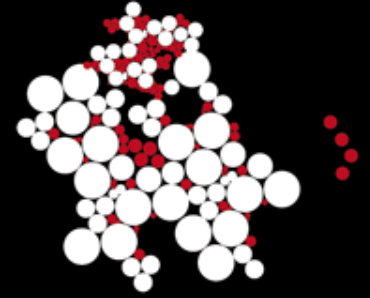


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ORAHS 2023 Graz

# Integrated Planning



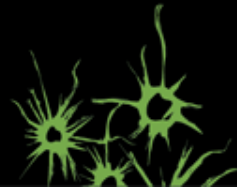
Prof.dr.ir. **Erwin W. Hans**

Full professor Operations Management in Healthcare

CHOIR-Center for Healthcare Operations Improvement & Research



**CHOIR**  

# InPlan-Care working group

## *Meeting in Wuppertal*





## Integrated Planning in Hospitals: A Review

Sebastian Rachuba<sup>a,b</sup>, Melanie Reuter-Oppermann<sup>a,c</sup>, Clemens Thielen<sup>d,e</sup>

<sup>a</sup>*Center for Healthcare Operations Improvement & Research, University of Twente, Enschede, The Netherlands*

<sup>b</sup>*University of Exeter, Medical School, Exeter, United Kingdom*

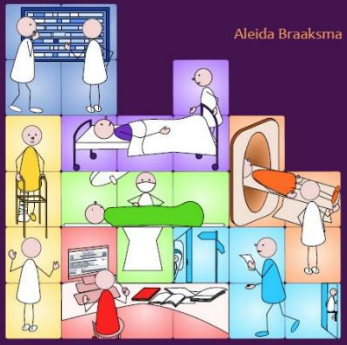
<sup>c</sup>*Information Systems | Software & Digital Business group, Technical University of Darmstadt, Hochschulstr. 1, 64289 Darmstadt, Germany*

<sup>d</sup>*TUM Campus Straubing for Biotechnology and Sustainability, Weihenstephan-Triesdorf University of Applied Sciences, Am Essigberg 3, 94315 Straubing, Germany*

<sup>e</sup>*Department of Mathematics, School of Computation, Information and Technology, Technical University of Munich, Boltzmannstraße 3, 85748 Garching bei München, Germany*


Timely and Efficient planning of Treatments through Intelligent Scheduling

Aleida Braaksma



Flowing through hospitals


Johanna Theresia van Essen



**Beta**  
Research School for Operations Management and Logistics

Interacting Hospital Departments and Uncertain Patient Flows: Theoretical Models and Applications

Peter Tulkens Vanberkel



Why wait?

Organizing integrated processes in cancer care

Gréanne Leeftink



Efficient healthcare logistics with a human touch

Maartje van de Vrugt



QUALITY-DRIVEN EFFICIENCY IN HEALTHCARE

NIKKY KORTBEEK




Organizing timely treatment in multi-disciplinary care

Ingeborg A. Bikker



Curing the Queue

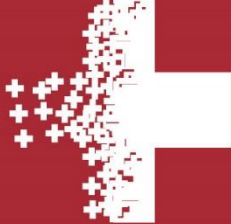
Maartje Elisabeth Zonderland



Integrated Decision Making in Healthcare

An Operations Research and Management Science Perspective

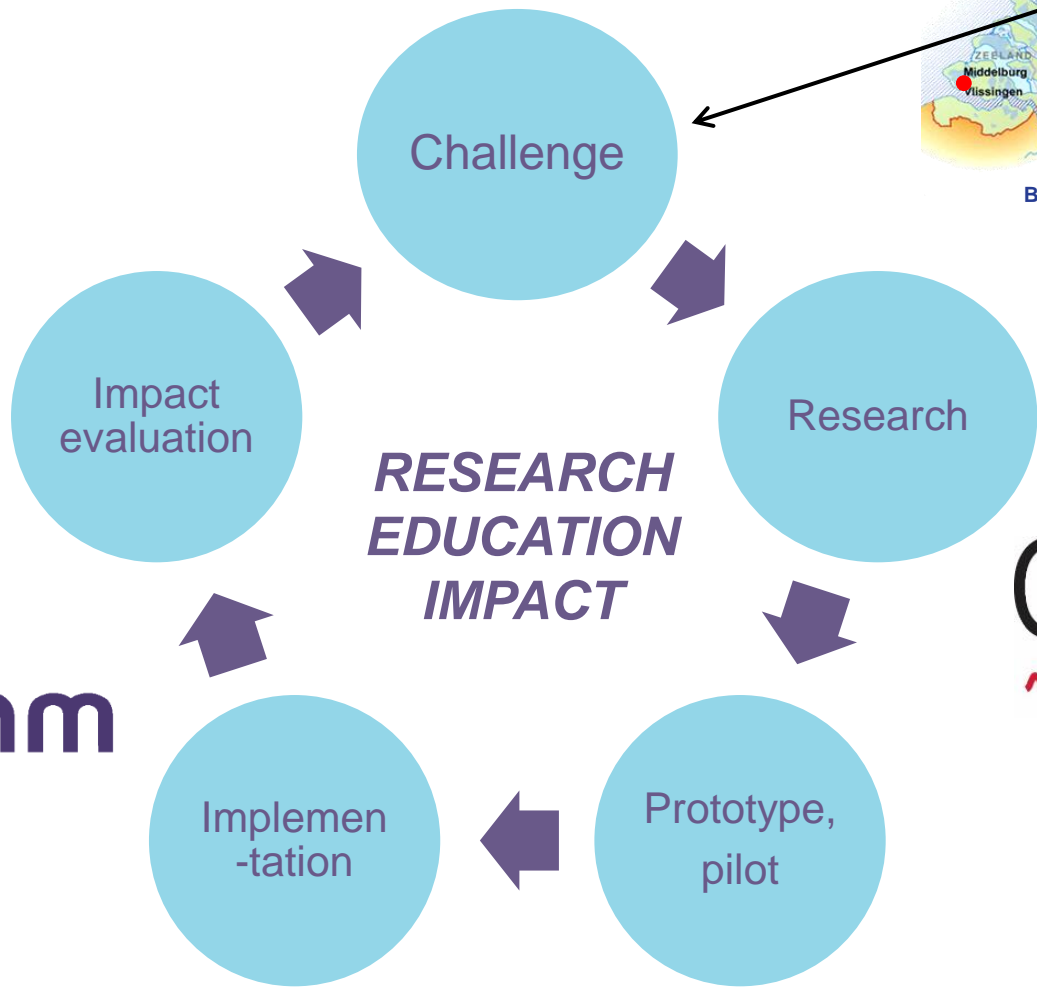
Peter J.H. Hulshof

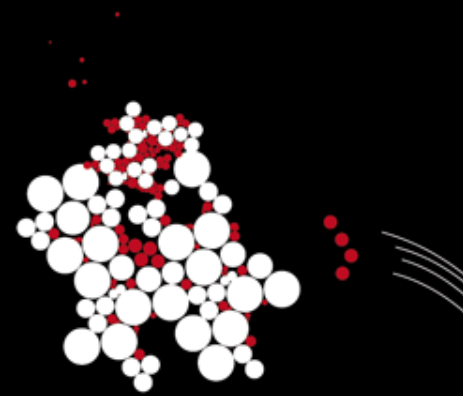


INTEGRAL CAPACITY MANAGEMENT & PLANNING

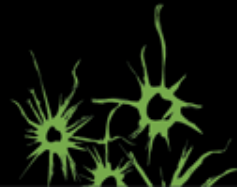


# Impact driven approach to research and education





# Why integrated planning? What is it?



*Improve productivity,  
quality of care & labor & service,  
without additional expenditures or capacity*



# Staffing crisis

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# Transformation of healthcare

## *main developments in the Netherlands*

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- Shift of care to the **first line**
- **Technology** supporting care **delivery & planning**
- More focus on **prevention**
- **Cost- and capacity-effective** care delivery
- More **intra- and trans-mural collaboration**

Managing patient flows, rather than utilization

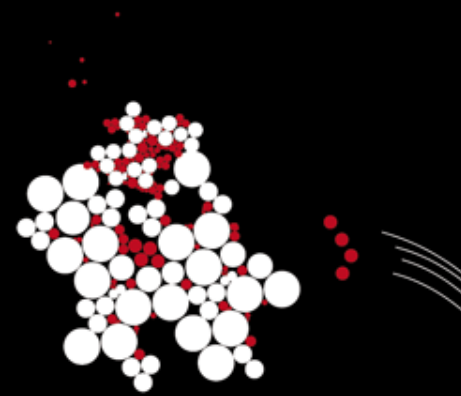
➔ Need for *integrated planning*

# Dimensions of integration

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- Care pathway
- Stakeholder values
- Hierarchical levels of control
- Domains of control



