



AI enhancing knowledge exchange about university buildings

■ NIEUWS

Trump kondigt grootschalig samenwerkingsverband aan voor AI-infrastructuur

Kunstmatige intelligentie Er zal volgens Trump de komende vier jaar minstens 500 miljard dollar geïnvesteerd worden in het project van initiatiefnemers Oracle, Softbank en OpenAI.

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NOS Nieuws • Vandaag, 01:39

Techbedrijven investeren miljarden in nieuw AI-initiatief in VS

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Minister Beljaarts wil AI-centrum in Nederland bouwen: 'Niet afhankelijk zijn van andere landen'

21-01-2025 06:30 | Binnenland | Auteur: **Annefleur van Wanroij**

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PROPERTYNL

Voorop in vastgoed

Van black box naar transparantie: AI deelt een mokerslag uit

Minister Beljaarts wil AI-centrum in Nederland bouwen: 'Niet afhankelijk zijn van andere landen'

1



Research
approach

2



Theoretical
research

3



Empirical
research

4



Discussion &
conclusion

5



Limitations &
Recommendations

Problem.



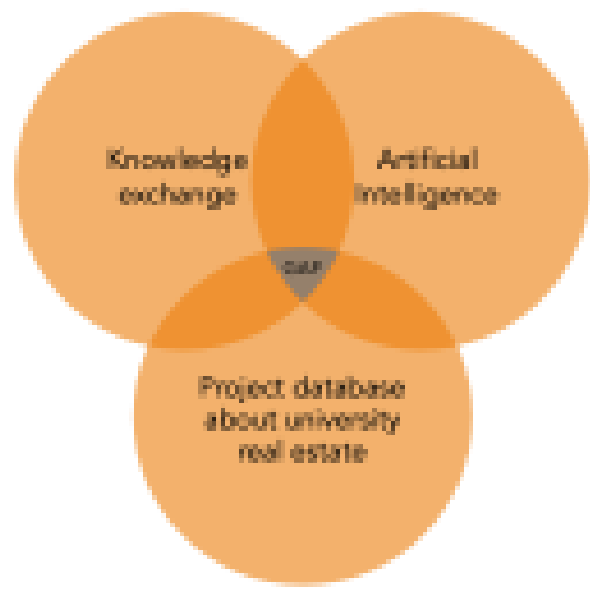
Problem.



Problem.

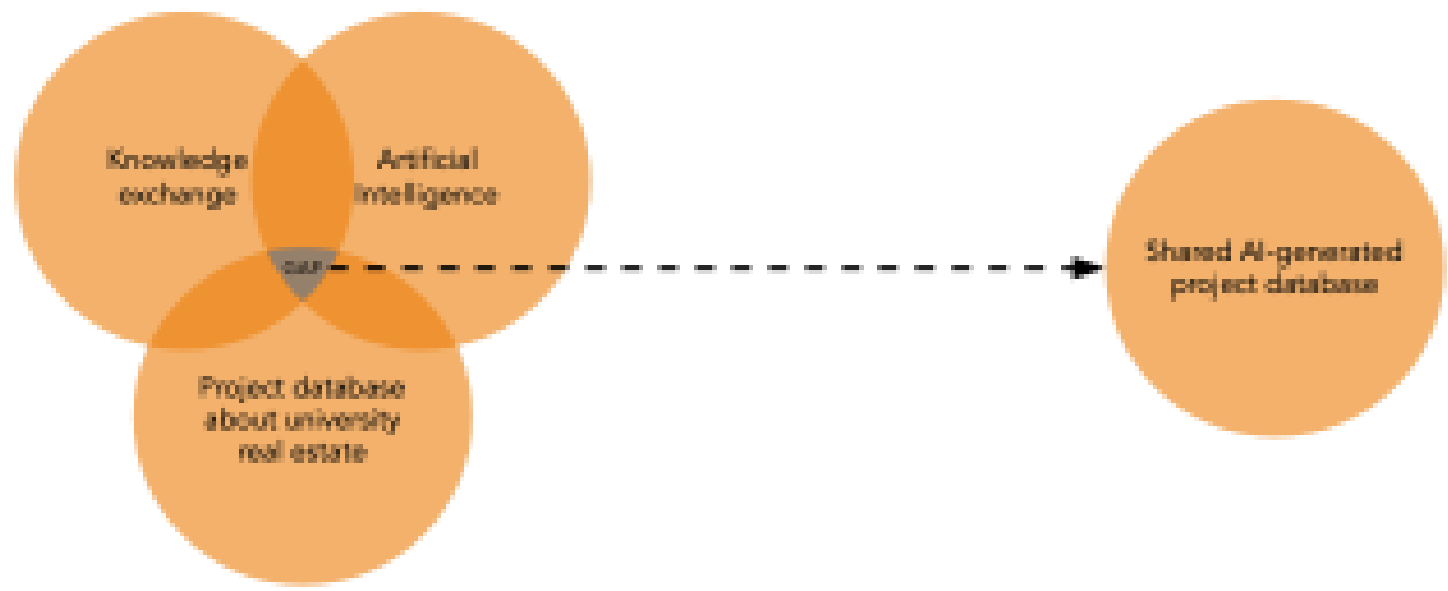


Problem.



(own figure)

Problem.



(own figure)

Research question.

