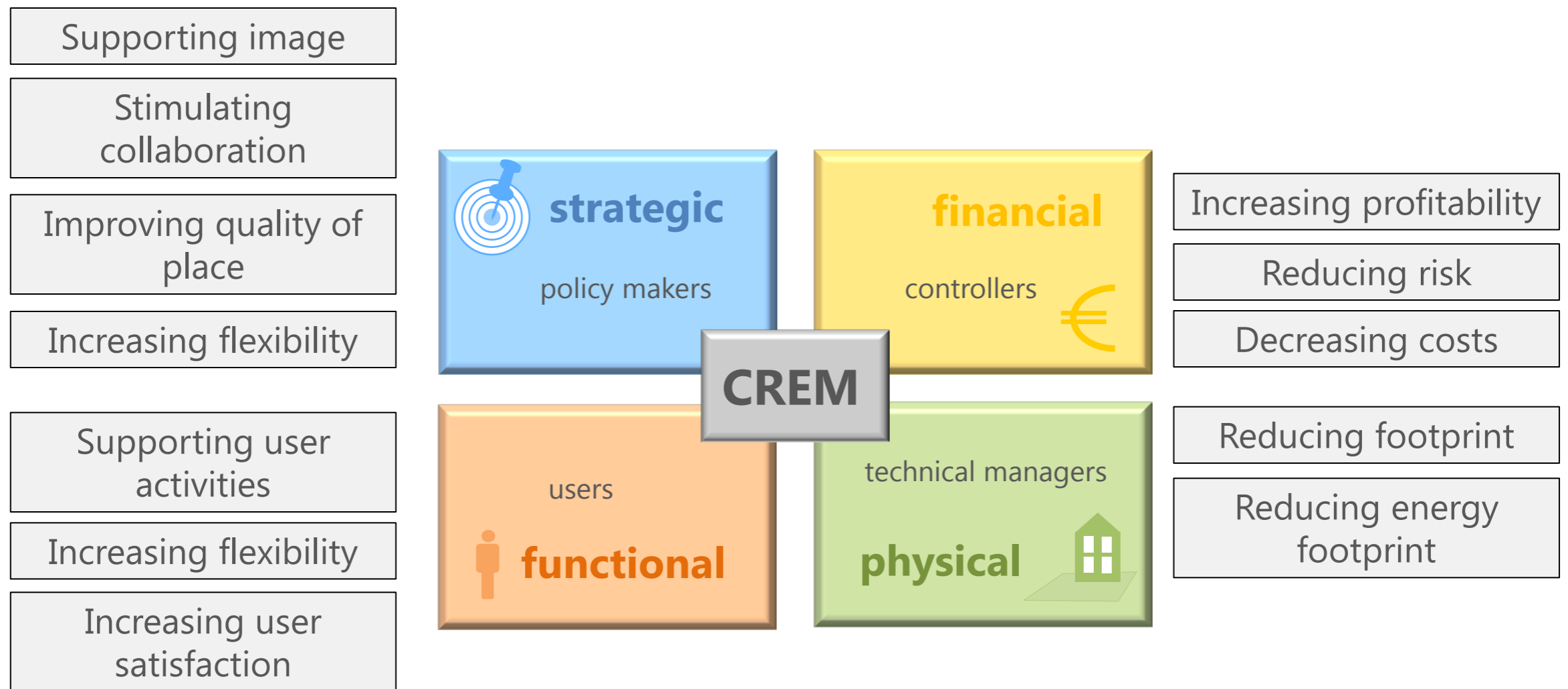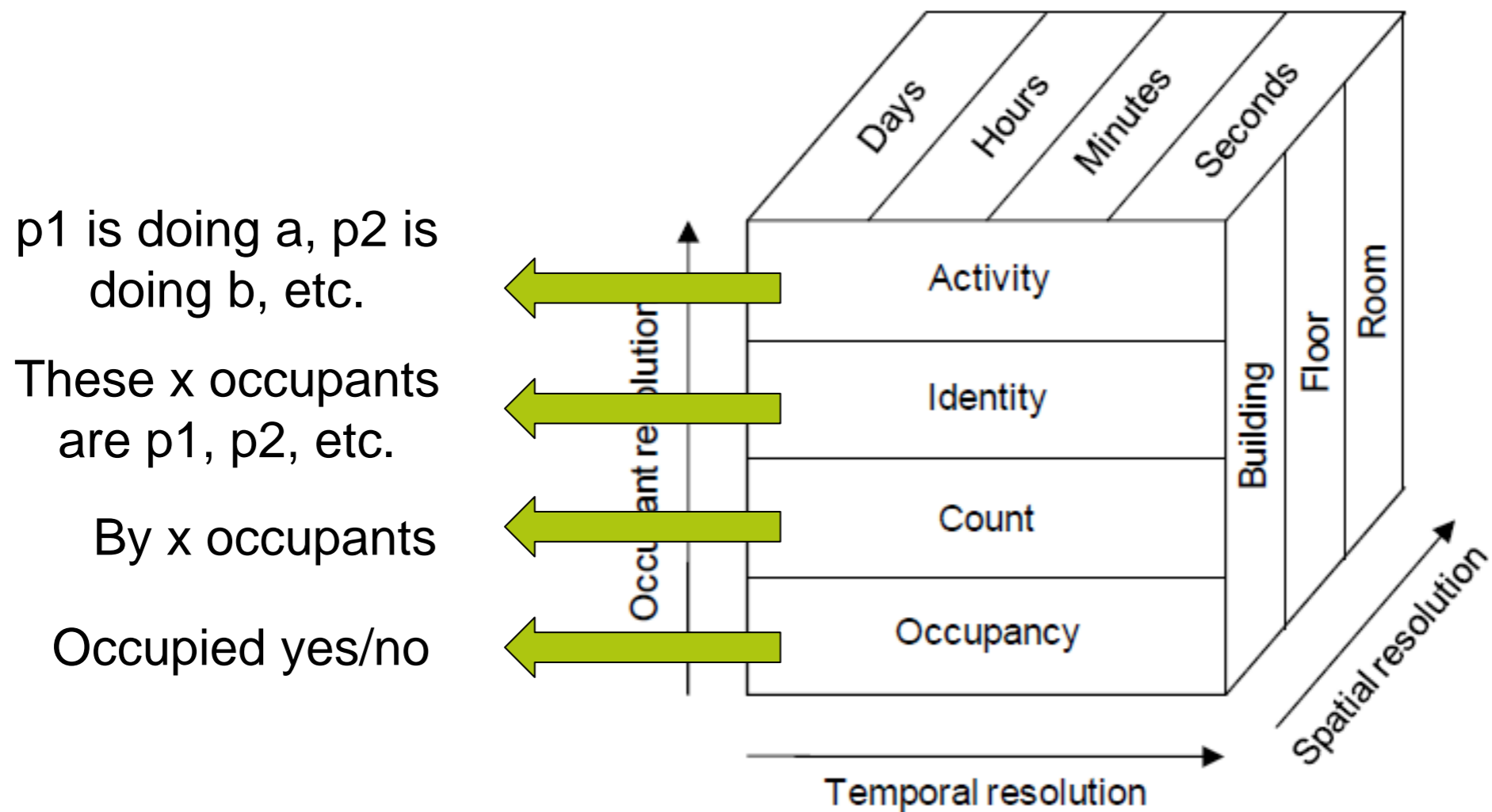
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Objectives (1/3)