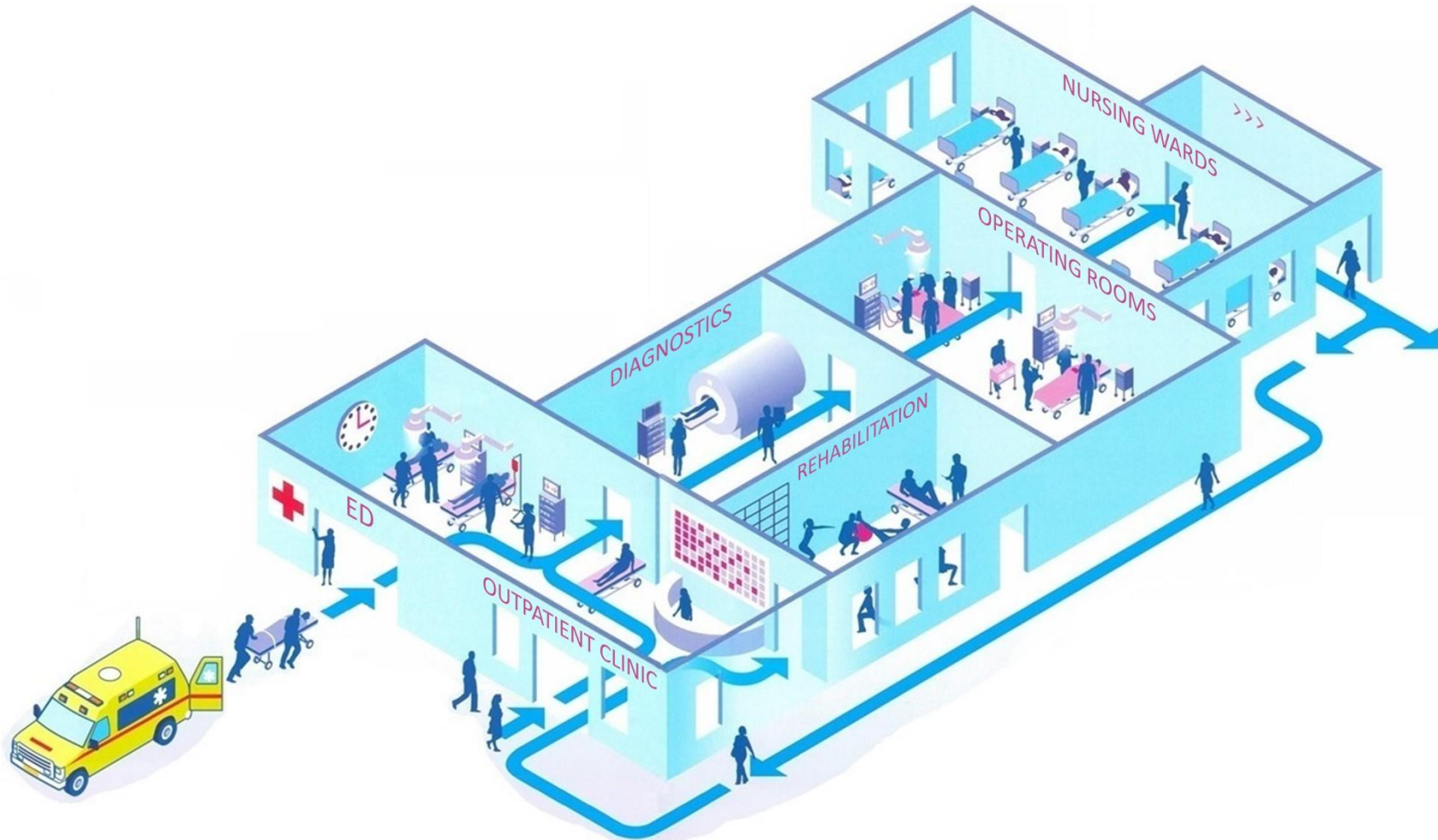


**Integrated planning dimension:  
Care pathway**



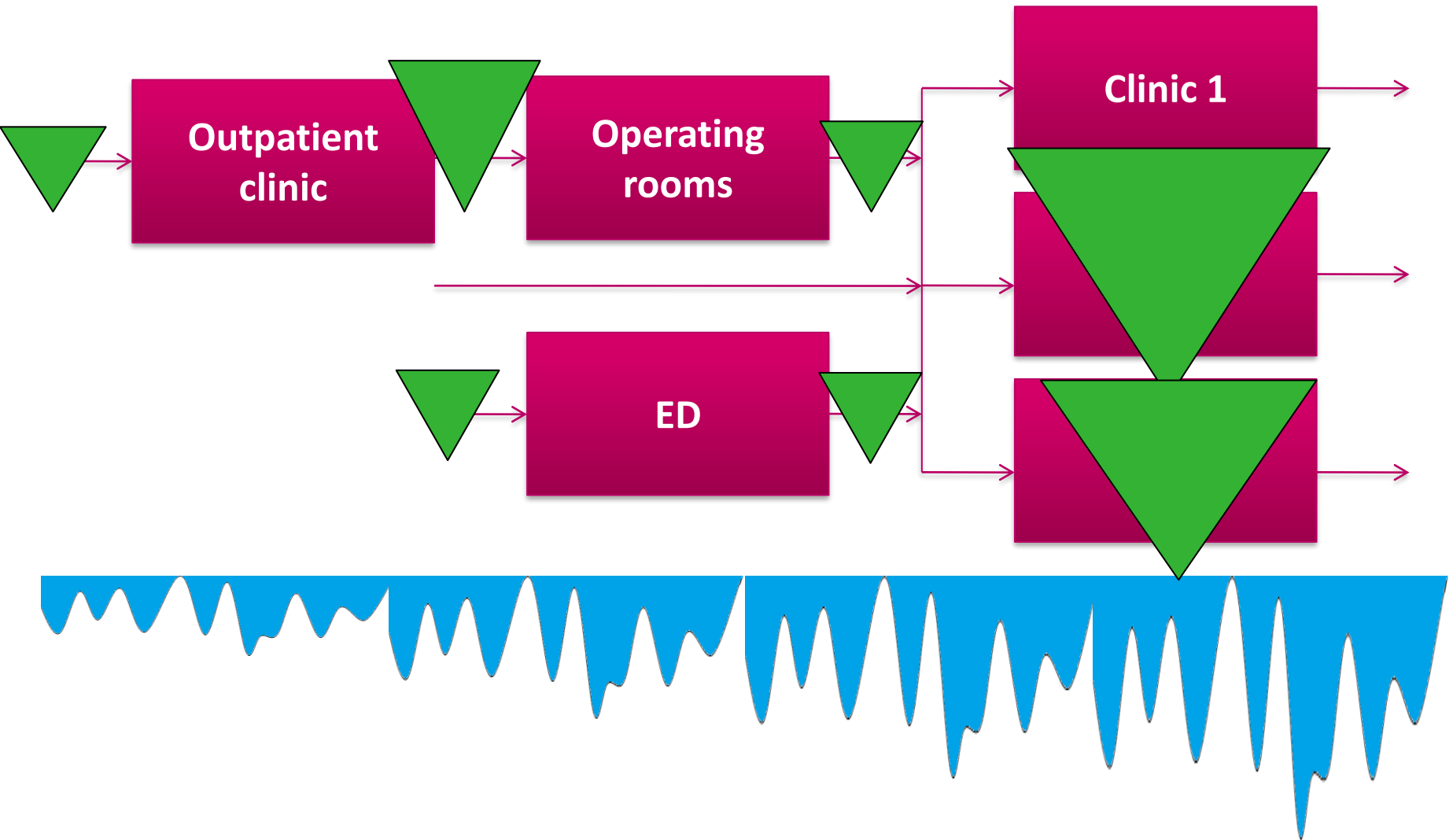
# Optimize the *entire* care pathway

---