*“How can **Artificial Intelligence (AI)** be utilized to enhance knowledge exchange about university real estate buildings?”*

Enhancing the exchange of knowledge between Dutch universities, by developing an AI-generated project database about university real estate buildings. For campus managers to easily and quickly access and exchange knowledge

Sub question.

Sub question.

1. What are the knowledge exchange barriers and drivers?

Sub question.

1. What are the knowledge exchange barriers and drivers?
2. How can Artificial Intelligence (AI) facilitate knowledge exchange?

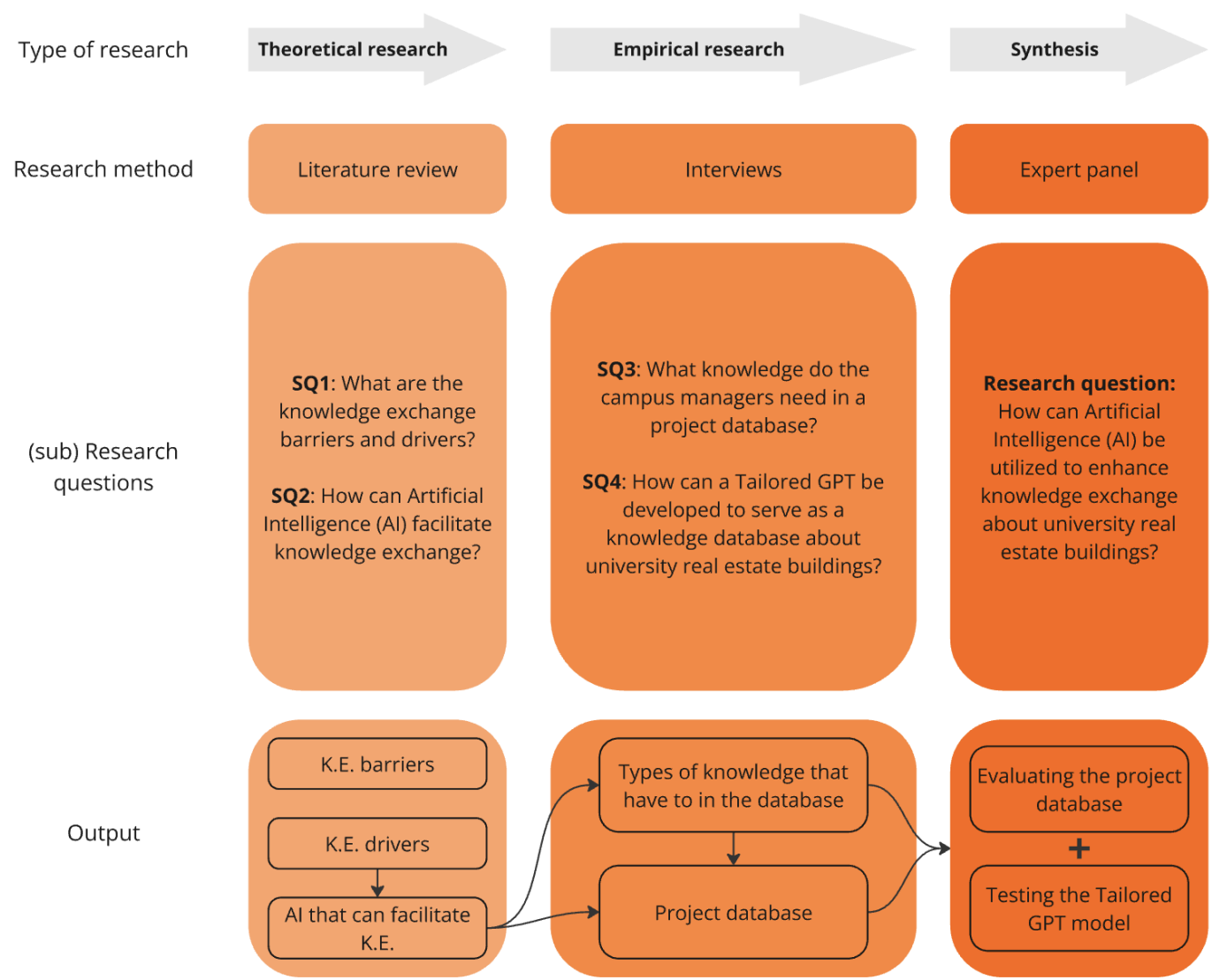
Sub question.

1. What are the knowledge exchange barriers and drivers?
2. How can Artificial Intelligence (AI) facilitate knowledge exchange?
3. What knowledge do the universities need in a project database?

Sub question.

