Campus of the future
smart tools and information to support strategic choices

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political conditions
ambitions university
agenda city
costs per m²
total costs of ownership
market value

user demands
health & safety
functionality
architecture - location
technical condition
energy-efficiency

Source: MazeMap, NTNU website

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professor Public Real Estate + Campus Research Team
Faculty of Architecture and the Built Environment
TU Delft’s Campus research team

Campus NL

- Campuses, cities & innovation

- Sustainable campus

- Decision support

- European campus

PhD circular BE / façade leasing

- PhD Smart tools, smart buildings

- Management information

- Guest researchers
  - Poland
  - Estonia
  - Norway
  - Finland
  - etc.

- 8 MSc graduate students 2018/2019

- University governance

- Circular business models

Our mission: to support campus decision-makers with new concepts, tools and information
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1. Vision on the campus of the future
2. Campus management challenges
3. Using big data & smart tools for management information
PHYSICAL definition of “campus”

the “campus” is defined as the (collection of) buildings and land, used for university or university-related functions
FUNCTIONAL definition of “campus”

- **ACADEMIC**
classrooms, library, offices, laboratories, lecture halls, ...

- **RESIDENTIAL**
student housing, hotels, ...

- **RELATED BUSINESS**
start-ups, incubators, industry, ...

- **RETAIL & LEISURE**
sports, restaurants, cafes, ...

- **INFRASTRUCTURE**
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Around the year 2000...
... literature and lectures about the future campus claimed:

“Bricks will be replaced by clicks”

“Campus managers will become ICT managers”

Campus strategy
“Clicks & Mortar”

(book: 21st century universities)
Content presentation based on

- Campus **NL - past, present & future**
  all 14 Dutch universities assessed in 1999, 2006 and 2016

- PhD thesis / dissertation
  “Managing the university campus” (2011)

- Case study research:

- **TU Delft’s CAMPUS RESEARCH TEAM**
May 13, 2008

Building TU Delft’s Faculty of Architecture totally destroyed: 3000 students + 1000 employees “homeless”
"Campus of the future" – 3 models – “solid, fluid, gas”

A = traditional

B = network

C = virtual
"Solid state"

Campus of the future: **model A – traditional university**
- strong hierarchy: top down
- fixed organisational structures
- exclusiveness, facilities per faculty
- individual territory / workplaces
- can we still afford this?

**Positive associations**
- Traditions, rituals
- Loyalty, belonging: "members only"
- “My own office…”
- Community feeling: academic family
- Ownership
- Home

**Negative associations**
- “You can not use ... my office, meeting room, lab…”
- Campus costs > 20%
- High footprint user
- Closed doors
- Old-fashioned
- Island culture
- Inflexible / empty...
University strategy = Resource-efficiency

- human resources: larger groups, fewer teachers
- energy resources: climate change, circular, no waste, energy-neutral
- financial resources: doing more with less
Campus of the future: 
**model B – network university**
- “campus is market place of knowledge”
- sharing the campus, “less territorial”,
- flexible, ‘univer-city’,

**Positive associations**
- Interdisciplinary
- Working in multiple teams, > 1 boss
- Serendipity
- Meeting place
- Open, more visible
- Flexible
- Campus costs lower

**Negative associations**
- Anonymous in large organisation
- Everyone’s workplace is nobody’s workplace
- Distractions, less privacy
- More mobility on campus
**Current + future campus = more dynamic**

1. More **temporary** staff – short contracts, visiting professors, summer schools
2. More and more **visitors**
3. Staff and students **travel more**

4. **International** students
5. **Research** (funding) has become more **unpredictable** (<2 year contracts)
6. Functional demands **change rapidly** (labs, ICT, legislation)
Positive associations
- Accessibility for long-distance students
- Very flexible
- Campus costs < 5%
- Very flexible
- Paperless
- Work-life balance
  own responsibility

Negative associations
- Lonely
- Social isolation
- Less loyalty to university
- Lower course completion rates
- Work-life balance
  hard to manage

Campus of the future:
model C – virtual university
work where you want, “third places”
“Online students can’t help being sociable” (April 9, 2014)

It was a revolution moving higher education from bricks to clicks... and now it's started to go back to bricks again.

Online university providers, which offered people the chance to study from home, are turning full circle by creating a network of learning centres where students can meet and study together.

Instead of demolishing the dusty old classrooms of academia, the online university revolution is responsible for opening some new ones.

Coursera, a major California-based provider of online courses, is creating an international network of "learning hubs", where students can follow these virtual courses in real-life, bricks and mortar settings.