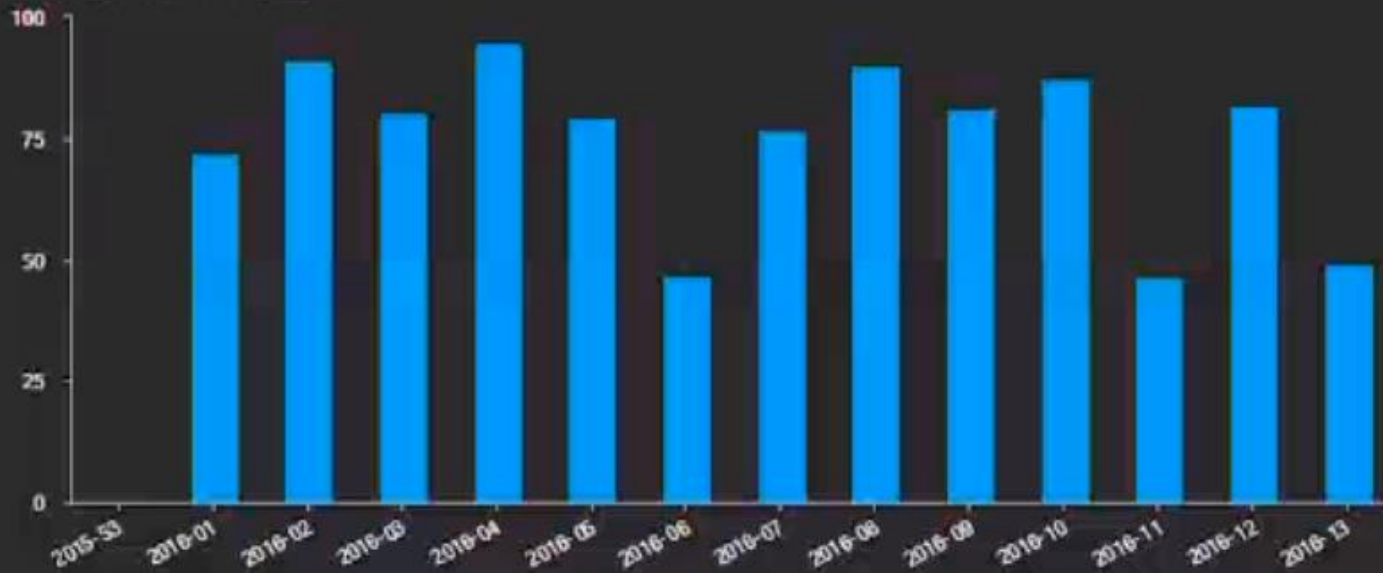




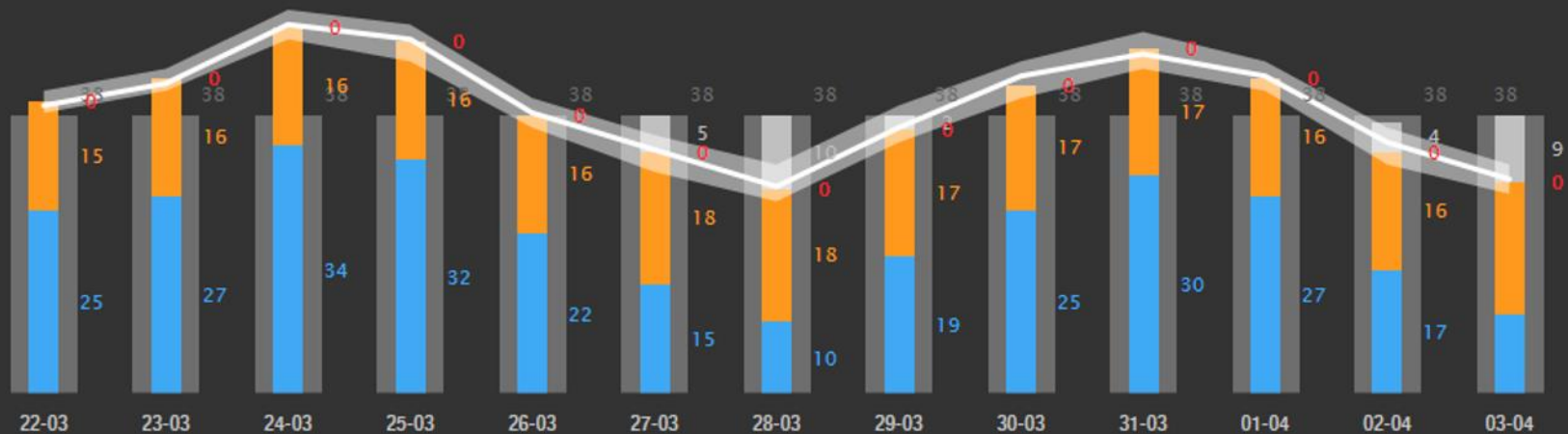
# Local optimization leads to bullwhip effect in the care chain



