

# Smart Campus Tools 2021

Gaining insights from universities and other organizations to support the back to campus movement following COVID-19

Lars Cazemier

24-06-2021

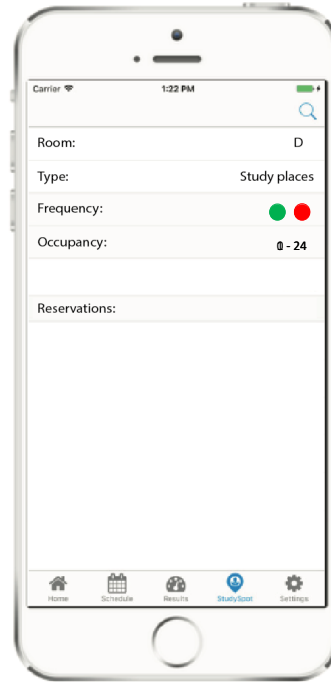
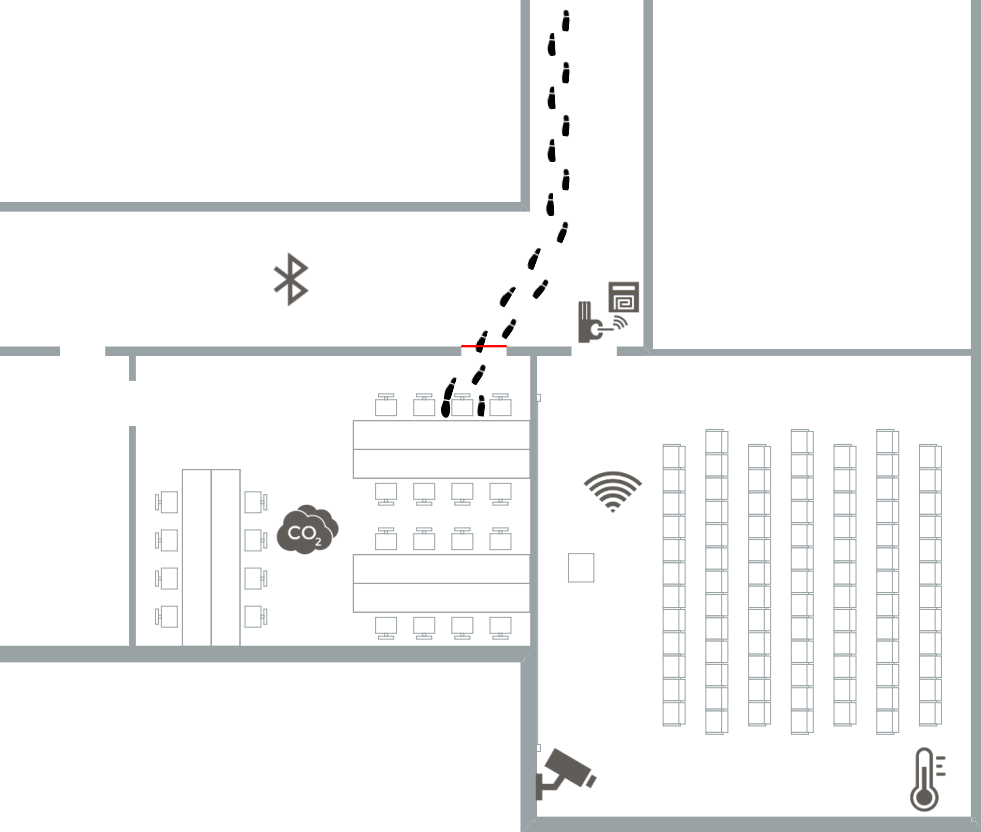


*“A smart campus tool is defined as a service or product which collects real-time information on space use to improve the space use on the current campus on the one hand, whilst supporting decision making on the future space use on the other hand”*

*(Valks, Arkesteijn & Den Heijer, 2018, p. 23)*



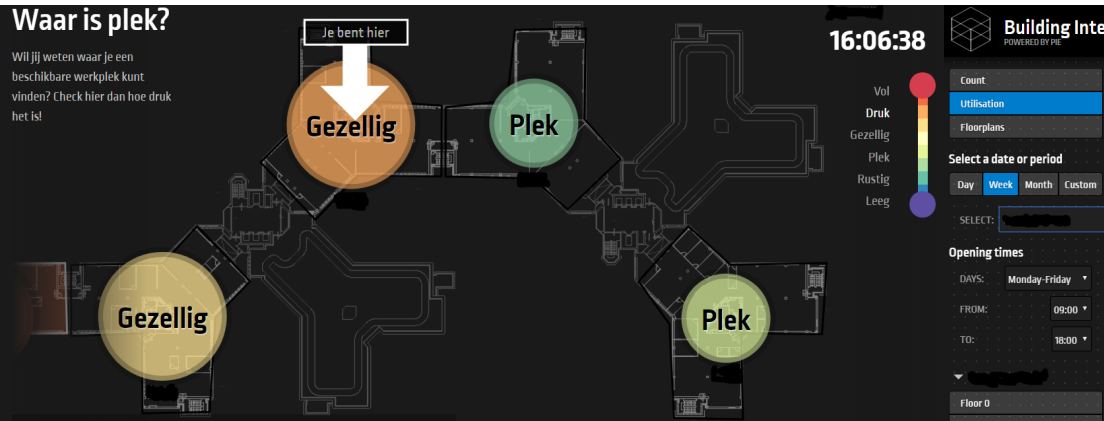




(Adapted from Valks, Arkesteijn & Den Heijer, 2018)

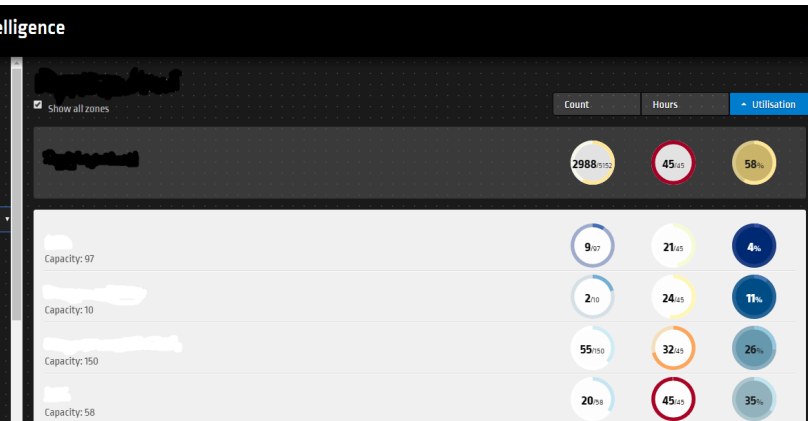
## Waar is plek?

Wil jij weten waar je een beschikbare werkplek kunt vinden? Check hier dan hoe druk het is!