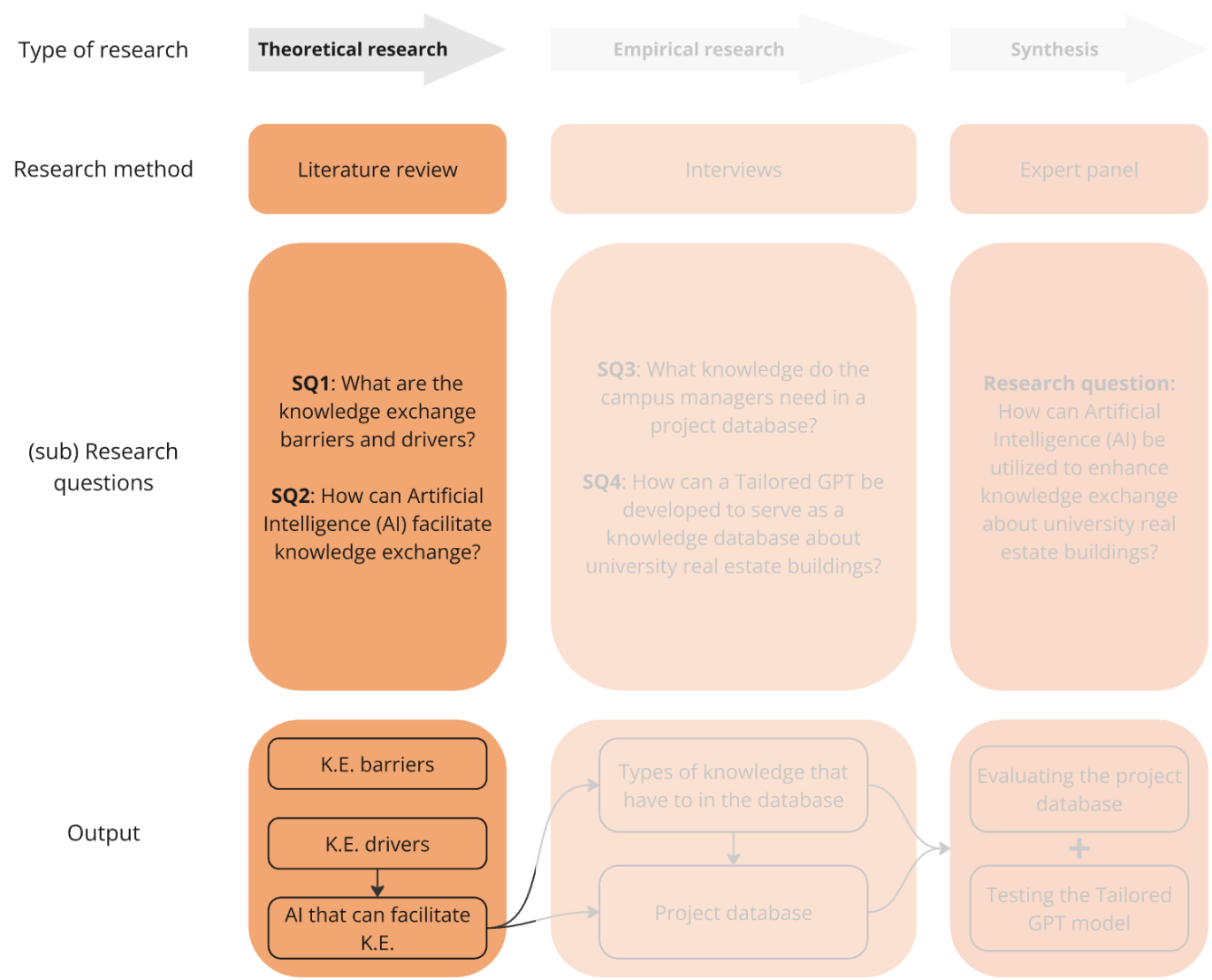
1. What are the knowledge exchange barriers and drivers?
2. How can Artificial Intelligence (AI) facilitate knowledge exchange?
3. What knowledge do the universities need in a project database?
4. How can a Tailored GPT be developed to serve as a knowledge database about university real estate buildings?

Methodology.