## Outpatient clinic hours per day (orthopaedics)



## Ward occupation per day (blue: elective, orange: non-elective)





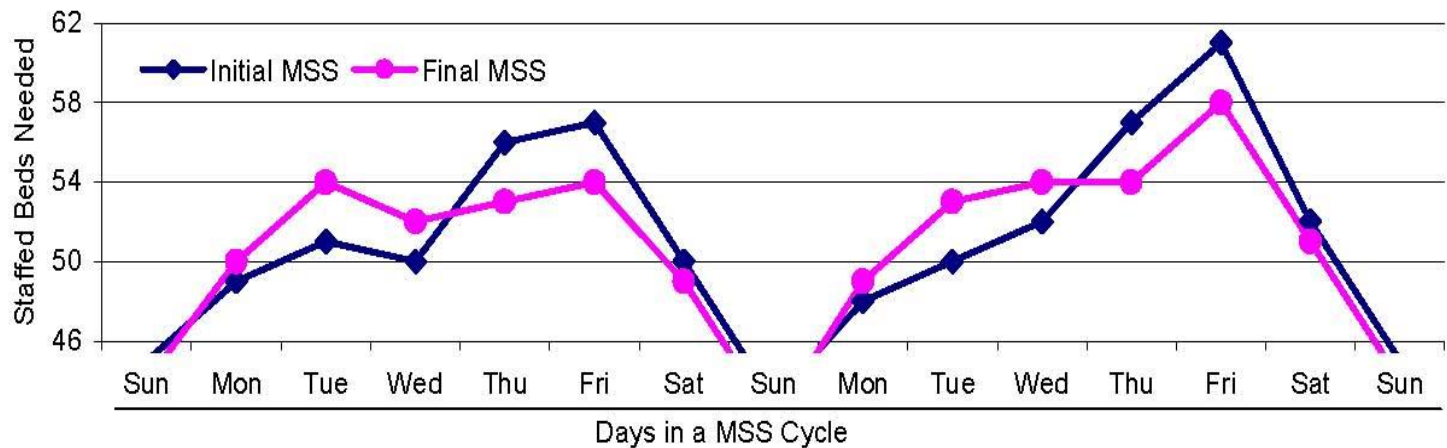
Peter Vanberkel

**Example:**

# The relation between operating rooms and wards

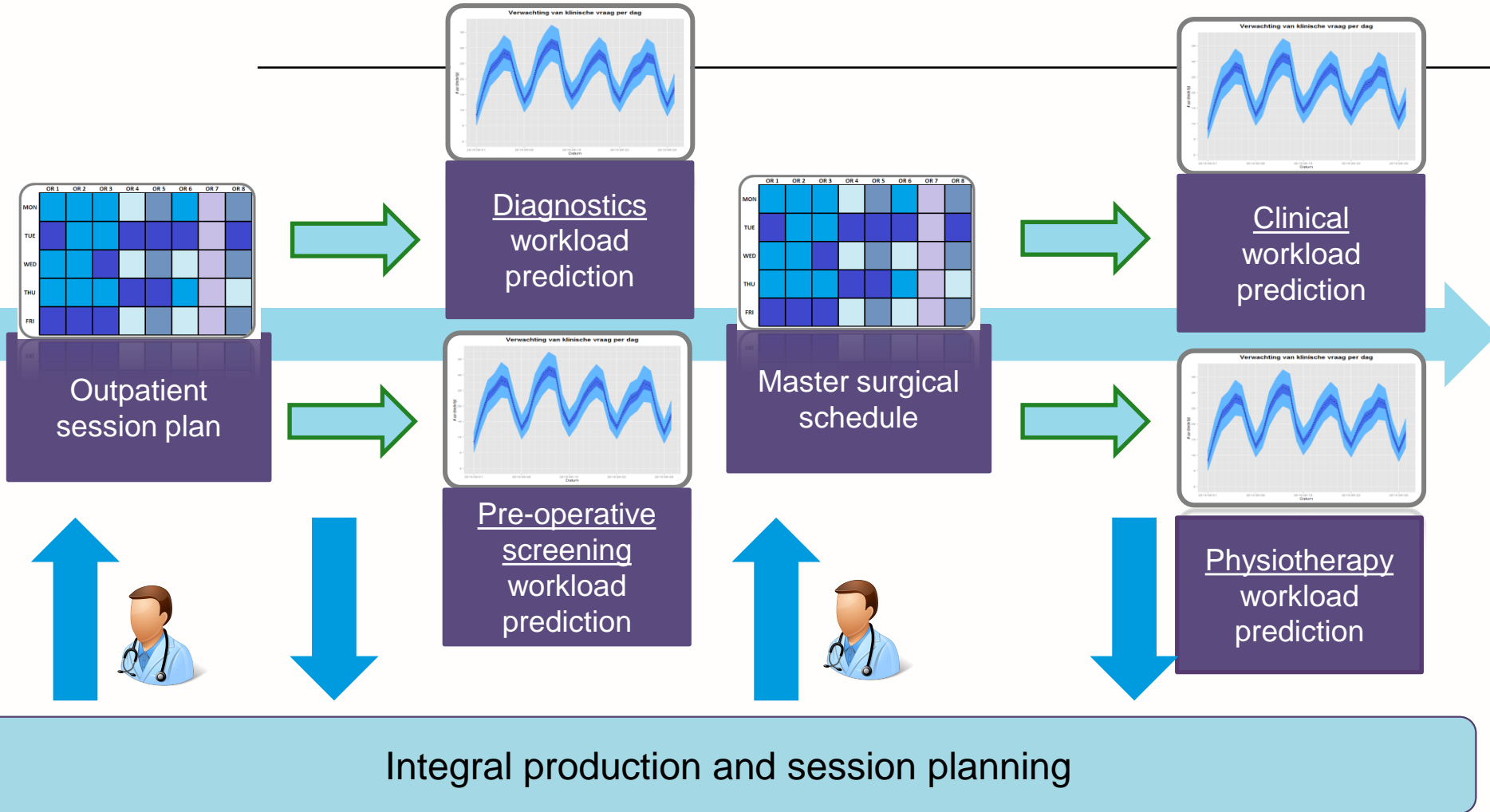
	OR 1	OR 2	OR 3	OR 4	OR 5	OR 6	OR 7	OR 8
MON	Green	Green	Green	Light Blue	Yellow	Green	Light Purple	Yellow
TUE	Light Pink	Green	Green	Light Pink	Light Pink	Light Pink	Light Purple	Light Pink
WED	Green	Green	Light Pink	Light Blue	Yellow	Light Blue	Light Purple	Yellow
THU	Green	Green	Green	Light Pink	Light Pink	Green	Light Purple	Light Blue
FRI	Light Pink	Light Pink	Light Pink	Light Blue	Yellow	Light Blue	Light Purple	Yellow

- **Additional 8<sup>th</sup> operating room without any additional nursing capacity**



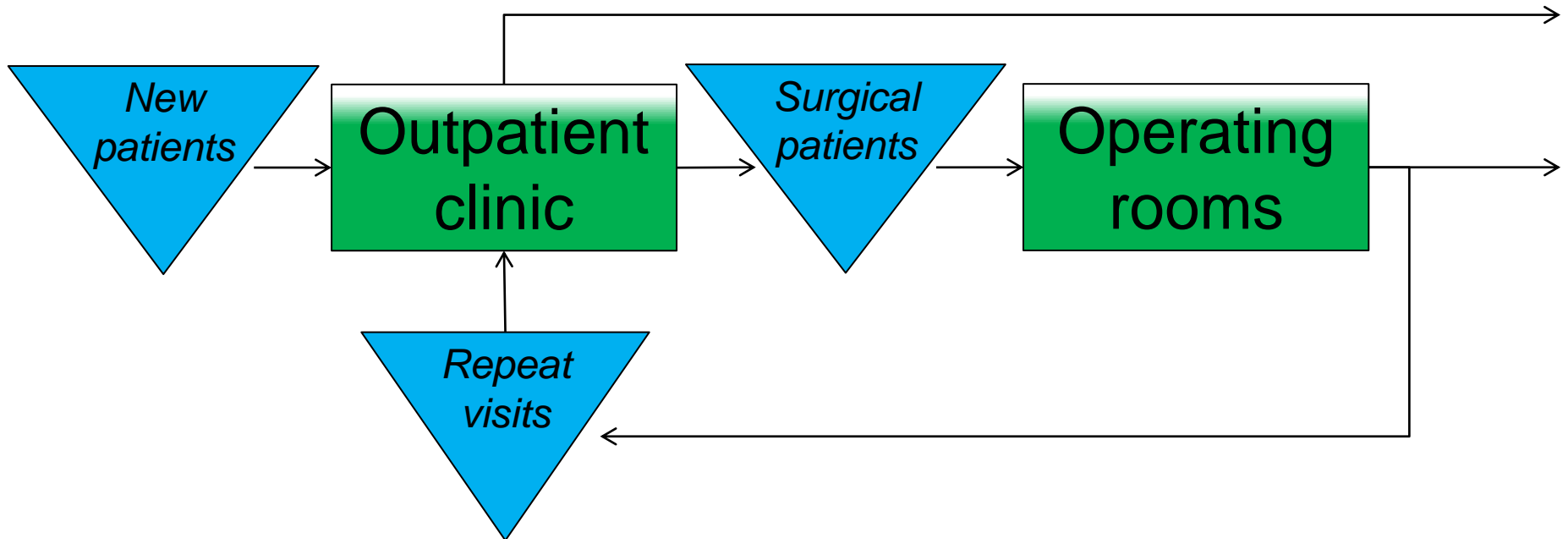


# A generic framework for optimization based on *workload predictions*

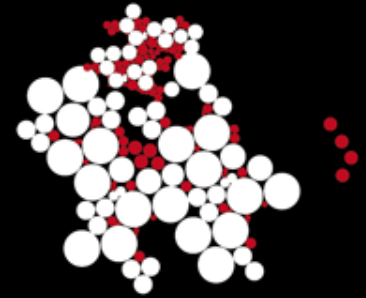


*Example:*

## Tactical planning of **outpatient clinic & operating rooms**



*How to flexibly react to fluctuations in demand and supply?  
→ See our ILP and ADP solutions (P.J.H. Hulshof et al.)*



**Integrated planning dimension:  
Stakeholder values**



# CAPACITY PLANNING AND CONTROL

---

= to match ***demand*** (care) and ***supply*** (capacity)

so that the ***desired performance*** is reached

Departure point for the **design of planning**:

what is the **performance** we strive for?

## From stakeholder values to decisions

---

Long access time, all appointments on one day (one-stop-shop)

**OR**

First appointment within a week.  
One week between appointments

Immediately give a surgery date.  
High probability of cancellation

**OR**

Immediately give a surgery week.  
Announce the day of surgery two weeks in advance.