(Valks et al., 2018)

User



Manager

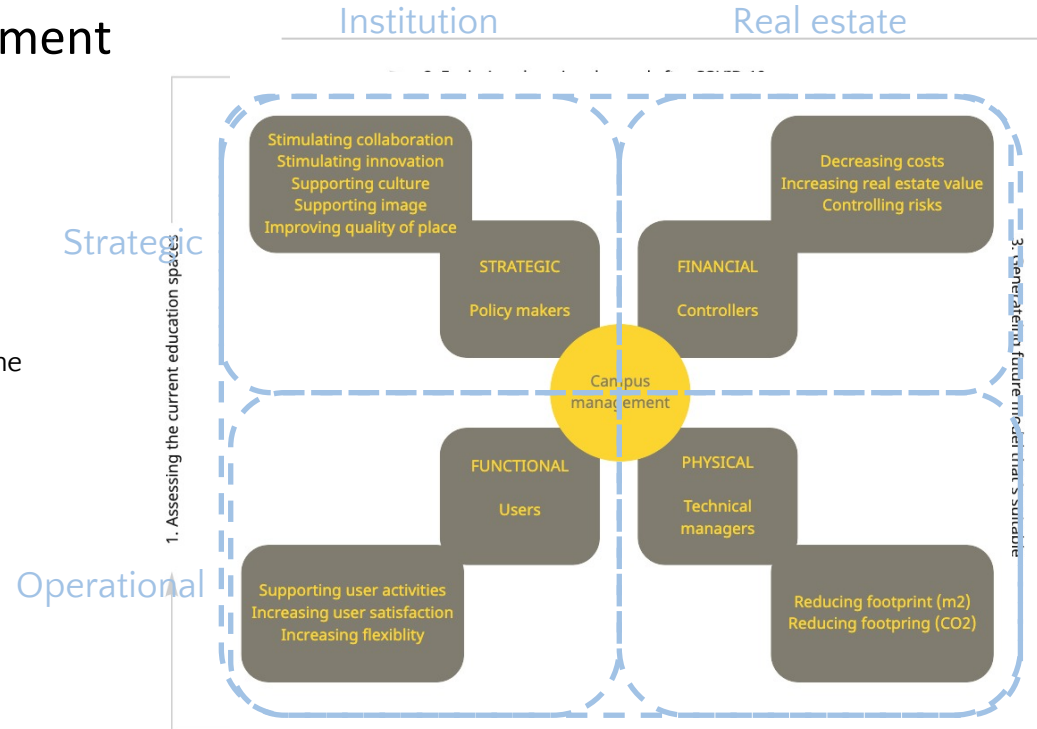


# Campus Management

## Campus management:

“the process of attuning the campus on the changing context of the university, the demands of the different stakeholder groups and contributing to the performance of the university”

(Valks, Arkesteijn, Den Heijer, 2018, p22).



(Derived from Den Heijer, 2008;2011)





January 30, 2020

**3.900.000.000.000<sup>1</sup>**

Users >90 countries



- People in lockdown<sup>1</sup>
- World population<sup>2</sup>

**1.600.000.000.000<sup>3</sup>**

Students



- Not affected by COVID-19
- Affected by COVID-19<sup>3</sup>



1. World Health Organization (2020)  
2. Worldometer - Real time wereld statistieken.  
Retrieved January 13, 2021, from <https://www.worldometers.info/nl/>  
3. (Sharma, 2020)

*Gaining insights from universities and other organizations to support the back to campus movement following COVID-19*





*What has changed in terms of type, demand, and use of Smart Campus Tools addressing space utilization at universities and other organizations due to COVID- 19 compared to the 'Smart Campus Tools 2.0' research?*





# Smart Campus Tools timeline

2016

14 Dutch universities  
5 other organizations

Smart campus tools



Smart campus tools 2.0  
An international comparison



2018

Update of data of Dutch universities  
International universities: 9 cases  
Other organizations: 9 cases



Leen Cuperus  
Madelon Theres Pijper  
Ph.  
1108221



2021

Update of data of 9 Dutch universities, 5 international universities, and 3 other organizations

01

What is campus management?



02

What are Smart Campus Tools, and what is the added value of Smart Campus Tools in a changing demand?



03

What effect does COVID-19 have on the campus?



04

What progress have Dutch universities, universities abroad, and other organizations realized on Smart (Campus) Tools addressing space utilization compared to previous research?



05

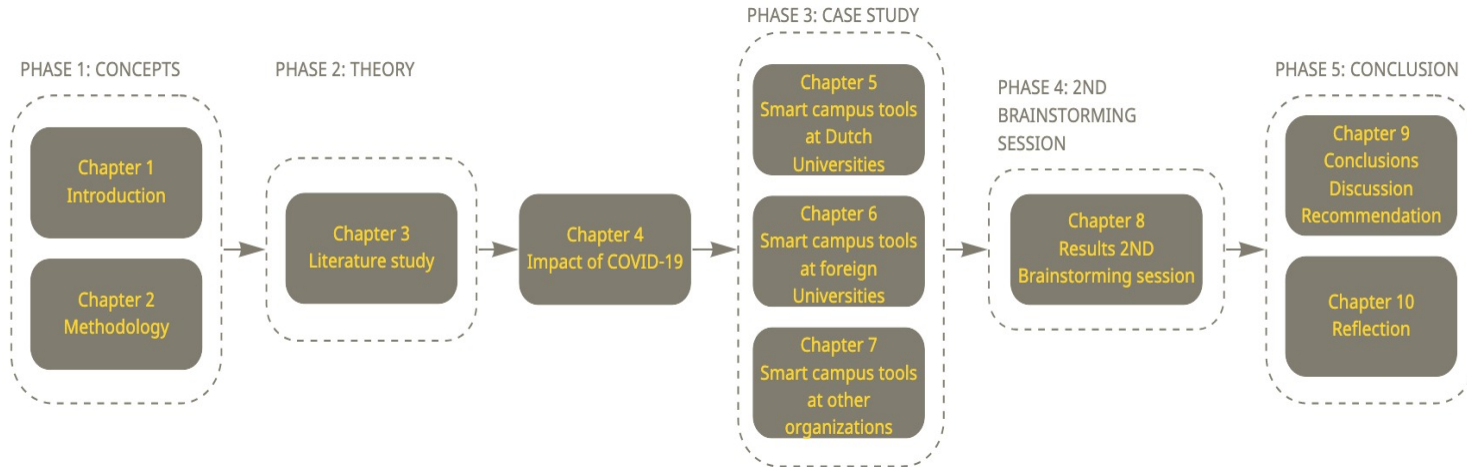
To what extent do these Smart (Campus) Tools meet the needs and use of the Dutch universities, universities abroad, and the other organizations after COVID-19?