! a 'smart tool' is a tool that collects real-time data about space use and provides **actionable** information about space use to real estate managers and/or users

Supporting image		
Stimulating collaboration		
Improving quality of place		
Increasing flexibility		

strategic
policy makers

financial
controllers

Increasing profitability
Reducing risk
Decreasing costs

CREM

Supporting user activities
Increasing flexibility
Increasing user satisfaction

users
functional

technical managers
physical

Reducing footprint
Reducing energy footprint

Den Heijer (2011): goals that will shape the future campus
(per stakeholder perspective)

Type of measurement (2/3)

! a 'smart tool' is a tool that collects real-time **data about space use** and provides actionable information about space use to real estate managers and/or users

p1 is doing a, p2 is doing b, etc.

These x occupants are p1, p2, etc.

By x occupants

Occupied yes/no

Christensen et al. (2014)
(to determine information quality)

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Methods (3/3)

! a 'smart tool' is a tool that collects **real-time** data about space use and provides actionable information about space use to real estate managers and/or users
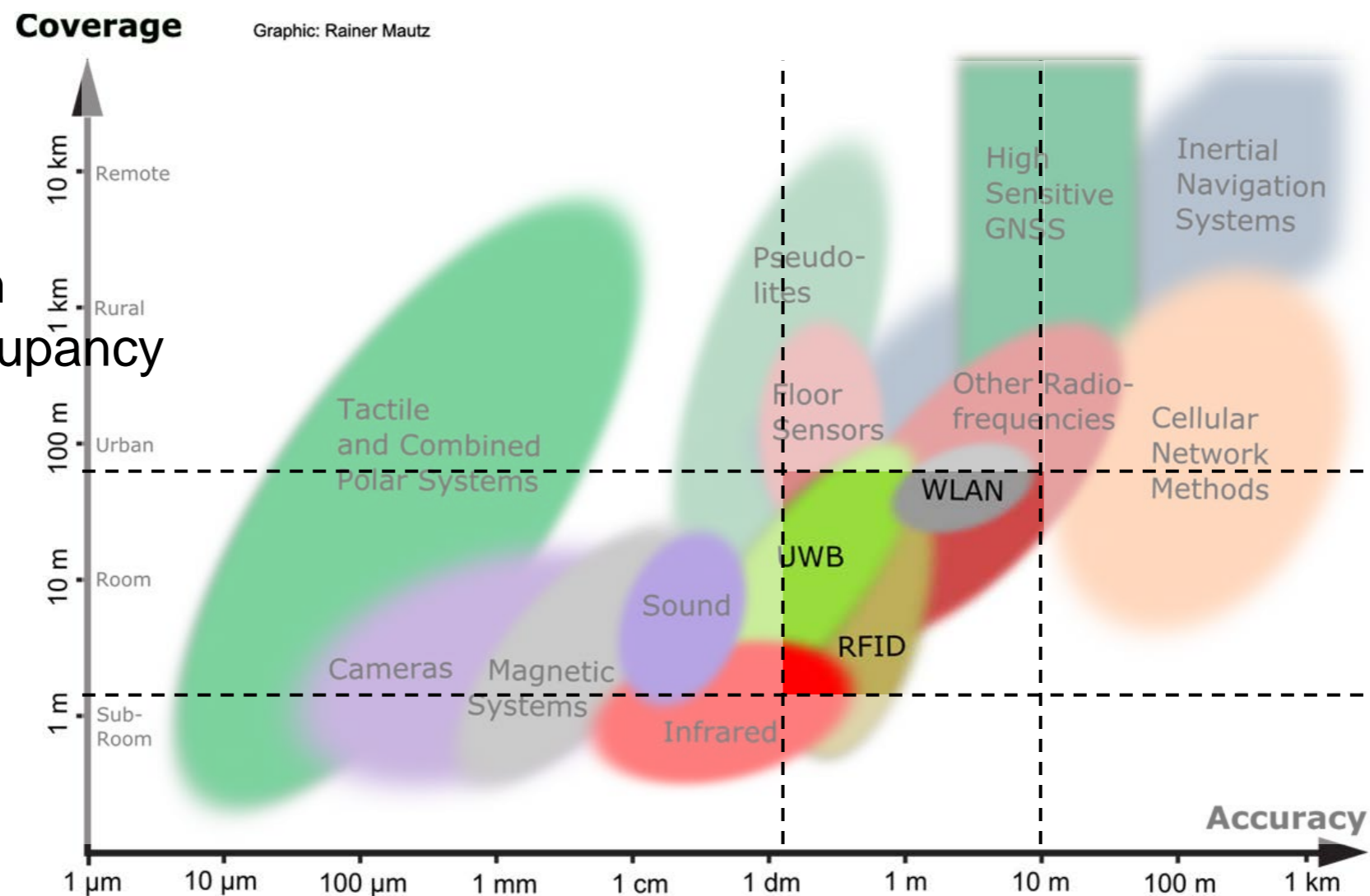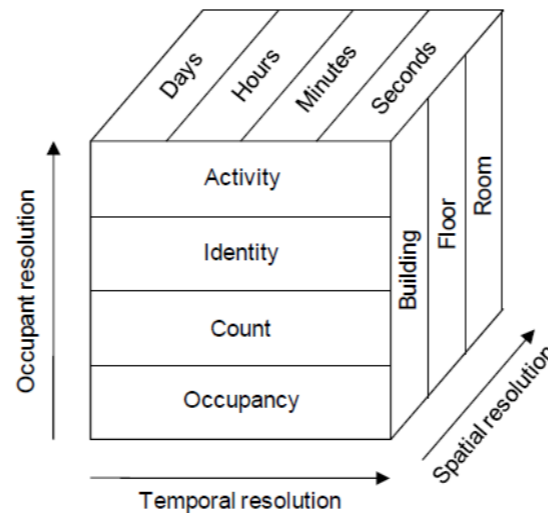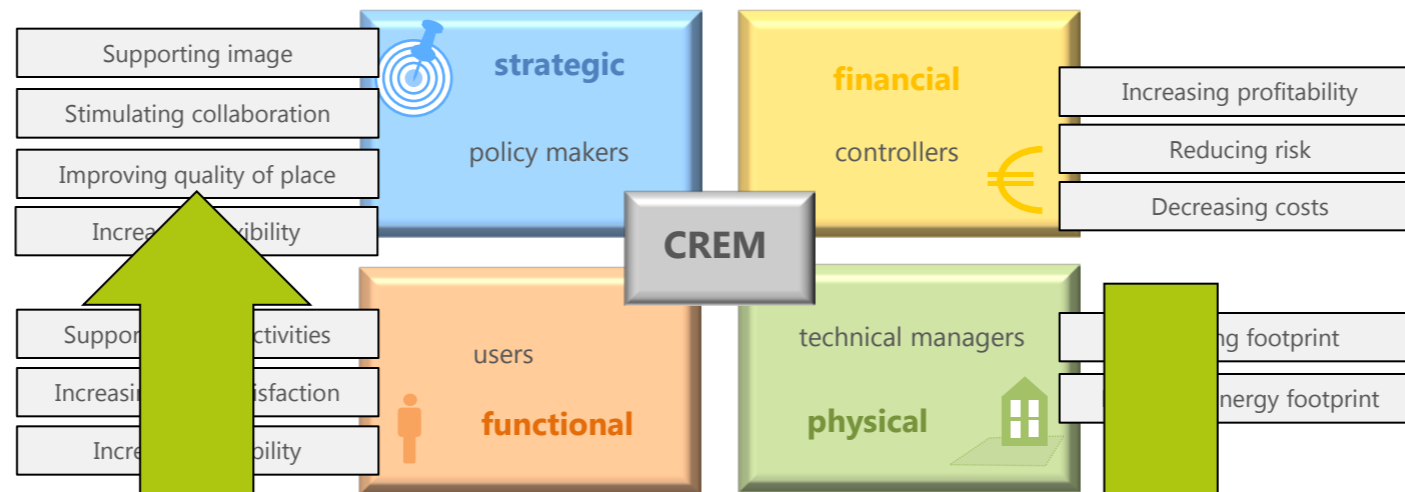
- RFID
- Wi-Fi
- UWB
- RF/Bluetooth
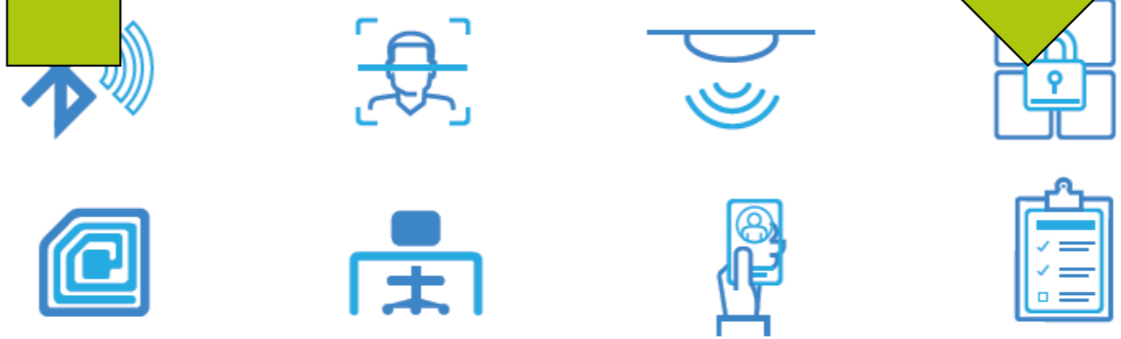- Infrared (occupancy sensors)