Video consult

**OR**

Physical meeting

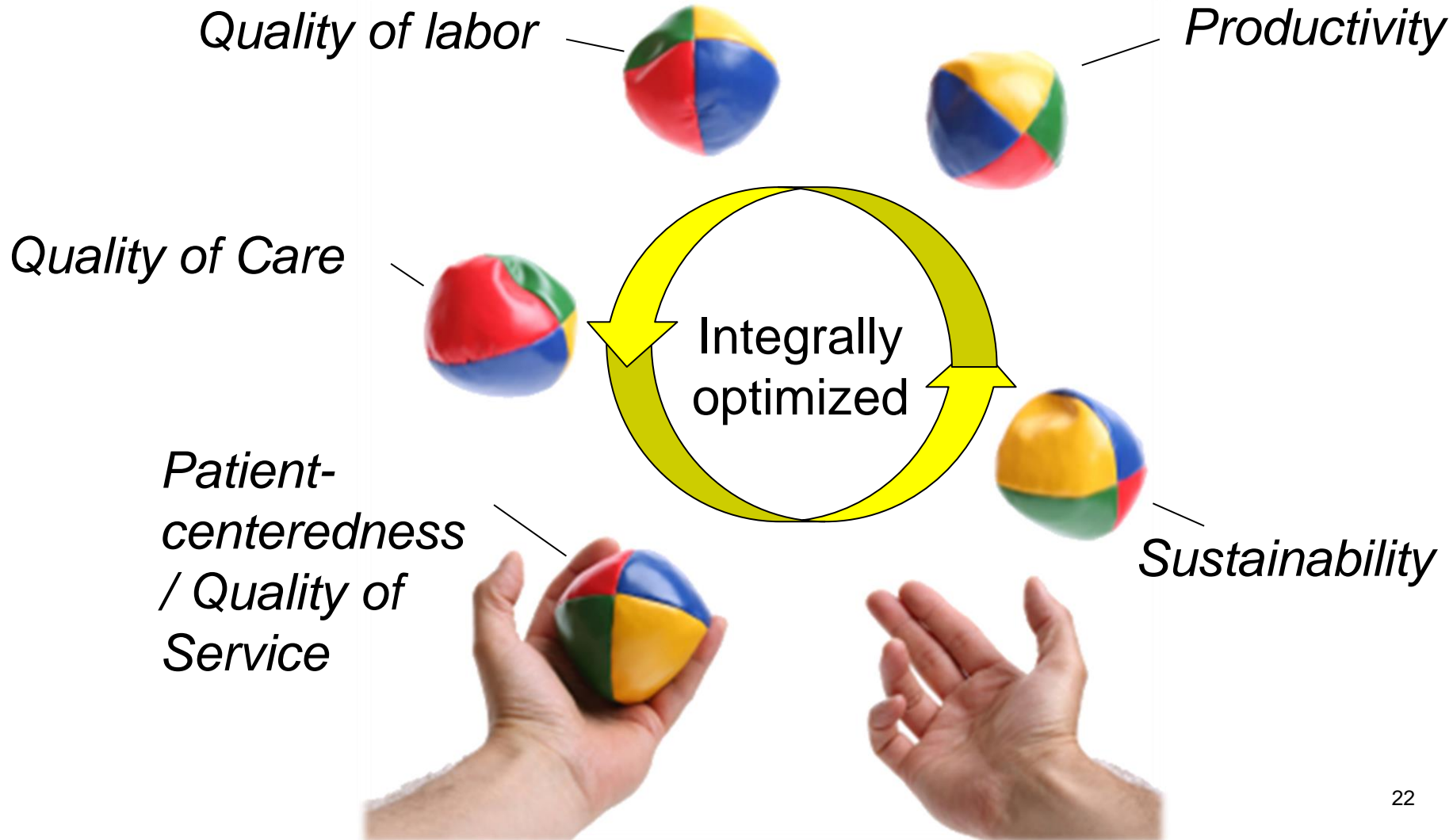
Travel for hours to the best specialist

**OR**

Appointment close to home

# Art of balance

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**Systems  
design**

# Approaches for organizational improvement

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**Top down**

Top down

**vs. Bottom up**

Bottom up



**Continuous  
improvement**





# Approaches for organizational improvement

---

**Top down**  
Top down

**vs. Bottom up**  
Bottom up

For both, the departure point is:

*What performance (stakeholder values)*

*does the organization strive for?*

---

**If you don't measure your ideals,  
that what is measured becomes the ideal**

*from: Flikkema, Meindert J. (2016).  
Sense of Serving- Reconsidering the Role of Universities in Society now.  
Amsterdam, VU University Press.*

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**When a measure becomes a target,  
it ceases to be a good measure**

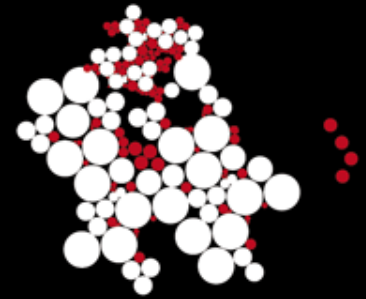
*Goodheart's law (1975)*

# Integrated planning & stakeholder values

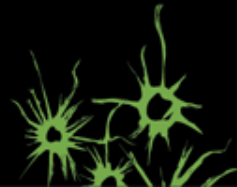
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If the stakeholder values ...

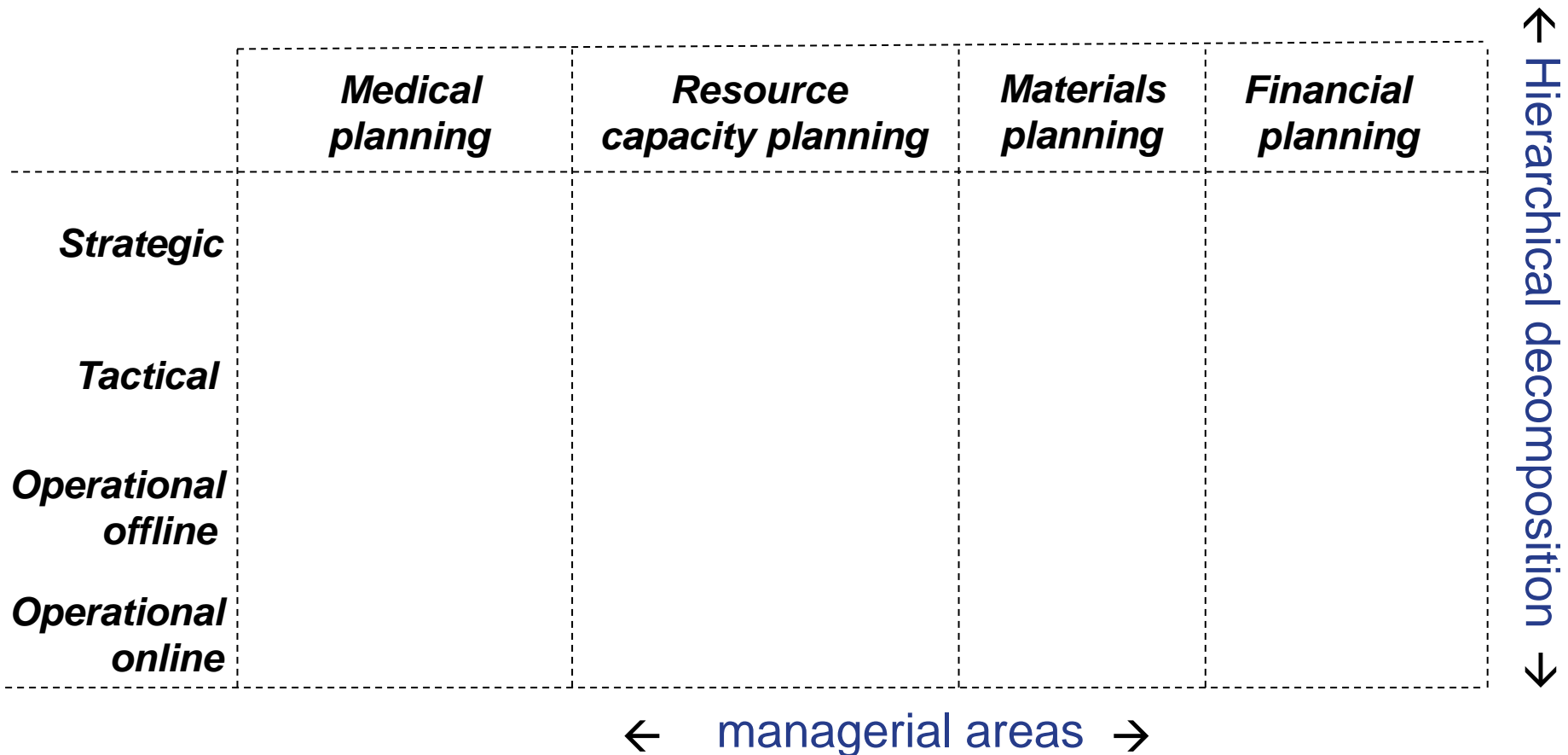
- are ambiguous / not known: you cannot direct planning and control; decisions are made arbitrarily
- aren't broadly supported in the organization: decision making is not aligned
- do not fit the organization's DNA: unrealistic values are strived after