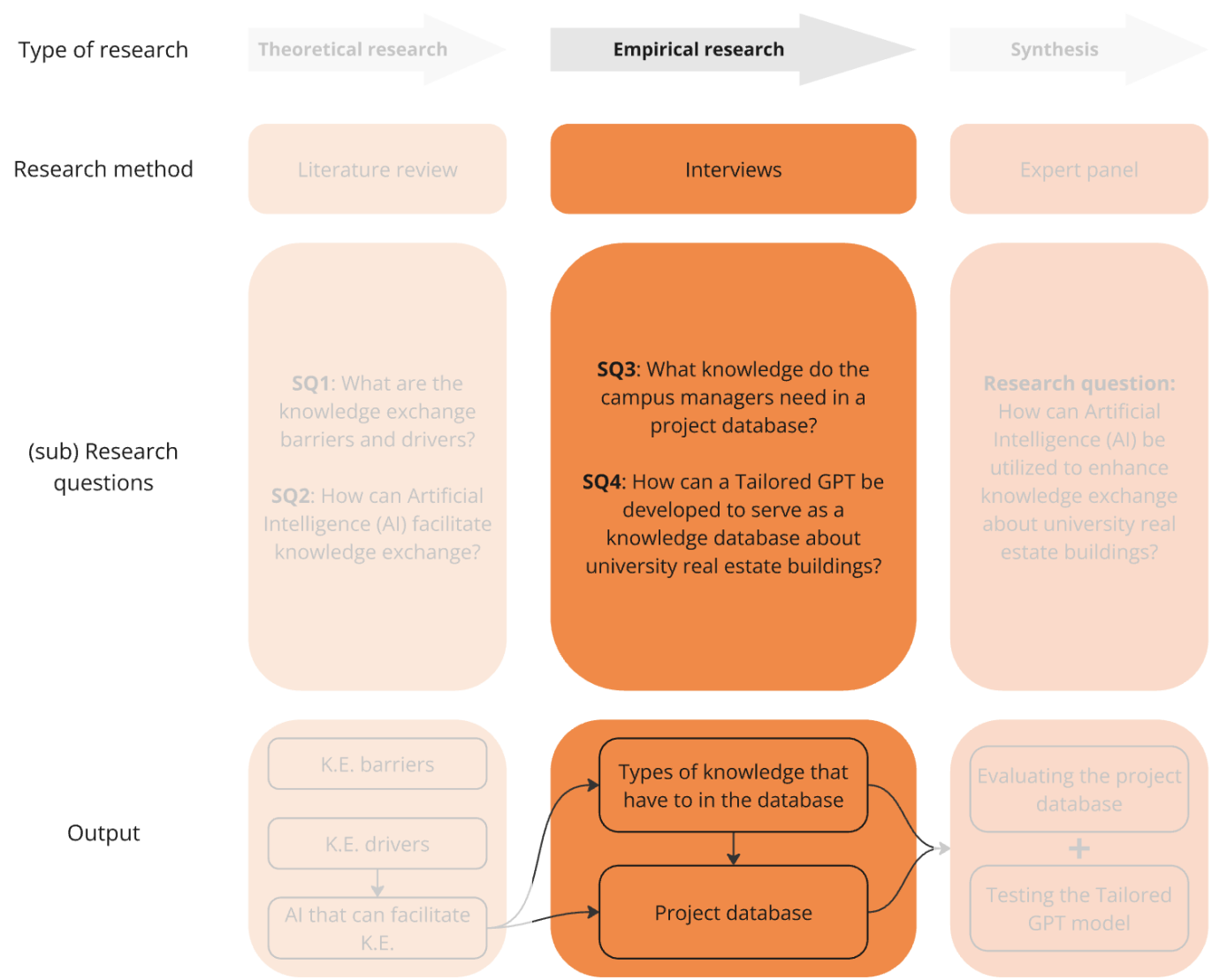
(own figure)

Methodology.



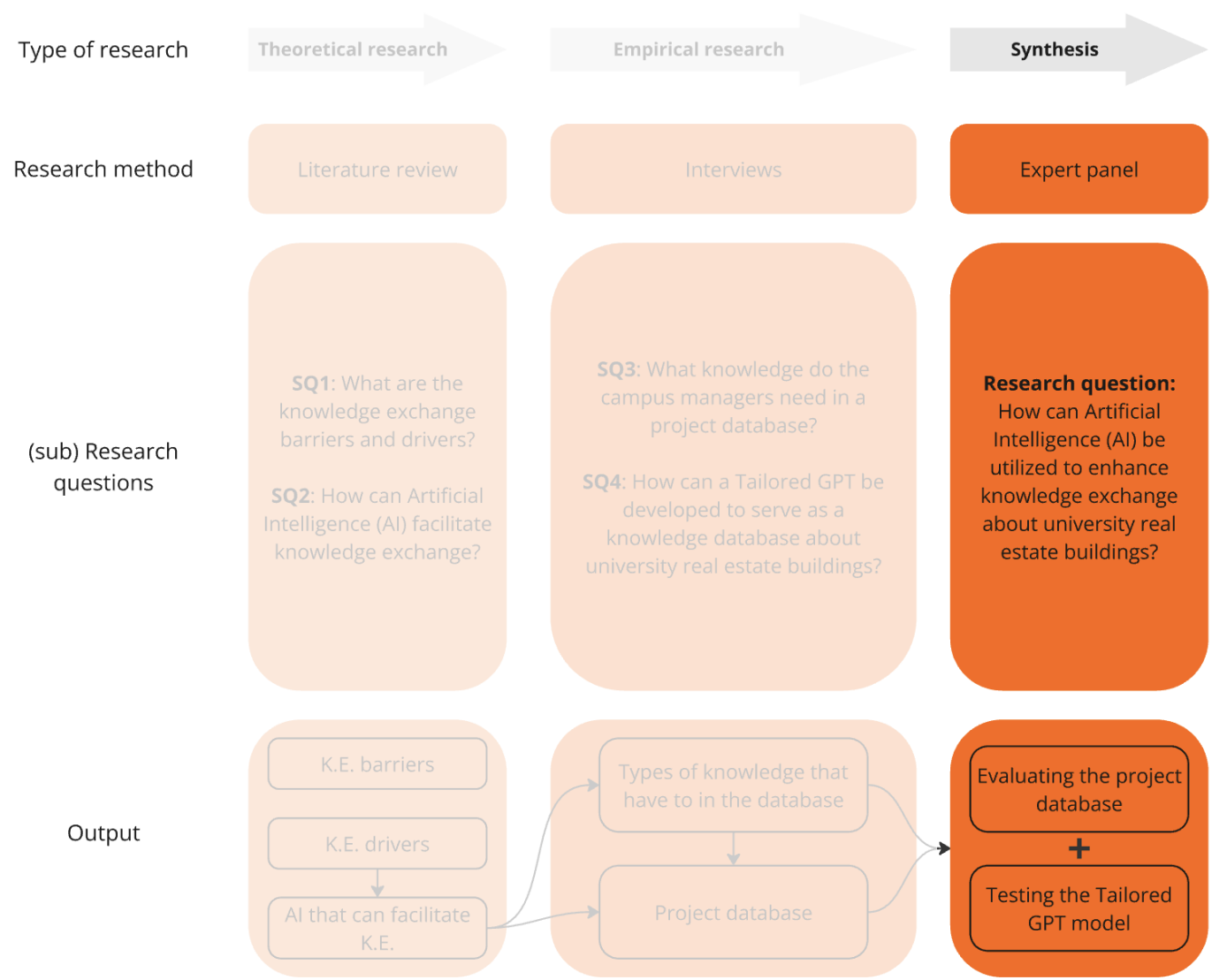
(own figure)

Methodology.