Mautz (2012): methods for indoor positioning, sorted by accuracy and coverage

Literature study

How are sensors linked to CREM objectives

What needs to be measured and with which sensors to reach CREM objectives?

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Research methods

- Literature study

1. Scopus query on different methods and objectives of indoor positioning: 200 papers
2. Selection of relevant papers; quick scan of 50 papers; CRE objectives, sensors, measurement objectives
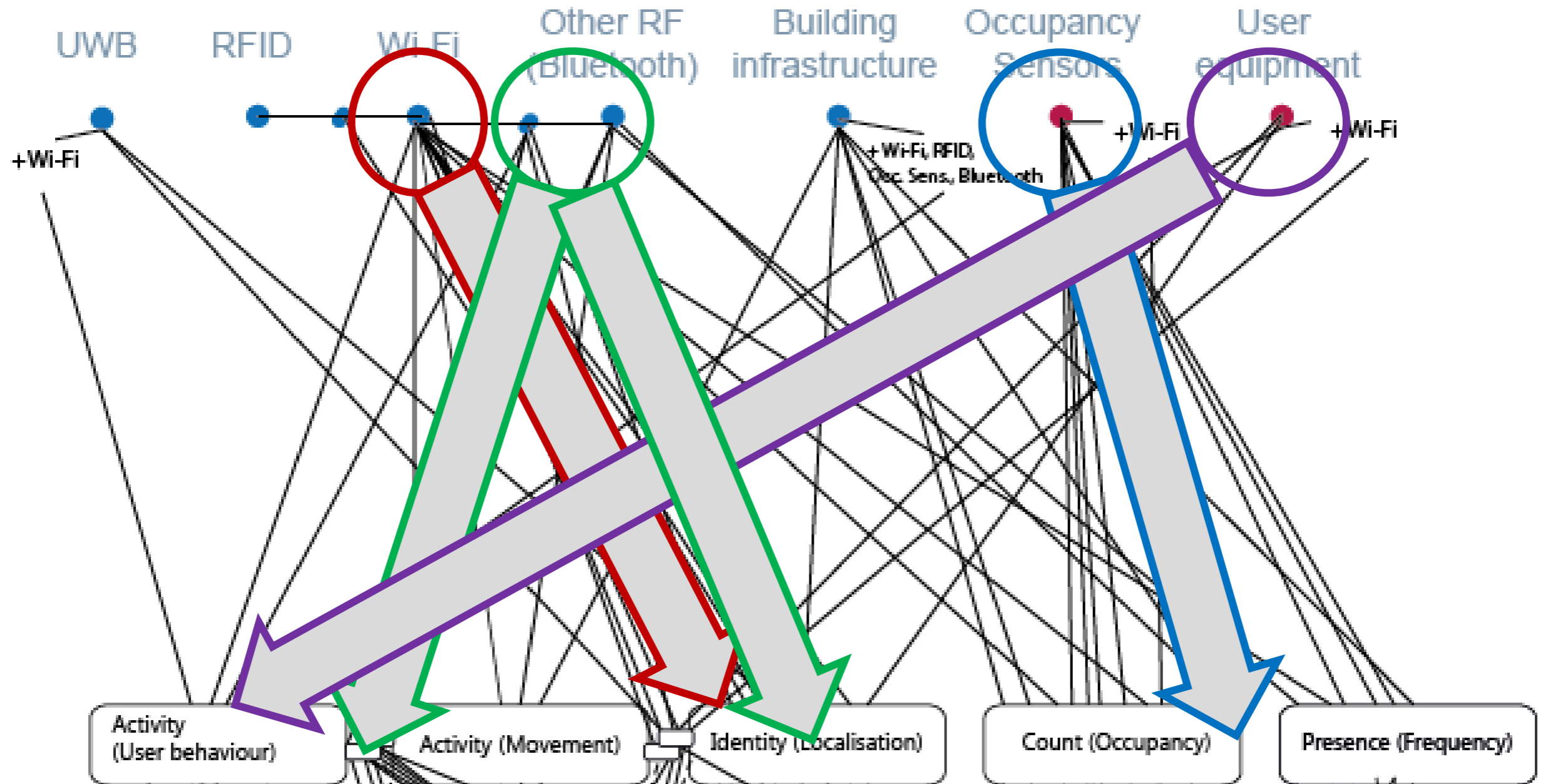
Finding a relation CRE objectives – used methods