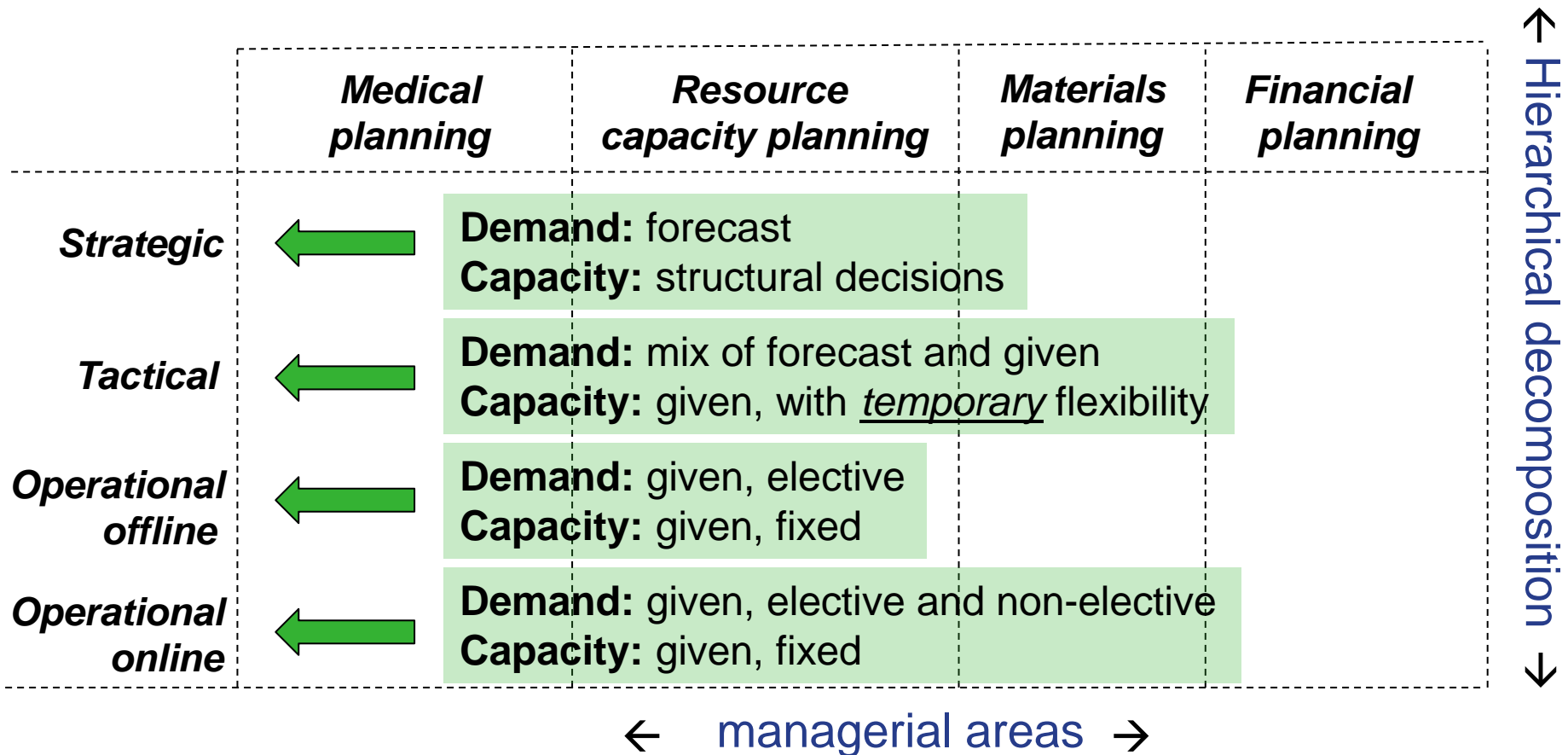
**Integrated planning dimension:  
Hierarchical levels of control**



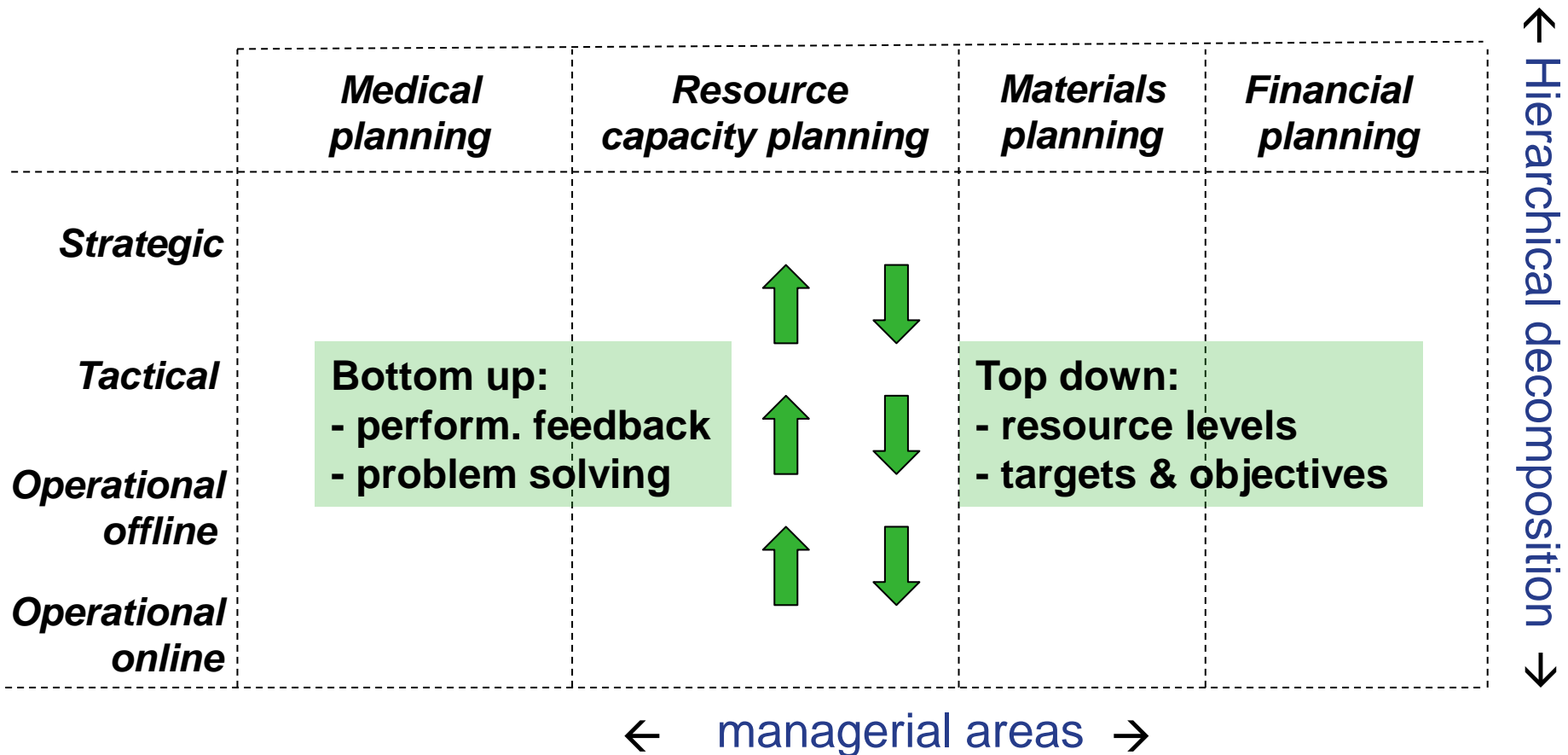
# Hierarchical planning & control framework