(own figure)

Methodology.



(own figure)

2



Theoretical
research

SQ1: What are the knowledge exchange barriers and drivers?

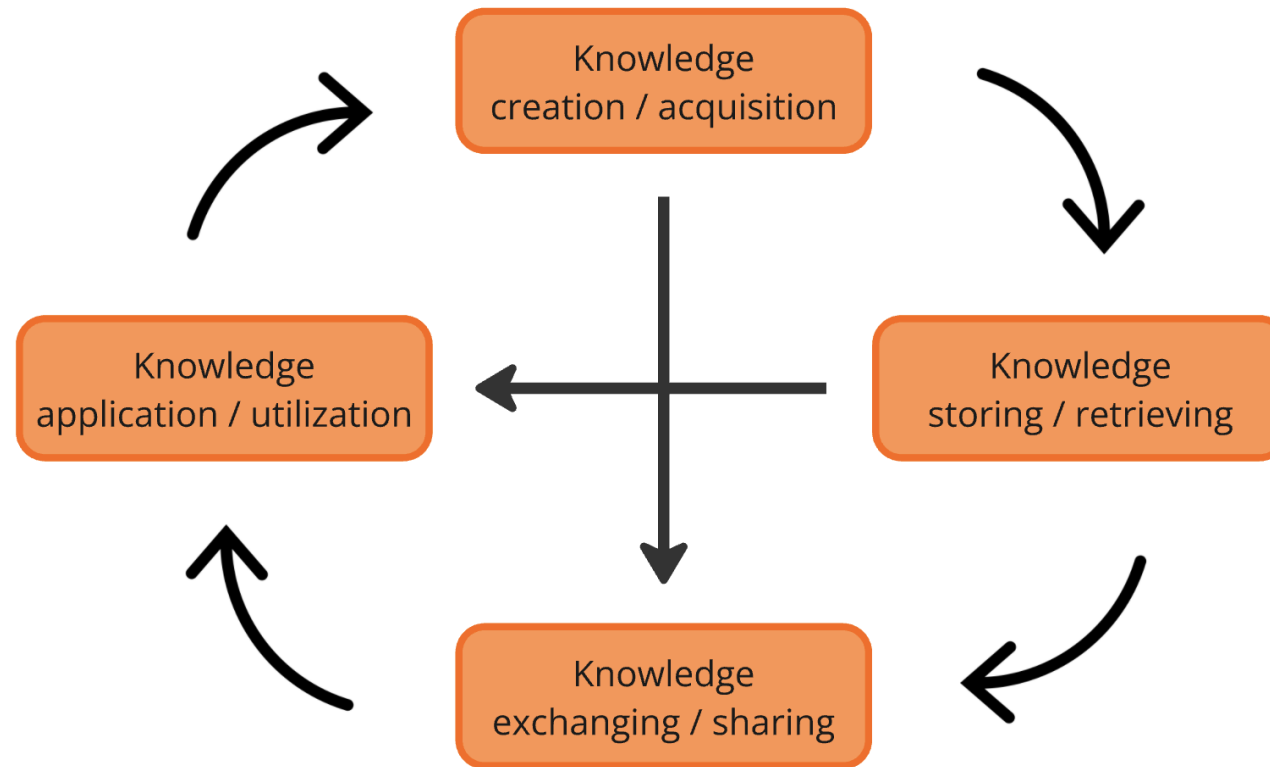
SQ2: How can Artificial Intelligence (AI) facilitate knowledge exchange?

Literature review:

1. Knowledge exchange
2. Artificial Intelligence
3. University real estate

Knowledge exchange.

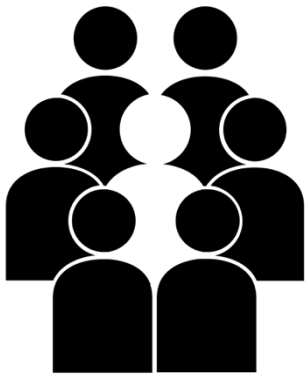
Knowledge exchange.



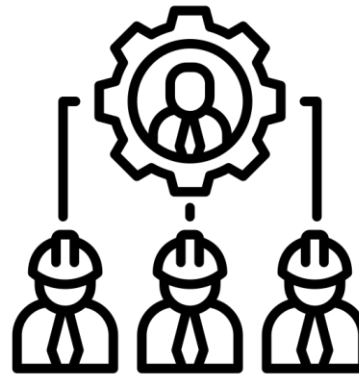
(own figure, based on Alavi & Leidner, 2001; Ayinde et al., 2021; Jarrahi et al., 2023; Ruggles 1997)

Knowledge exchange.