# Methodology





# First brainstorming session





# First brainstorming session

## Aim

- Effect of COVID-19
- 9 propositions

## Participants

- 9 Dutch universities
- 1 Belgium university

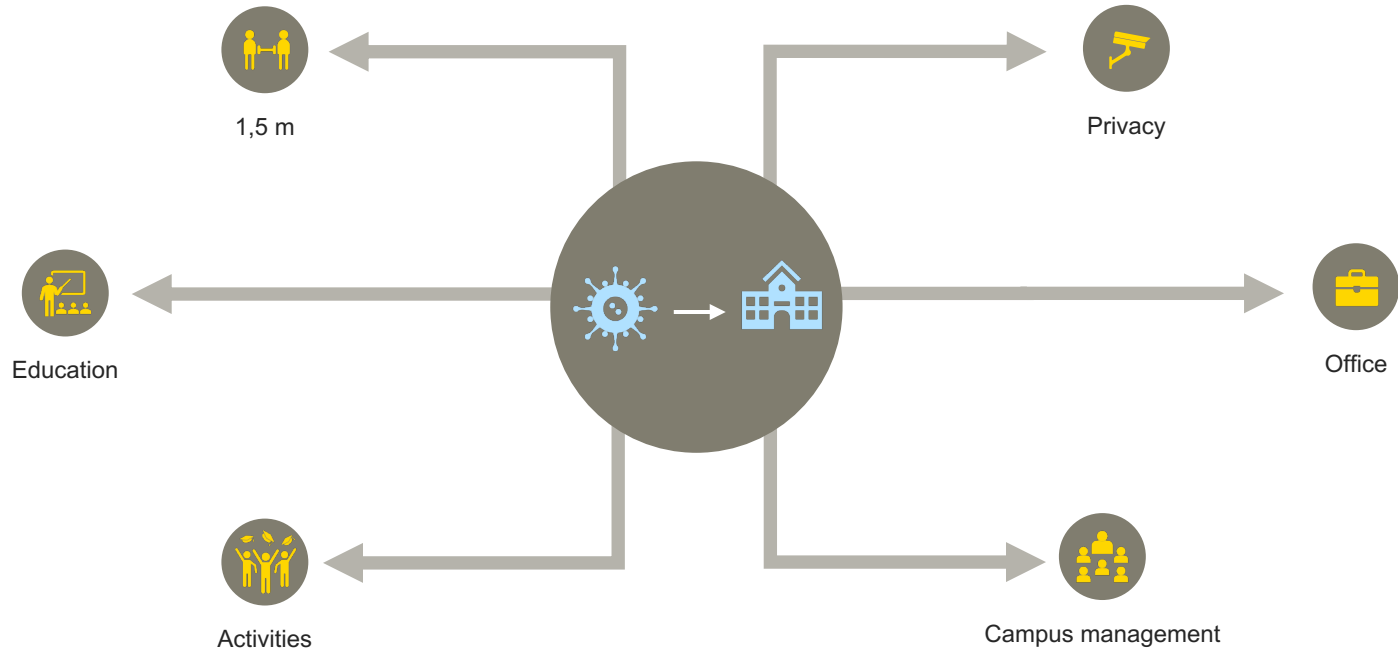
## Themes

- Short term changes
- Back-to-campus
- Long-term changes





# COVID-19 effects on campus





## Case study





## Interviewed parties



### Dutch universities



Universiteit Utrecht



UNIVERSITEIT VAN AMSTERDAM



UNIVERSITY OF TWENTE.

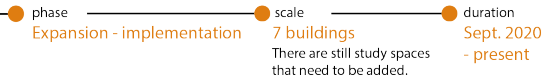


### Universities abroad



### Other organizations





**Project description**

The need to reserve study spaces came from COVID-19 with the need to understand which students are/were on campus and at what location. Due to COVID-19, there were limited places available and this was quickly entered into Planon as this tool was available. The library then purchased LibCAL for the workstations in that building. Facility Services took over that management and incorporated all the study places into LibCAL.

**Foreseen developments**

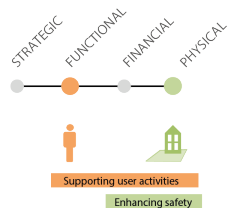
The foreseen developments are enabling employees to reserve workplaces. In addition, displaying the crowds per location on narrow casting or webview.

Manage Spaces & Equipment

ID	Locations	Access	Hours	Zones	Spaces	Seats	Equipment	Action
1022	Collaboration building (for students)	Admin-Only	Monday Hours	2 Zones	3 Spaces / 152 Seats	Disabled		
1027	Circle building (for students)	Admin-Only	Monday Hours	3 Zones	45 Spaces / 483 Seats	Disabled		
1025	Discovery Learning Center (for students)	Admin-Only	Monday Hours	7 Zones	2 Spaces / 27 Seats	Disabled		
1023	5 floor (for students)	Public	Monday Hours	2 Zones	17 Spaces / 440 Seats	Disabled		
1020	Multiplaces Learning Center (for students)	Admin-Only	Monday Hours	2 Zones	2 Spaces / 141 Seats	Disabled		
1026	1st floor (for students)	Public	Monday Hours	2 Zones	3 Spaces / 111 Seats	Disabled		
2081	Planon Point (for students)	Admin-Only	Monday Hours	1 Zone	7 Spaces / 281 Seats	Disabled		
2082	Planon Point (for students)	Admin-Only	Monday Hours	2 Zones	11 Spaces / 101 Seats	Disabled		
2081	Planon Point (for students)	Admin-Only	Monday Hours	2 Zones	9 Spaces / 111 Seats	Disabled		
2102	Multiplaces Learning Center	Admin-Only	Monday Hours	1 Zone	2 Spaces / 111 Seats	Disabled		

**Profile**

Why: Objective



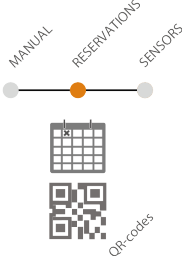
In addition to supporting users, in order to meet the "traceable for source and contact research" requirement, security is currently important.

What: Measurement

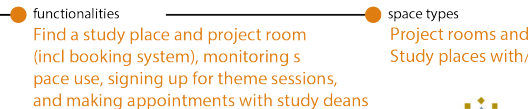


It is original frequency but because it is currently by COVID-19 about individual work places now also occupancy.

How: Measurement method



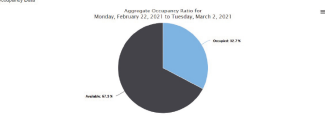
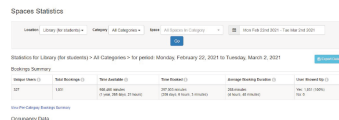
A booking must be confirmed by scanning the QR code on the table (and at the door in case of meeting room).



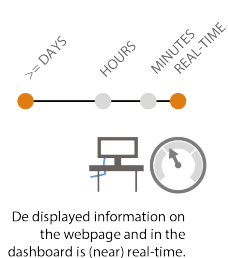
**User information**

Currently by COVID-19 a limited group of students can use it by reading in a specific group of "vulnerable students".

A student makes their own reservation and can cancel or confirm it. Upon arrival of this place, a QR code needs to be scanned. If this QR code is not scanned after 30 minutes, the reservation expires and this place can be reserved again.



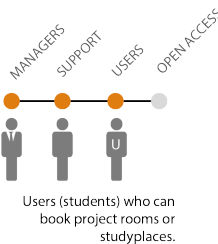
Actuality of the information



De displayed information on the webpage and in the dashboard is (near) real-time.

The data used in reporting goes from near real-time to as far back as possible.

Access levels



Users (students) who can book project rooms or studyplaces.

Managers for configuring the system and they can retrieve overviews of data from LibCal.