# Hierarchical levels



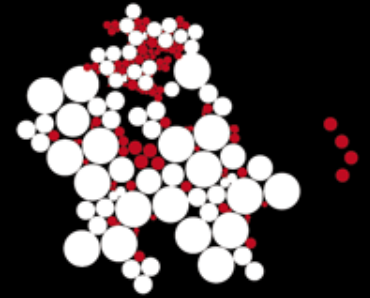
# Alignment of hierarchical levels



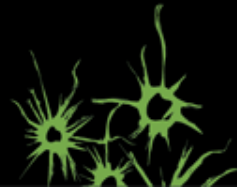


# Tactical planning... the missing link

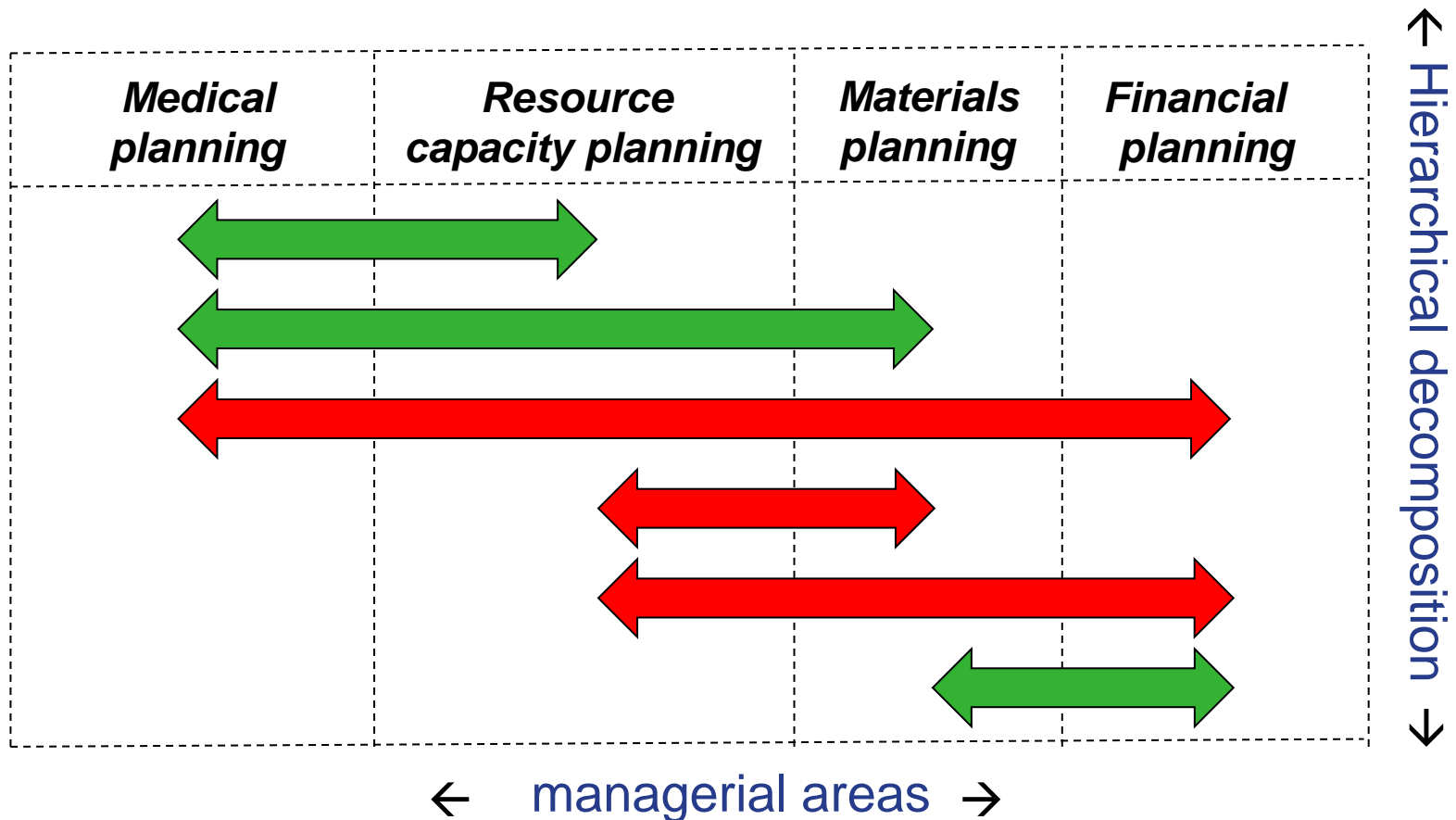


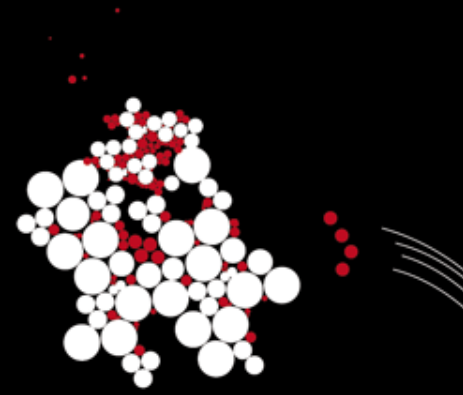


**Integrated planning dimension:  
Domains of control**

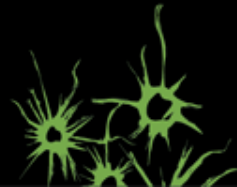


# Alignment of managerial areas





# Levels of planning integration





## Integrated Planning in Hospitals: A Review

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<sup>a</sup>*Center for Healthcare Operations Improvement & Research, University of Twente, Enschede, The Netherlands*

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<sup>c</sup>*Information Systems | Software & Digital Business group, Technical University of Darmstadt, Hochschulstr. 1, 64289 Darmstadt, Germany*

<sup>d</sup>*TUM Campus Straubing for Biotechnology and Sustainability, Weihenstephan-Triesdorf University of Applied Sciences, Am Essigberg 3, 94315 Straubing, Germany*

<sup>e</sup>*Department of Mathematics, School of Computation, Information and Technology, Technical University of Munich, Boltzmannstraße 3, 85748 Garching bei München, Germany*



# A taxonomy of *levels* of integrated resource planning

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## ***Level 1:***

Independent planning of resources, with constraints regarding other resources

## ***Level 2:***

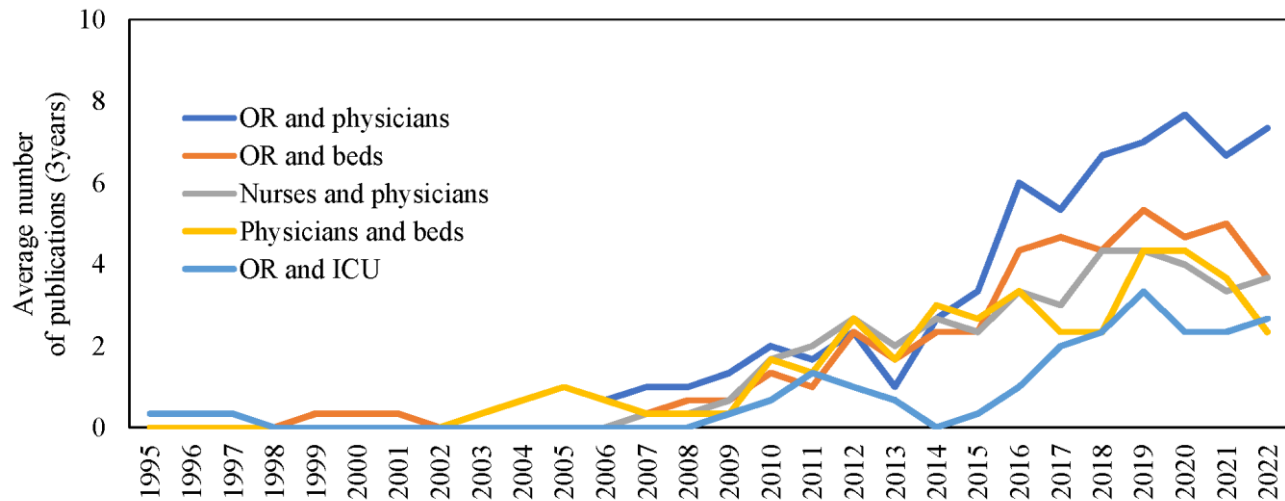
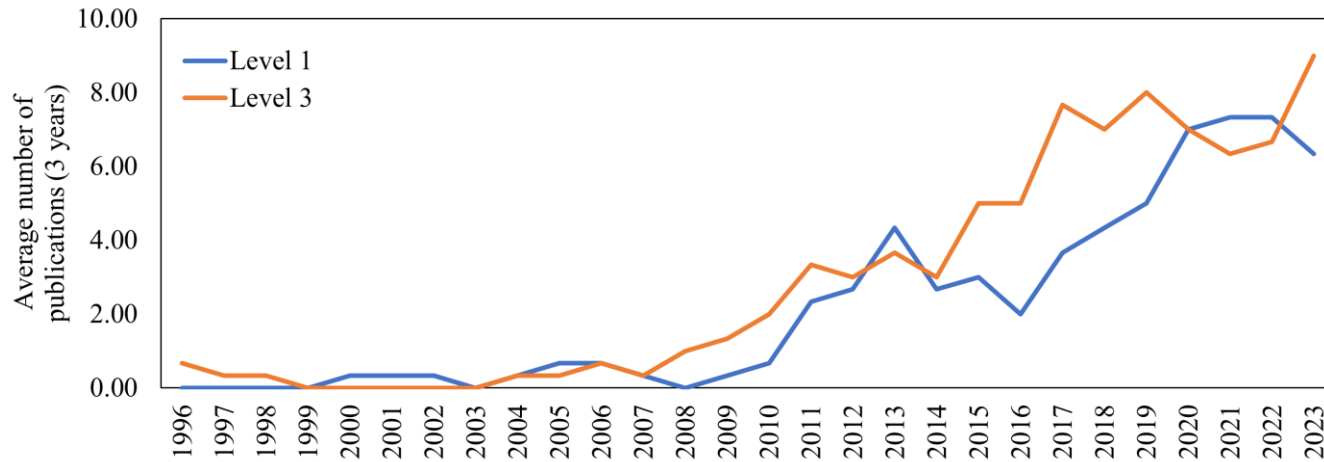
Sequential planning of resources, in a predefined order, taking the previous results as input