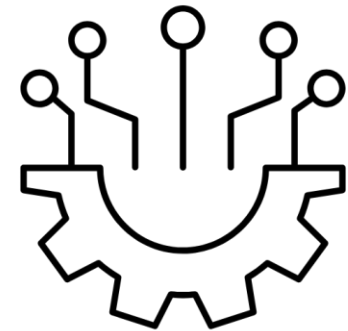
Three levels for knowledge exchange barriers & drivers (Rego et al., 2009):



1. Individual



2. Socio-organizational



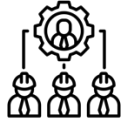
3. Technological



1. Individual

Barriers.

Barrier	Literature
Lack of trust	Birdi et al. (2020); Asrar-ul-Huq & Anwar (2016); Rego et al. (2009)
Lack of motivation	Birdi et al. (2020); Asrar-ul-Huq & Anwar (2016); Rego et al. (2009)
Lack of time	Rego et al. (2009)
Poor communication	Rego et al. (2009)
Fear	Rego et al. (2009)
Heavy workload	Asrar-ul-Huq & Anwar (2016)
Variability of people	Argate & Ingram (2000); Aslam et al. (2023)



2. Socio-organizational

Barriers.

Barrier	Literature
Cultural differences	Asrar-ul-Huq & Anwar (2016); Rego et al. (2009); Tzavides et al. (2020)
Organizational and management structure	Asrar-ul-Huq & Anwar (2016); Tzavides et al. (2020); Rego et al. (2009)
Lack of incentives and rewards	Rego et al. (2009); Birdi et al. (2020); Asrar-ul-Huq & Anwar (2016)
Leadership	Birdi et al. (2020); Rego et al. (2009)
Organizational silos	Asrar-ul-Huq & Anwar (2016); Rego et al. (2009)
Shortage of formal and informal spaces	Rego et al. (2009)
Diverse agendas, goals, and processes	Borg & Von Knorring (2019)
Unclear integration of KM practices	Tzavides et al. (2020); Rego et al. (2009)



Barriers.

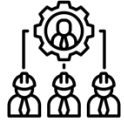
Barrier	Literature
Lack of shared databases and repositories	Birdi et al. (2020); Tzavides et al. (2020); Rego et al. (2009); Bektas et al. (2015)
Lack of training	Birdi et al. (2020); Rego et al. (2009)
Unnecessary information	Rego et al. (2009)
Unrealistic expectations	Rego et al. (2009)



1. Individual

Drivers.

Driver	Literature
Willingness to exchange knowledge	Nassuora (2011); Rego et al. (2009)
Willingness to learn	Rego et al. (2009)
Trust	Birdi et al. (2020); Asrar-ul-Huq & Anwar (2016); Al-Gharibeh (2011)
Collaboration	Nassuora (2011); Al-Gharibeh (2011)
Help-seeking	Rego et al. (2009)



2. Socio-organizational

Drivers.

Driver

Collaborative culture

Leadership

Incentives and rewards

Centralization

Integrating KM

Face-to-face communication

Literature

Asrar-ul-Huq & Anwar (2016); Rego et al. (2009); Al-Kurdi et al. (2018); Nassuora (2011)

Al-Gharibeh (2011); Nassuora (2011); Rego et al. (2009)

Asrar-ul-Huq & Anwar (2016); Rego et al. (2009);

Al-Gharibeh (2011); Nassuora (2011); Rego et al. (2009)

Al-Kurdi et al. (2018); Rego et al. (2009)

Rego et al. (2009)



3. Technological

Drivers.

Driver

Utilization of technology

Centralized knowledge repository

Literature

Asrar-ul-Huq & Anwar (2016); Rego et al. (2009); Al-Gharibeh (2011); Al-Kurdi et al. (2018); Nassuora (2011); Tzavides et al. (2020)

Rego et al. (2009)

Barriers & Drivers.

Important barriers & drivers for this research:

Barriers:

- Lack of shared databases and repositories
- Lack of time

Drivers:

- Utilization of technology
- Centralized repository

Barriers & Drivers.

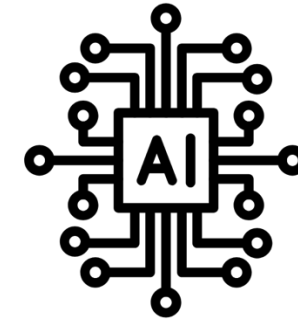
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Drivers:

- Utilization of technology
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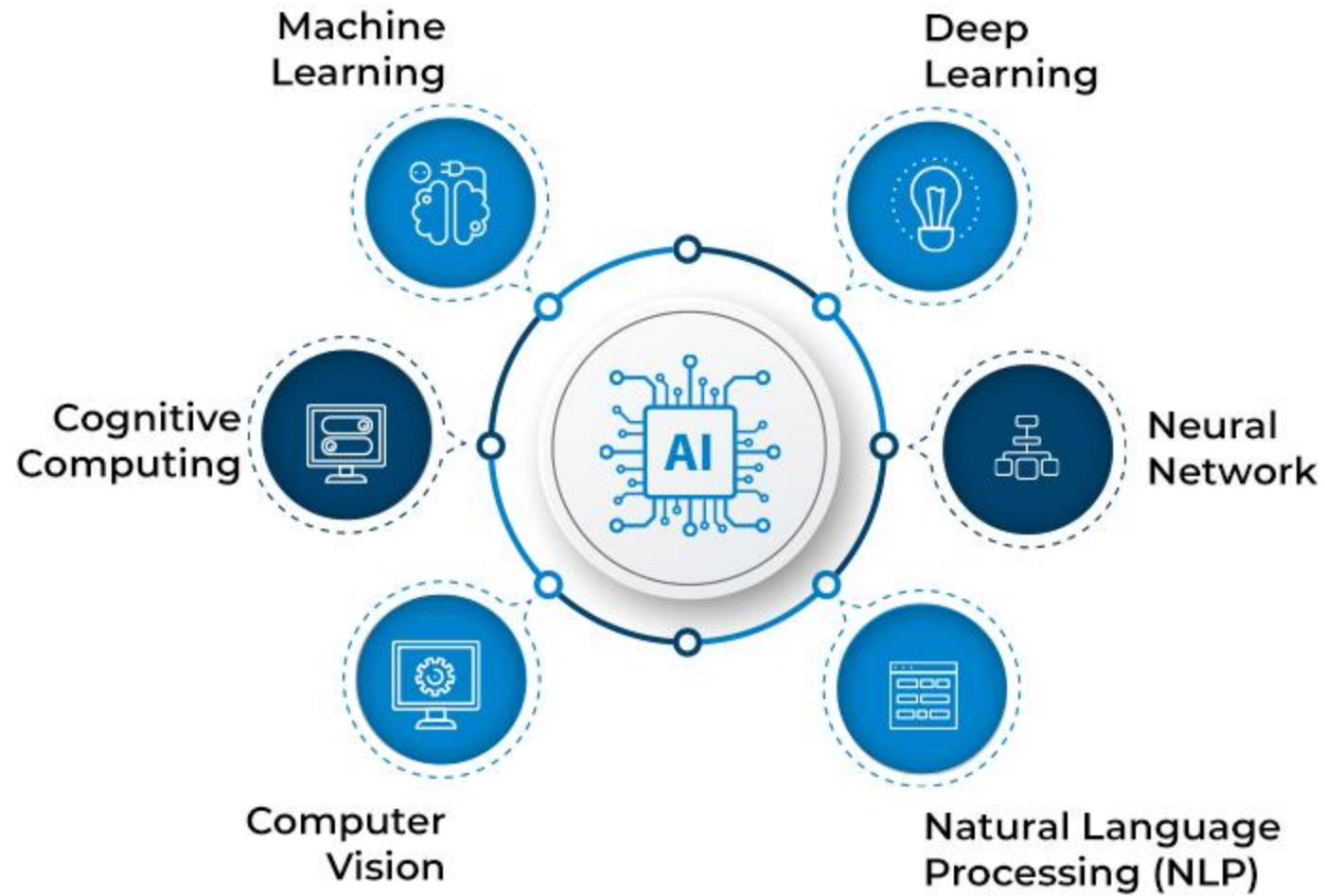


Potential to overcome
& enable

(Liebowitz, 2001; Olan et al., 2022; Bolisani & Nakash, 2024; Jarrahi et al., 2023)

Artificial Intelligence.

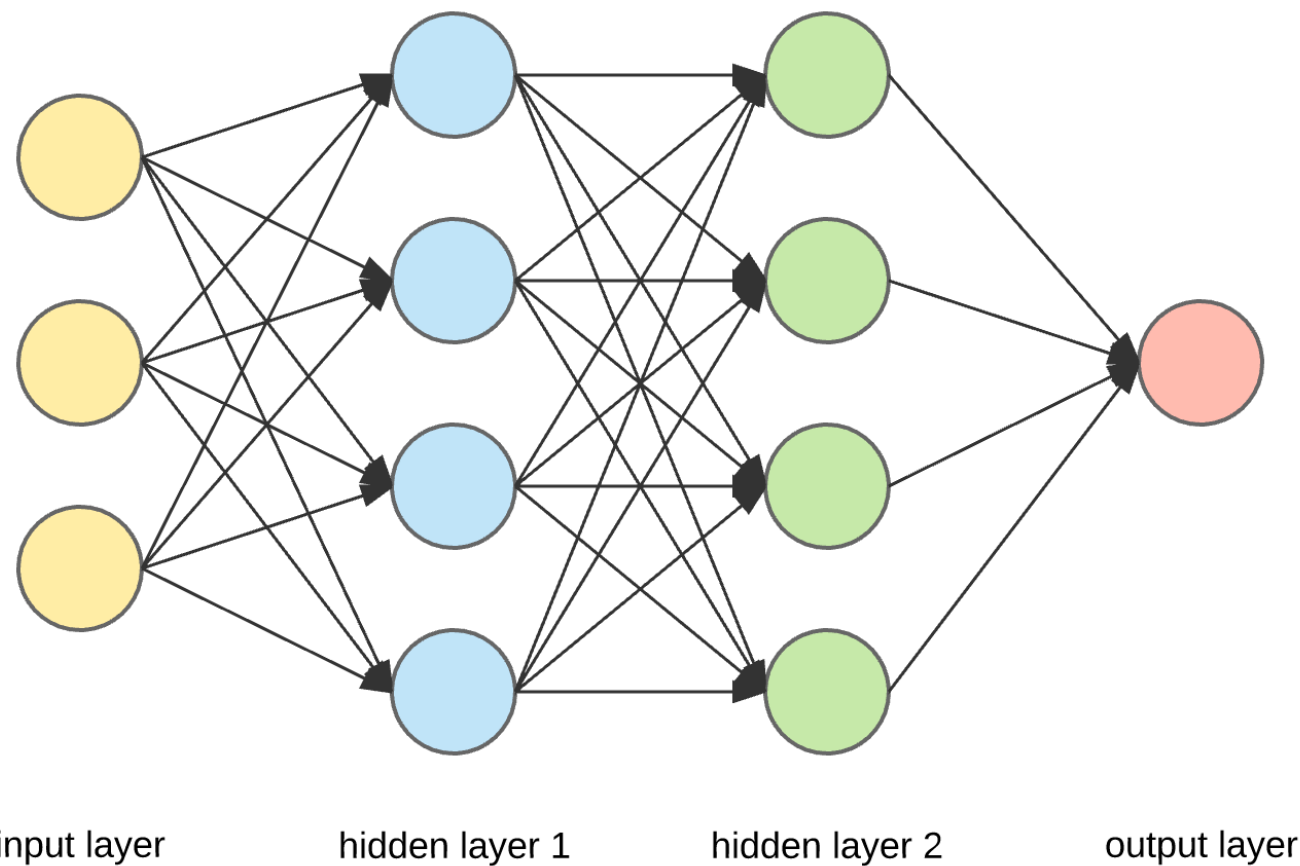
Artificial Intelligence.