**Management information**  
The management can request an overview of the occupancy per location, per moment, and the popular places. In addition, the percentage of reservations that expire due to cancellation or no-show can be determined.

**Benefits**

LibCal provides insight who is in the buildings and it can be used for any source and contact research. This system also allowed a limited number of students to use study places during COVID-19.

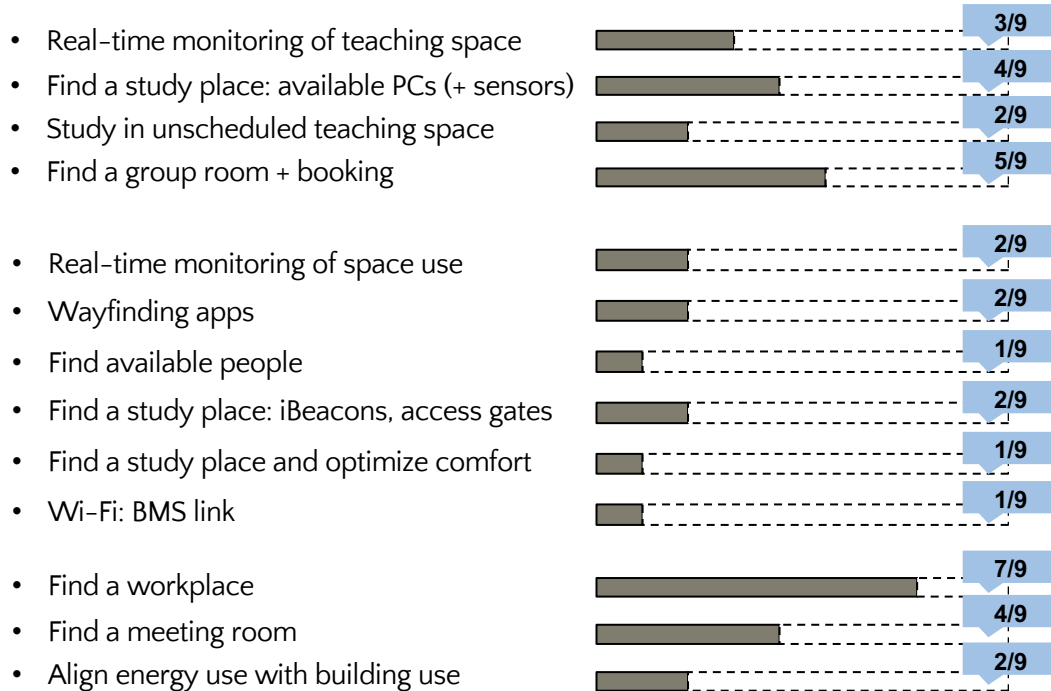
**Side notes**

It was found that the tool can be implemented with little effort and cost. However, it is an existing tool, which can mean that customization is difficult. The tool does what it is supposed to do, but could have a bit more appeal.