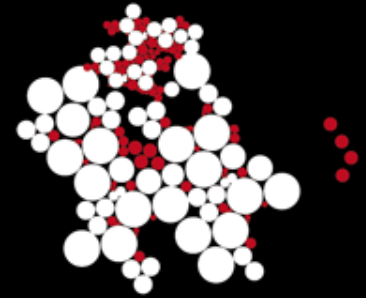
## ***Level 3:***

Completely integrated planning of resources

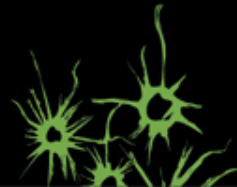


# Publications over time





# Transmural integrated planning





# Transmural integrated planning

*(between organizations)*

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- Patient transfer along care pathway
  - E.g. from hospital to aftercare to reduce bed blocking
- Patient allocation
  - E.g. regional allocation of covid patients to hospitals
- Pooling of capacity
  - E.g. nurses between home care & hospital



**“To pool or not to pool...”**

# CAPACITY SHARING IN NEONATAL CARE BETWEEN 9 CATCHMENT AREAS



# CAPACITY SHARING IN NEONATAL CARE

NO CAPACITY IN THE CATCHMENT AREA? A PATIENT IS TRANSPORTED TO ANOTHER LOCATION

---



# 440 NICU TRANSPORTS EVERY 6 MONTHS...



## A LITTLE FLEXIBILITY...

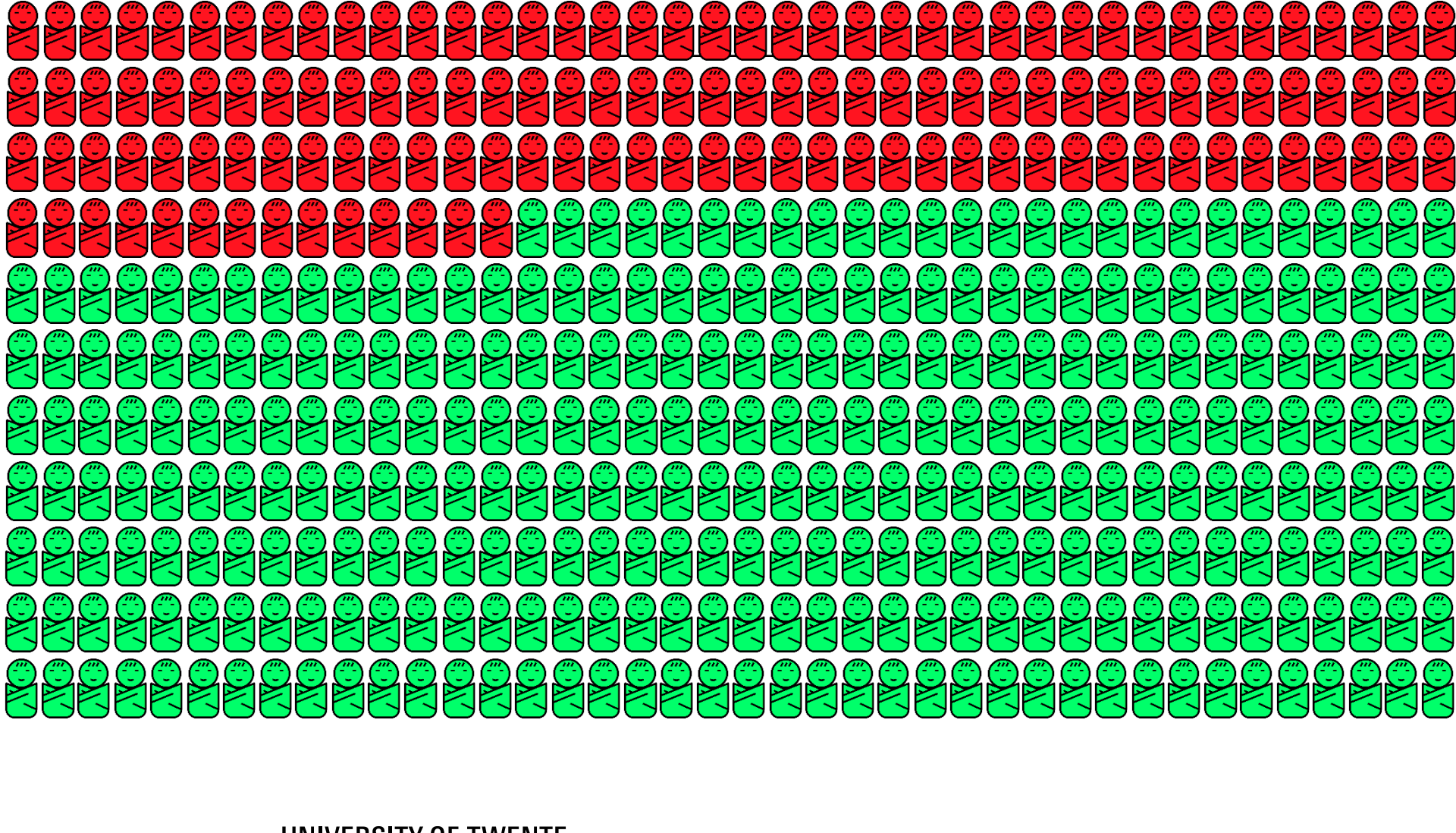
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**What if we move nurses  
instead of babies?!**

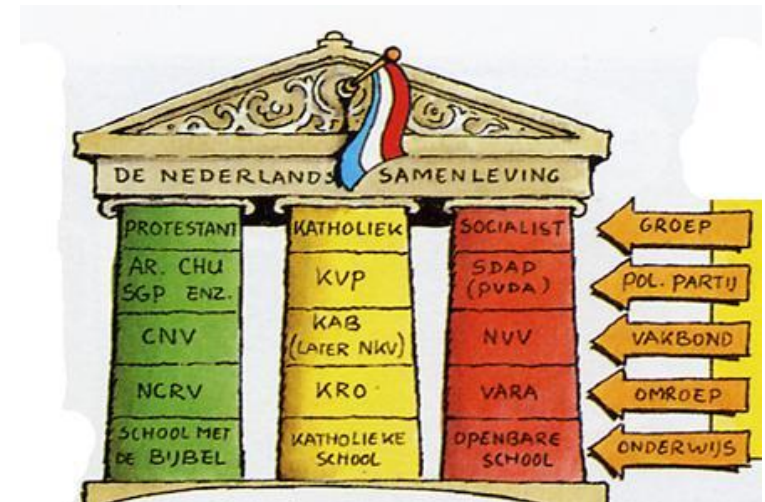
# 70% reduction when pooling 5 nurses per location

*“A little flexibility goes a long way”*



# Impact requires interdisciplinarity

- Science is siloed
- Implementation barriers:
  - ICT
  - Judicial
  - Financial
  - HRM
  - Leadership
  - Education
  - Organizational behavior
  - ...





## **TECHNOLOGY IN HEALTHCARE TRANSFORMATIONS**

We need to join  
forces to make  
effective, efficient,  
and sustainable  
transformations!



# CONCLUDING

## TAKE HOME MESSAGES

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**Integral perspective on the organization of care can increase all stakeholders' performance**

**A little flexibility goes a long way**

**We need to interdisciplinary work together to transform towards sustainable healthcare**

# We need to close the design cycle

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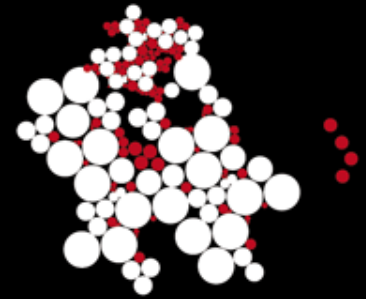


# ORAHS memories



UNIVERSITY OF TWENTE.

**Thank you for your attention!**



**Prof.dr.ir. Erwin W. Hans**

Professor Operations Management in Healthcare

E-mail: [e.w.hans@utwente.nl](mailto:e.w.hans@utwente.nl)

CHOIR: <http://www.utwente.nl/en/choir>

**CHOIR**