- Interviews

1. Phone interviews
2. Different stakeholders: consultants, end users, engineers

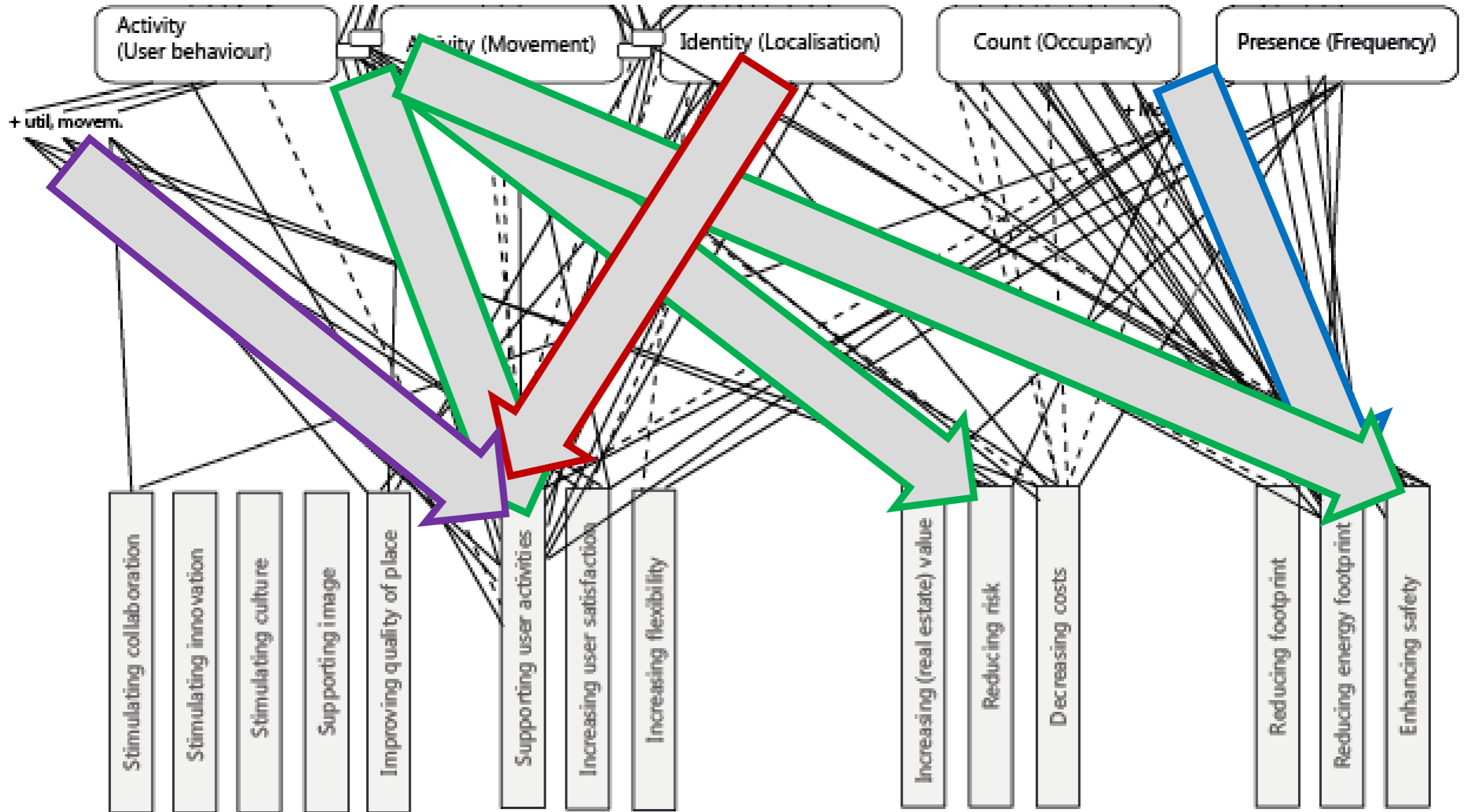**Best fit spatial scale and information requirements – sensors**
State of the art

Sensors

Occupancy levels

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Conclusions

sensor   *measurement*   *objective*   *themes*

Occupancy

Count

Identity

Activity (Movement)

Activity (Behavior)