# Smart Campus Tools 2.0



**Dutch universities**



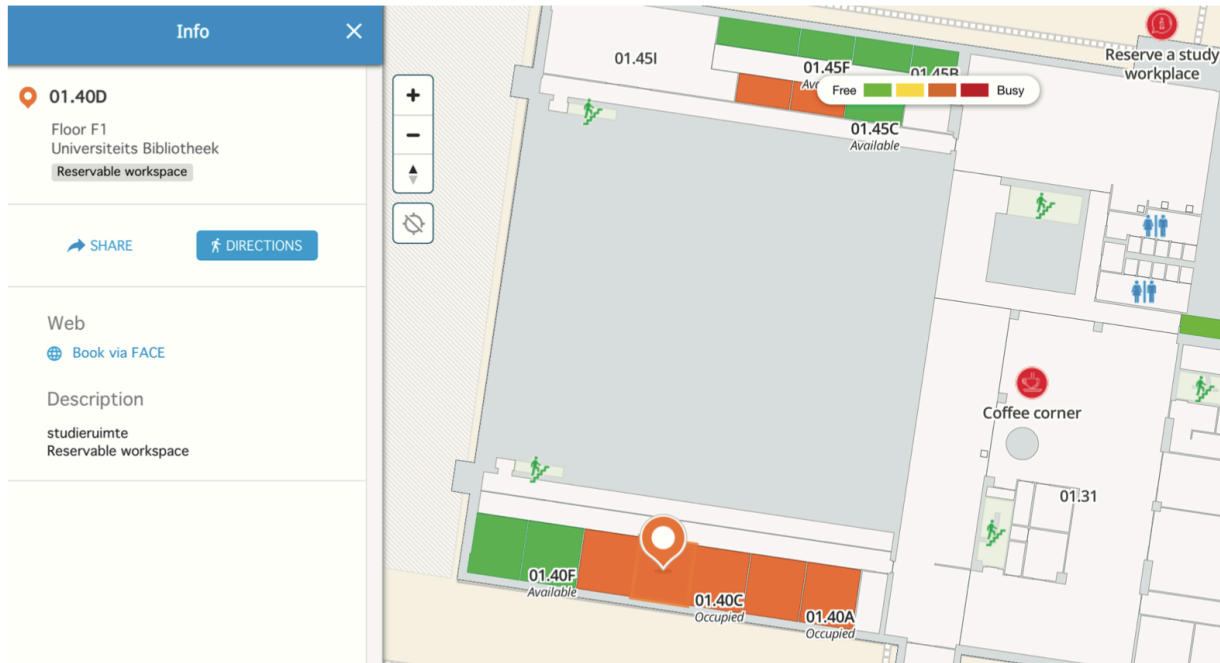
**Universities abroad**



**Other organizations**



# New implemented Smart Campus Tools



MazeMap, Planon & Swycs

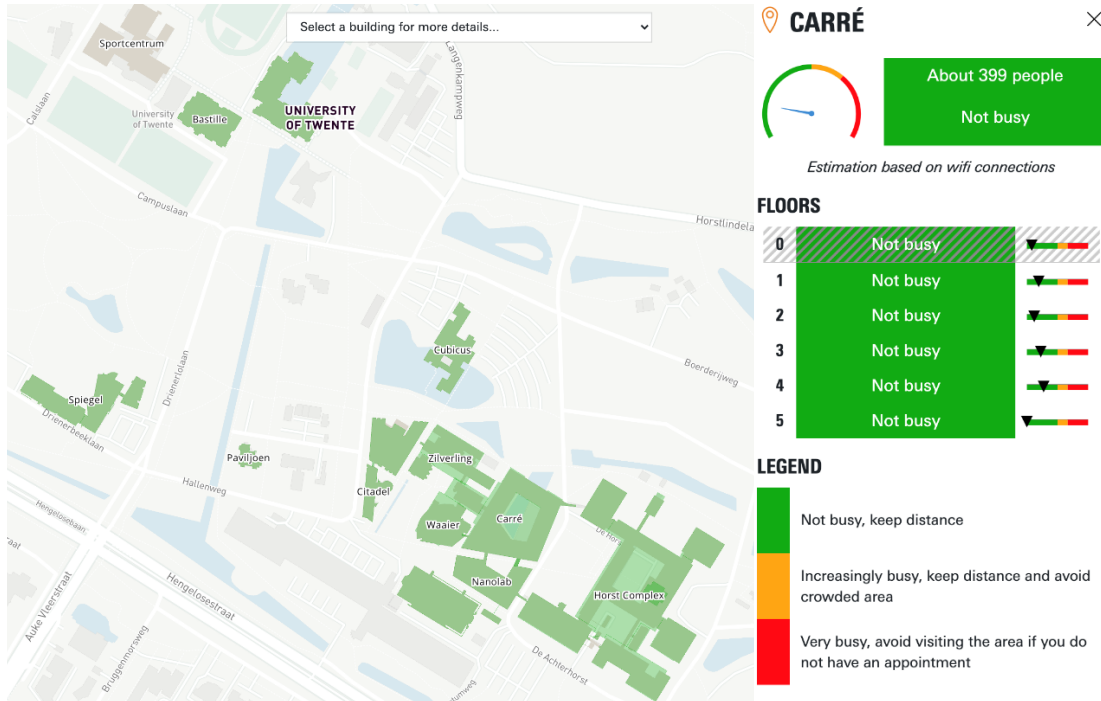
Radboud University







# New implemented Smart Campus Tools



Crowd Control  
MazeMap  
**UNIVERSITY OF TWENTE.**



# Existing Smart Campus Tools

**Spaces are in use**  
16%  
of the time they are available.

This is based on a calculation of 83,637 positive checks equivalent to 8,660 hours out of a potential 53,522 hours

**Spaces are booked an average of**  
44%  
of the available time

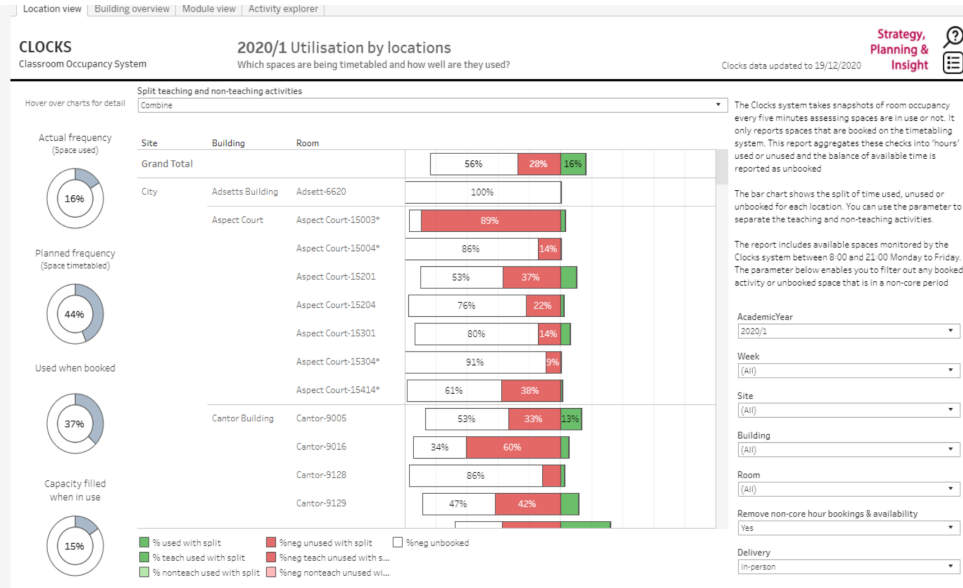
This is based on 23,399 booked hours out of a potential 53,522 hours

**Spaces are used**  
37%  
of the time when they're booked

This is based on 83,637 positive checks equivalent to 8,660 hours out of 23,399 booked hours

**When the booked space is in use**  
15%  
of the spaces capacity is occupied

This is calculated on the sum of people counted in each check divided by the capacity of those spaces in each check