They're scheduled and arranged online, with the only vital ingredients being a laptop, wi-fi and somewhere to talk.

“The typical completion rate for a MOOC is about 5% to 10%.

For MOOC students who attend learning hubs, the completion rates are above 30%”

Source: Coursera (7 mln students)
Campus models A-B-C as basis

A = traditional  
- exclusive & territorial -

B = network  
- interactive & shared -

C = virtual  
- place independent & individual -

trend in 2006 “from bricks to clicks”
trend in 2016, 10 years later

campus estate managers (2006+2016): “indeed, clicks... and we still need bricks, so EXTRA work”
Faculty of Architecture and the Built Environment

> 3,000 students, > 800 employees

#3 in 2018 QS Ranking Architecture schools
BK city (design 1917 > 100 years ago) is “new old” building of the
"the search for a quiet place to study"

"students queue up < 9am"

the library of Nanjing University in China
Mental health & safety
... high on the university’s agenda

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Source: MazeMap, NTNU website
“Work pressure too high”

Too many distractions at home: roommates, Netflix etc.

French universities ban smart phones from school

“Love-hate relationship with the smart phone”

Why “campus favorite study place”?

“push factors”
- Distractions at home:
  - room mates
  - social life, hobbies
  - Netflix
- More pressure on students:
  - higher tuition fees
  - stricter deadlines, rules
  - risk of burn-out

“pull factors”
- Quality of campus:
  - better facilities, network, ICT applications
- Other students
  - more group work
  - group pressure to study
  - friendship and love (!)

Students:
“Protect us from working day & night”
“We need regular working hours and deadlines”
”We need to work on campus to be disciplined and focused”
Campus of the future: study space

- Studying at your own faculty library
- Learning centres (to share) on campus
- Public library (example: NY), at coffee bars, at home etc.
Campus of the future: lectures

Lectures without distractions (= laptops & smart phones)

Technology-supported lectures

MOOCs: Massive Open Online Courses
Campus of the future: workplace

- Individual territory 2.0 (quiet) cellular office
- Activity-based workplaces to share
- Workplaces off-campus like home
Campus of the future: meetings

Old-school meetings (without technology)

Technology-supported meetings

Virtual meetings
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NETWORK with the following partners from PRACTICE

UK
166 HEIs
22 million m2
700 professionals

THE NETHERLANDS
14 HEIs
5,1 million m2

EUROPE
2400 HEIs
170 million m2

NORWAY
40 HEIs
2,9 million m2

FINLAND
10 HEIs
1,1 million m2

SWEDEN
51 centres of education
3,2 million m2

CZECH REPUBLIC
26 HEIs
1,6 million m2

+ 18 academic partners

source: website data
2400 HEIs / universities in Europe need management information to make ‘the right’ decisions

- political conditions
- ambitions university
- agenda city
- costs per m2
- total costs of ownership
- market value
- architecture - location
- technical condition
- energy-efficiency

Source: MazeMap, NTNU website
The European Campus Heritage & Challenges (2014)

The university Campus is an asset for Europe’s knowledge economy:
• quality of place,
• cultural heritage buildings,
• attractive universities

The university campus is a (potential) problem for Europe’s knowledge economy:
• bad technical state
• inefficient use of space
• costly maintenance

Managing the campus as strategic resource requires:
• More information on all perspectives
• More references to support decisions

866 universities / 24 member states / 9 indicators
The European Campus (2019)
Management & Information

14 universities of technology / 9 countries / 29 indicators
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We asked campus managers in 2015... urgencies?

“claiming space and not using it”
“in top 10 holiday frustrations”
Reality campus: underutilized, often empty
Perception users: booked, full
Big data about real-time use of space
... “the key to better campus management”

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Source: MazeMap, NTNU website
“The schedule often provides FAKE news”

Start of a PhD study > 2016

- Bart Valks
- Supervised by Campus Research Team
- Supported by graduate students

Collecting big data about campus use, based on positioning of user devices

(image: Rob Braggaar, 2017/2018)

To connect and support campus users
Campus of the Future – collecting big data

Source: TU Delft research on TU Delft campus - searching for use patterns, based on REAL-TIME DATA
GPS-Tracking
Using Eduroam/WiFi

GPS-Navigation
Find a quiet study place

Smart campus tools
based on REAL use
(not on scheduled use)
Smart campus tools 2.0 format

Project description
TU Delft wants to organize the space use on campus as effectively and efficiently as possible. A number of proof of concepts have been done to experiment with different sensor technologies, with which the frequency and occupancy of education spaces and study places could be measured. One of those was with Lone Rooftop.