Wearables

Complexity

Energy savings

Supporting users
Improving services

Monitoring visitor
flows, behavior at
large events

Person tracking

Sensor figures by Serraview; objective figures by Den Heijer (2011)
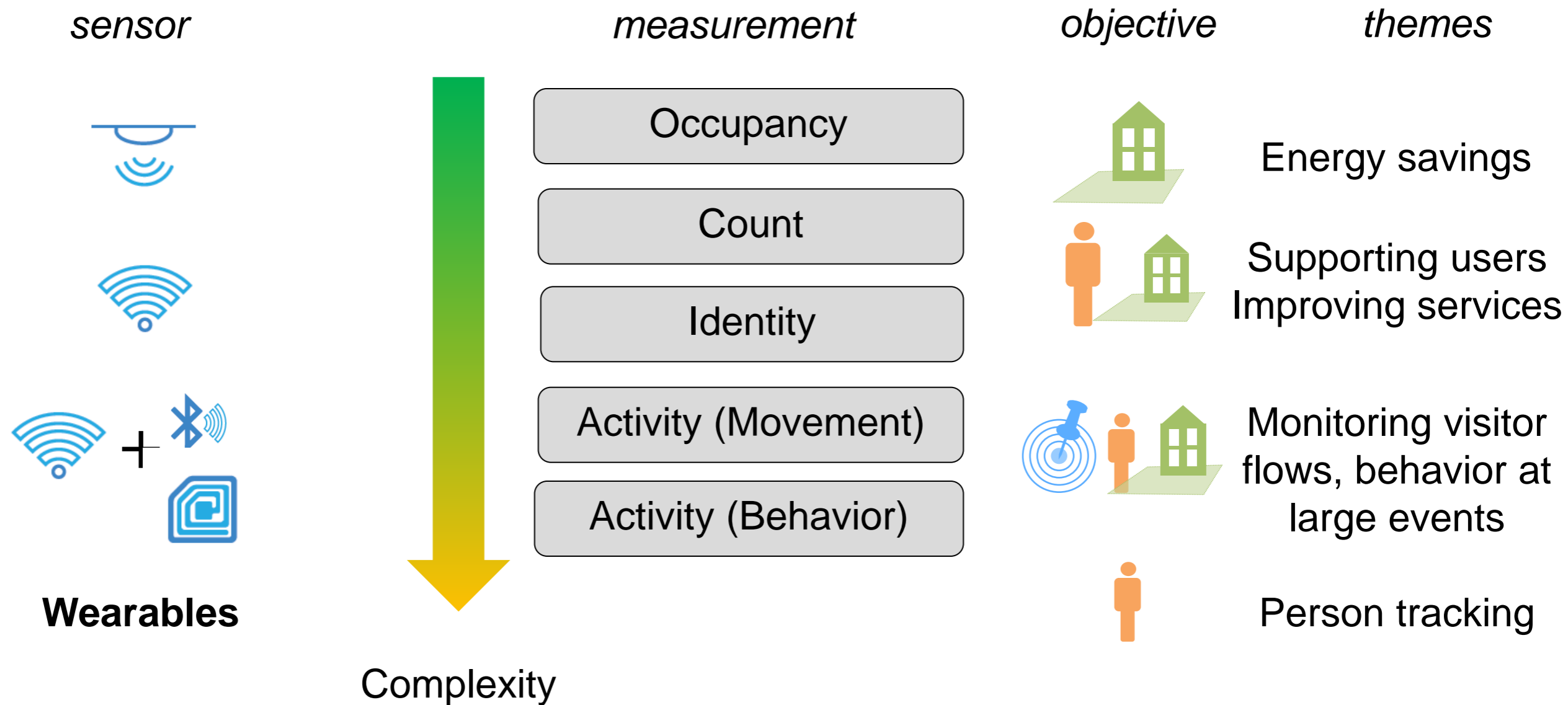
Conclusions and discussion

- Limited amount of publications

- Degree of variability in sensors, occupancy levels and CREM goals

- Strategic perspective, m2 reduction are hardly touched upon

- Increasing flexibility is hardly touched upon
  =/= smart tools?

- In studied papers the 'why' is hardly paid attention to

Alignment on a high resolution

temporal resolution

years / months / days / hours / minutes / seconds

Campus / building / floor / room / workstation

spatial resolution

Alignment on a low resolution

Occupancy / count / identity / activity

occupancy resolution

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