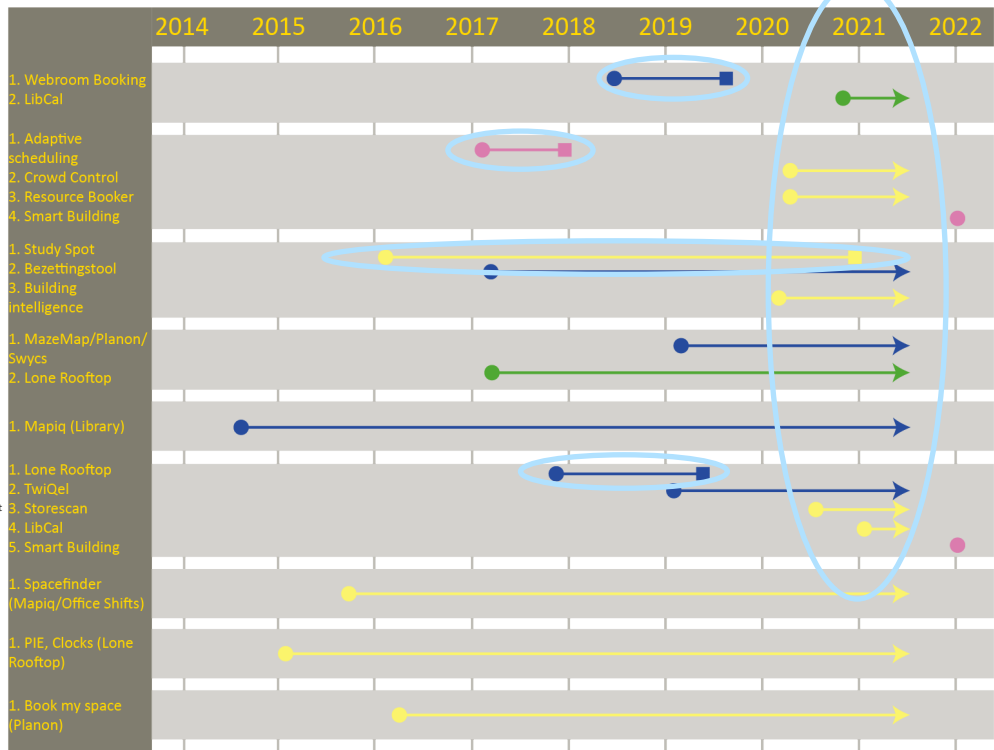


Dashboard in Tableau  
Data uit Clocks Lone Rooftop

**Sheffield  
Hallam  
University**



# Timeline

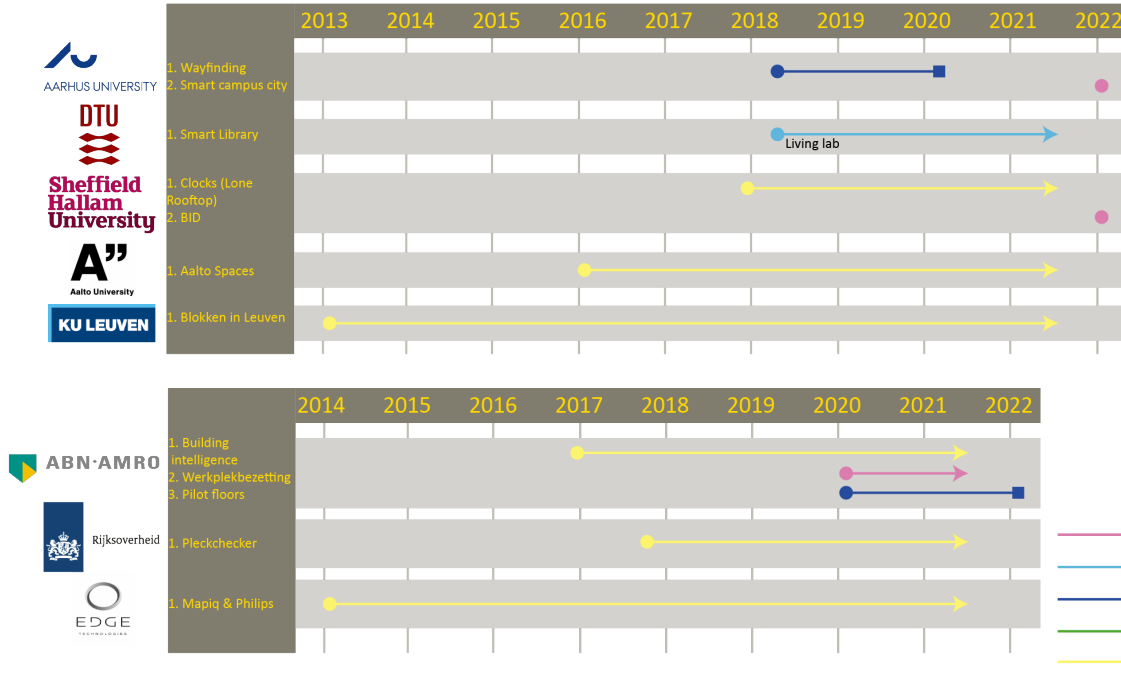


Dutch universities

- Research
- Product development
- Pilot
- Expansion
- Implementation



# Timeline



Universities abroad

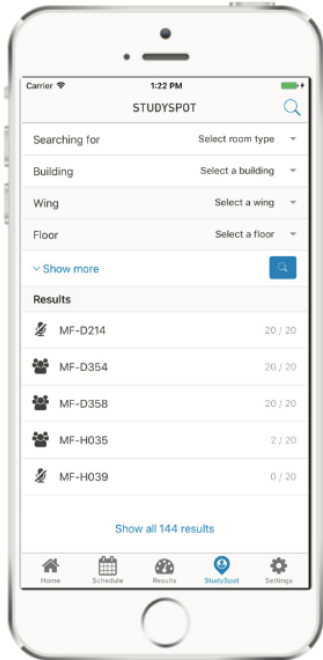


Other organisations

- Research
- Product development
- Pilot
- Expansion
- Implementation



# Reason for delay or termination of SCT projects



Study Spot



(Valks et al., 2018)

## Ravelijn

- Ravelijn 1501: empty  
Scheduled: 75
- Ravelijn 2231: 5  
Scheduled: 15
- Ravelijn 2237: 3  
Scheduled: empty
- Ravelijn 2334: 1  
Scheduled: empty
- Ravelijn 2336: 2  
Scheduled: 30
- Ravelijn 2501: empty  
Scheduled: empty
- Ravelijn 2502: 30  
Scheduled: 64
- Ravelijn 2503: empty  
Scheduled: empty
- Ravelijn 2504: 25  
Scheduled: 65
- Ravelijn 3231: 4  
Scheduled: 30

(Valks et al., 2018)

## Spiegel

- Spiegel 1: empty  
Scheduled: empty
- Spiegel 2: 15  
Scheduled: 185
- Spiegel 3: empty  
Scheduled: empty
- Spiegel 4: empty  
Scheduled: empty
- Spiegel 5: 19  
Scheduled: 96
- Spiegel 6: 14  
Scheduled: 55
- Spiegel 7: 2  
Scheduled: empty

## Waaier

- Waaier 1: 1  
Scheduled: empty
- Waaier 2: empty  
Scheduled: empty
- Waaier 3: 14  
Scheduled: 130
- Waaier 4: 13  
Scheduled: 130
- Carré 2A: empty  
Scheduled: empty
- Carré 2B: empty  
Scheduled: empty
- Carré 2C: 1  
Scheduled: empty

Research on adaptive scheduling  
UNIVERSITY OF TWENTE.

## Carré



# Reason for delay or termination of SCT projects

## Dutch universities



Knowledge shortage & collaboration between management and IT.



Different expectations of data or accuracy & collaboration between management and IT.

## Universities abroad



Stakeholder support has changed



Other expectations of data or accuracy



Change in demand, time to completion too long and collaboration between management and IT.

## Other organizations



# Comparison of foreseen developments 2017 - 2021

## Cases Dutch universities

- Active or completed
- Without succes



## Cases universities abroad

- Aarhus University case without succes
- DTU and KL cases with minimal progression
- Sheffield Hallam University case completed

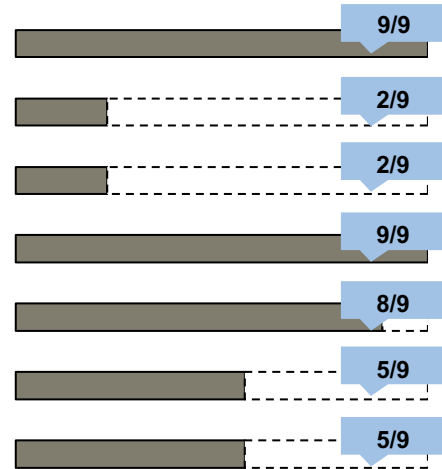
## Organizations

- ABN AMRO pilots frequency and occupancy (meetingrooms)
- Rijksoverheid research tools related to own regulations



## Development in comparison with 2017- 2018

- Expansion (buildings and m2) or *additions*
- *Crowd indicator for users*
- *Crowd indicator for management*
- *Monitoring/managing capacity*
- Use of sensors
- *Objective: Improving safety*
- New Smart Campus Tools

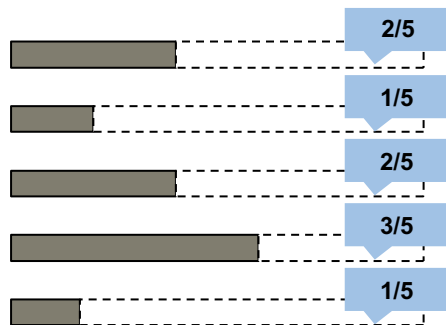






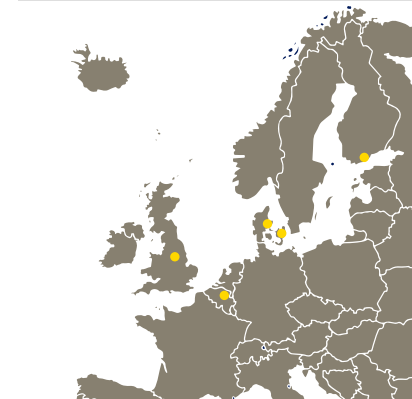
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- Expansion (buildings and m2) or additions
- *Crowd indicator for users*
- *Monitoring/managing capacity*
- *Objective: Improving safety*
- New Smart Campus Tools

ABN  
ABN & NLG  
ABN & NLG  
ABN & NLG  
ABN





# Reservation system

Universiteit stelt meer studieplekken open voor Leidse studenten, die vaak toch niet komen: 'de no-show is erg groot'



Terrasje bij de universiteitsbibliotheek aan de Witte Singel.