Foresen developments
Based on the proof of concepts it was concluded that Wi-Fi is suitable for education spaces, but limited when it comes to study places. Based on these conclusions the options are being researched to apply Wi-Fi on a larger scale.

User information (scheduler)
The user - in this application the scheduler - can make a report for the education spaces with in it all the scheduled activities and the space use of each activity. Per activity the amount of users, the amount of expected and enrolled users, and the capacity of the reserved space are compared.

In the reporting tool of Clocks activities and courses can also be sorted on their performance, i.e. high amount of no-showed or low occupancy.

Management information
In PIE the campus manager can select two display options: floor plans and reports. In floor plans a dashboard is displayed giving the actual situation in the building. Per zone the amount of users is shown. The campus manager can also view historical data in the dashboard, or the development during the day.

In the reports function the user can display the use of a zone, a floor or a building during the day or the week. In the reports function the desired display can easily be achieved - although the data cannot be exported.

Profile
Why: Objectives
Reducing energy
Reducing costs

Measurement
Frequency | Occupancy | Safety

Access levels
Open access
Manager
Support

The information displayed in floor plans and reports is (near) real-time.

The frequency and occupancy per activity is processed after the activity in Clocks.

De PIE module is available for specific users via a portal.

In the proof of concept it turned out that the occupancy data for a large part of the building was not reliable. This seemed to be caused by the decisions made in the network infrastructure of TU Delft (capacity network) - although the density of access points is high the users are not positioned correctly because they connect to the access point that delivers the highest speed (MB/s) and not the closest access point. Also the building itself, the construction of the building and its design - the large atrium with multiple floors adjacent to the atrium - seems to contribute to the reduced accuracy.

In the Education spaces the occupancy measurement are quite accurate. An explanation for this is that in the placement of access points it was assumed that large amounts of users would congregate in the education spaces, which means that users can be localized accurately in those locations.
Cases

Did you know?
In February, 22% of scheduled meetings in building 43 were abandoned.

If you are a meeting organizer, take a moment and double check your calendar to ensure that recurring meetings you own are still valid. If not, please cancel them to free up resources.

51
233

Spacefinder
1 Smart tools to find available study places

- Cause is a perceived lack of study places on campus by students or desire of library to improve its service

- There is a shortage of available campus management information for study places. How well are study places used?

- Solution contains:
  - Real-time availability
  - (Booking of project spaces)
  - (Location of study places)
  - (Properties of study places)
2 Smart tools to optimise teaching space use

• Cause is a wish to further optimise frequency and occupancy rates

• Possibility to monitor and adjust based on no-show behaviour and expected student attendance

• Solution is measurement of space use via Wi-Fi; in some cases intended via infrared
3 Smart tools to share classrooms for studying

• Cause is a perceived lack of study places by students or wish of library to improve its services

• Solution is the use of ~25% initial vacancy in classrooms

• Solutions have multiple components – also booking project rooms, finding study places with PCs
4 Finding free (office) workplaces

- Cause is a transition to shared workplace concepts, lower amount of workplaces per FTE

- Employees can find a workplace in a building or search between multiple locations

- Alternative measurement methods: Wi-Fi, docking stations, desktop PCs
5 Optimising the use of meeting rooms

• Cause is a shortage of meeting rooms, and many unused meetings due to high employee turnover rate

• Solutions use infrared sensors and videoconferencing facilities
6 Aligning building use and energy use

- Cause is the wish to avoid waste of energy on vacant buildings and spaces (combined with other demands)

- Cases contain multiple sensors and functionalities.
  - Possibility to adjust temperature and light to preferences
  - Reserving workplaces (check-in)
  - Find your colleague, wayfinding etc.
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“Bipolar campus strategy”
reinventing the past + supporting the future with smart tools

“Do not disturb”
“Place to meet”
“Off the radar”
“Interconnected”

Solitude
Silence
Offline

Community
Buzz
Online
Yes, we can afford the campus

- if we are prepared to share more space and use smart tools to be more resource-efficient
Managing the university campus

Our blog

- for more information…
- this PPT under DOWNLOADS
- books under SMART TOOLS and PUBLICATIONS

Thank you for your attention!

Google:
- Alexandra
- TU Delft
- Campus

Writing a new book... off-campus

by Alexandra den Heijer

In the past months I have been spending less time on social media and increasingly more time offline. I noticed that I actually seem to practice what I preach (…): moving somewhat back from virtual to traditional. Not only concerning the working environment, but also with respect to traditional working hours. Nonetheless, I still make exceptions. Otherwise I would not write and publish this blog post late at night...