© Foto Hielco Kuipers

Erna Straatsma

17/09/2020 om 12:57

[https://www.leidschdagblad.nl/cnt/dmf20200917\\_29224877?utm\\_source=google&utm\\_medium=organic](https://www.leidschdagblad.nl/cnt/dmf20200917_29224877?utm_source=google&utm_medium=organic)



UU wil wat doen aan 'no-showers' die schaarse studieplekken bezet houden

GESCHREVEN DOOR  
CARMEN NELISSEN

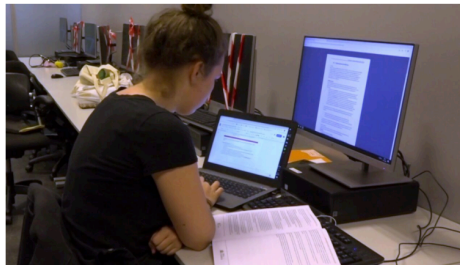
<https://www.rtvutrecht.nl/nieuws/2097998/uu-wil-wat-doen-aan-noshowers-die-schaarse-studieplekken-bezet-houden.html>

**'Het badhanddoekenprobleem is van alle tijden. Het keert nu in een andere vorm terug'**

<https://www.mareonline.nl/nieuws/het-badhanddoekenprobleem/>

**Helpt studenten komt niet opdagen bij reservering studieplekken**

De helft van het al beperkte aantal studieplekken op campus Woudestein blijft leeg. De oorzaak: studenten reserveren wel, maar komen niet.



Veel lege studieplekken in het Tinberggebouw.



Elmer Smaling 02-06-2020 leestijd: 1 minuut



<https://www.erasmusmagazine.nl/2020/06/02/helpt-studenten-komt-niet-opdagen-bij-reservering-studieplekken/>

ingang UB Binnenstad, foto DUB

**Studenten klagen over thuis studeren, maar gaan niet naar de bieb**

NIEUWS

Veel studenten die een werkplek reserveren in de Universiteitsbibliotheek, komen niet opdagen. Vanaf volgende week onderneemt de UB actie tegen het hoge percentage 'no show'. Dat werd tijd, vindt een geërgerde masterstudent. Maar volgens de bibliotheek is de belangstelling van studenten voor de studieplekken sowieso lauw.

[Read in English](#)

Door Xander Bronkhorst  
25/09/2020

<https://dub.uu.nl/nl/nieuws/studenten-klagen-over-thuis-studeren-maar-gaan-niet-naar-de-bieb>

UNIVERSITEIT VAN AMSTERDAM

Economie en Bedrijfskunde

Zoek...

Mededelingen Nieuws Agenda A-Z Contact

Studenten Economie en Bedrijfskunde

Weinig fysiek onderwijs, weinig beschikbare studieplekken, maar toch heel veel lege ruimtes – hoe zit dat?

9 oktober 2020

<https://www.uva.nl/shared-content/studentensites/fmg/fmg-gedeelde-content/nl/nieuws/2020/10/studieplekken.html>



# Reservation system



## Dutch universities

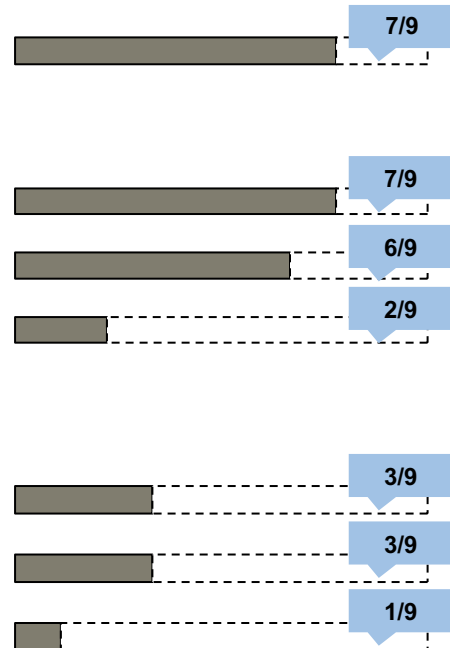
Use:

Spacetype:

- *Study places*
- Project rooms
- Workplaces

Measurement of no-show of study places:

- QR-codes
- Manual
- Real-time





# Reservation system



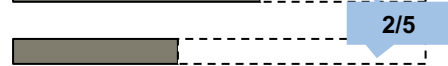
## Universities abroad

Use:



Space type:

- *Study places*
- Project rooms



Measurement of no-show of study places:

- Unknown



## Other organisations

- ABN: Attendance registration & check-in
- NLG: Intention



# New foreseen developments

NOS NIEUWS · ECONOMIE · TECH · DO 29 APRIL, 06:46 · AANGEPAST DO 29 APRIL, 11:24

## Privacywaakhond legt Enschede boete op van 600.000 euro vanwege wifitracking

Maandag 03 mei 2021 | Het laatste nieuws het eerst op NU.nl



Winkelend publiek in centrum van Enschede. ANP

<https://nos.nl/artikel/2378665-privacywaakhond-legt-enschede-boete-op-van-600-000-euro-vanwege-wifitracking>



30 april 2021 17:03

Laatste update: 2 dagen, 23 uur geleden

46 NUJij-reacties

**De gemeente Hengelo stopt tijdelijk met het meten van drukte in de binnenstad via wifitellingen, schrijft *Tubantia* vrijdag. Dat doet de gemeente nadat Enschede donderdag een boete van 600.000 euro kreeg opgelegd van de Autoriteit Persoonsgegevens (AP) voor het gebruik van wifitracking.**

<https://www.nu.nl/tech/6130785/hengelo-schakelt-wifitracking-in-binnenstad-uit-na-boete-voor-enschede.html>

## Den Bosch gecontroleerd uit de lockdown met crowd management dashboard

woensdag 28 april 2021



Den Bosch zet een 'digital twin' in voor een veilige versoepeling van de lockdown

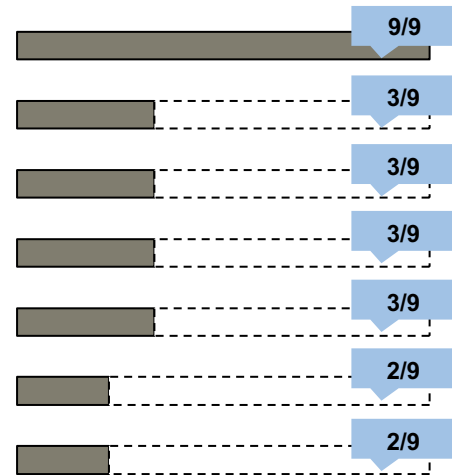
De gemeente 's-Hertogenbosch zet een nieuwe tool in om de toenemende bezoekersstromen als gevolg van de versoepelde coronamaatregelen in de komende maanden goed te managen. Hiervoor heeft de gemeente samen met het Bossche Argaleo een crowd management dashboard ontwikkeld. In een digitale kopie van de stad, een zogenaamde digital twin, wordt data slim gekoppeld en geanalyseerd om inzicht te geven in de bezoekersstromen in de binnenstad.

<https://www.mobiliteitsplatform.nl/nieuws/den-bosch-gecontroleerd-uit-de-lockdown-met-crowd-management-dashboard>



## New foreseen developments

- Expansion of the intended solution
- *Use of sensors for study places*
- *Reservation system for employees*
- Study in unscheduled teaching space
- *Analyze data from crowd indications*
- Adaptive scheduling
- Smart building / campus





# New foreseen developments

## Universities abroad

- Expansion of the intended solution
- Use of sensors (CO2)
- *Use of sensor to measure no-show*
- Use of radar sensors

## Other organizations

- *Reservation system*
- Smart building
- LoRa network



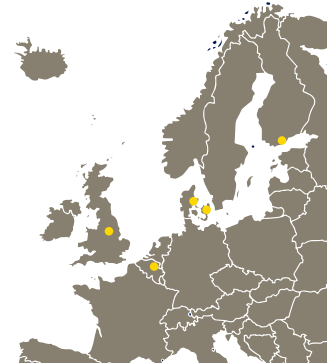
Aalto

DTU

ABN & NLG

ABN

NLG





# Progression

## Dutch universities

- 7 new cases of Smart Campus Tools
- 4 cases unsuccessful
- Not only dependent on scheduled or reservation data
- Reservation systems for individual study places

## Universities abroad

- 1 new case of Smart Campus Tools
- 1 case unsuccessful
- Few adjustments

## Other organizations

- 2 new cases of Smart tools
- No case unsuccessful
- Further development of the existing tools





# Smart Campus Tools meet the needs and use

## Needs and use

- Monitoring/managing capacity
- Possibility to study/work

“This tool was actually contingent on being able for the 'back to campus' at all”

(Translated quote from an interviewee)

## Improvements

- *Better utilizing received data*
- *Obtaining real-time information for study places*
- More effectively use of camera's
- Utilization of heatmaps
- *Reservation system*
- *Possible portfolio (m2) reduction*

DTU

SHU

ABN & NLG

NLG

## 2<sup>nd</sup> Brainstorming session





## 2<sup>nd</sup> Brainstorming session

### Aim

- 13 propositions and questions
- Notable concept results and pronouncements

### Participants

- 8 Dutch universities
- 1 Belgium university

### Themes

- Back-to-campus phase
- Reservation
- Smart campus tools in a hybrid environment
- Identify new needs for Smart campus tools
- Support for Smart campus tools

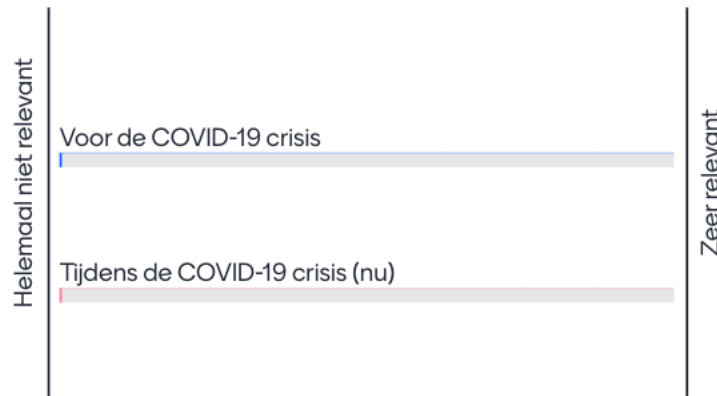


# Proposition

Go to [www.menti.com](https://www.menti.com) and use the code 3812 4083

## Hoe relevant zijn/waren Smart campus tools in de periode

Mentimeter



Results are hidden

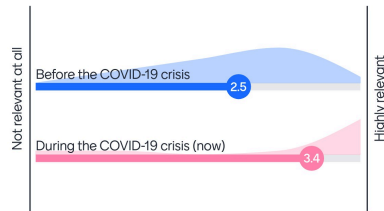
13



# Main findings

## Relevance

- Before/during COVID-19



## New Smart Campus Tool needs

- Supporting facilities processes and real estate policies
- Sustainability

## Reservation system

- No-show: 15 – 60 min
- Maximum reservable hours

## Support for Smart Campus Tools

- Different approaches
- Diligence in data collection, selection, and presentation

## Hybrid environment

- Study places:
- Education spaces:
- Workplaces:
- Meeting rooms

*Combination*

Reservation & combination

Combination

Combination





## Conclusion





# Main research question

“What has changed in terms of type, demand, and use of Smart campus tools addressing space utilization at universities and other organizations due to COVID-19 compared to the ‘Smart campus tools 2.0’ research?”

## Demand for

- Measuring to keep control
- Collaborations between facilities has increased
- Reservable individual study place
- Real-time information has increased

## Type

- Not only dependent on scheduled or reservation data
- Modified or new Smart Campus Tools to enhance safety

## Use

- Changing use case
- No-show





# Discussion

## Theory

- Added value
- Standalone reservation system
- Space use individual places & project rooms

## Practice

- Wi-Fi as sensor
- Privacy
- User's demand

## Limitations on research

- COVID-19
- Emperical part
- From the manager's perspective
- Qualitative research



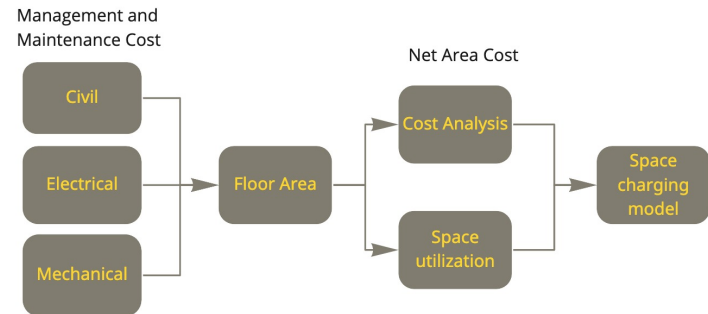
# Recommendations for

## Further research

- A repetitive research
- Quantitative study
- The other cases from the SCT2.0 research
- Detailed design study
- Empirical research

## Practice

- Monitor the process to identify the benefits
- Involve users to increase support
- Learn from the failures
- 'Het digitale handdoekje'



Space Charging Model at the University Tun Hussein Onn Malaysia (adopted from Ibrahim et al., 2011).



**Thank you!**

**Questions?**

3. What **effect** does **COVID-19** have on the **campus**?



4. *What progress have Dutch universities, universities abroad, and other organizations realized on Smart (Campus) Tools addressing space utilization compared to previous research?*



5. To *what extent* do these Smart (campus) tools **meet the needs and use** of the Dutch universities, universities abroad, and the other organizations **after** COVID-19?