Large Language model.

Large Language model.

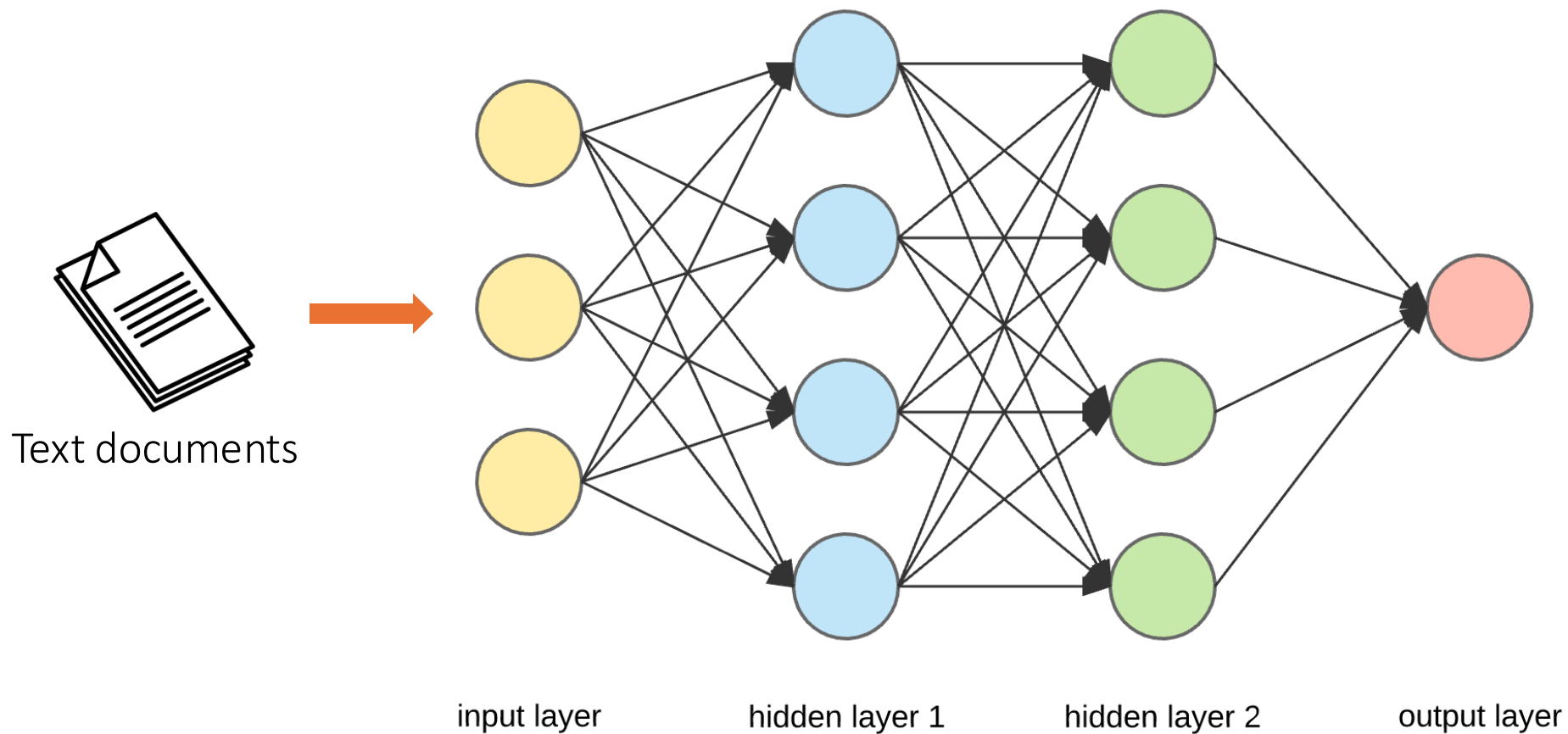
Large Language Model



Neural network-based model (Dertat, 2022)

Large Language model.

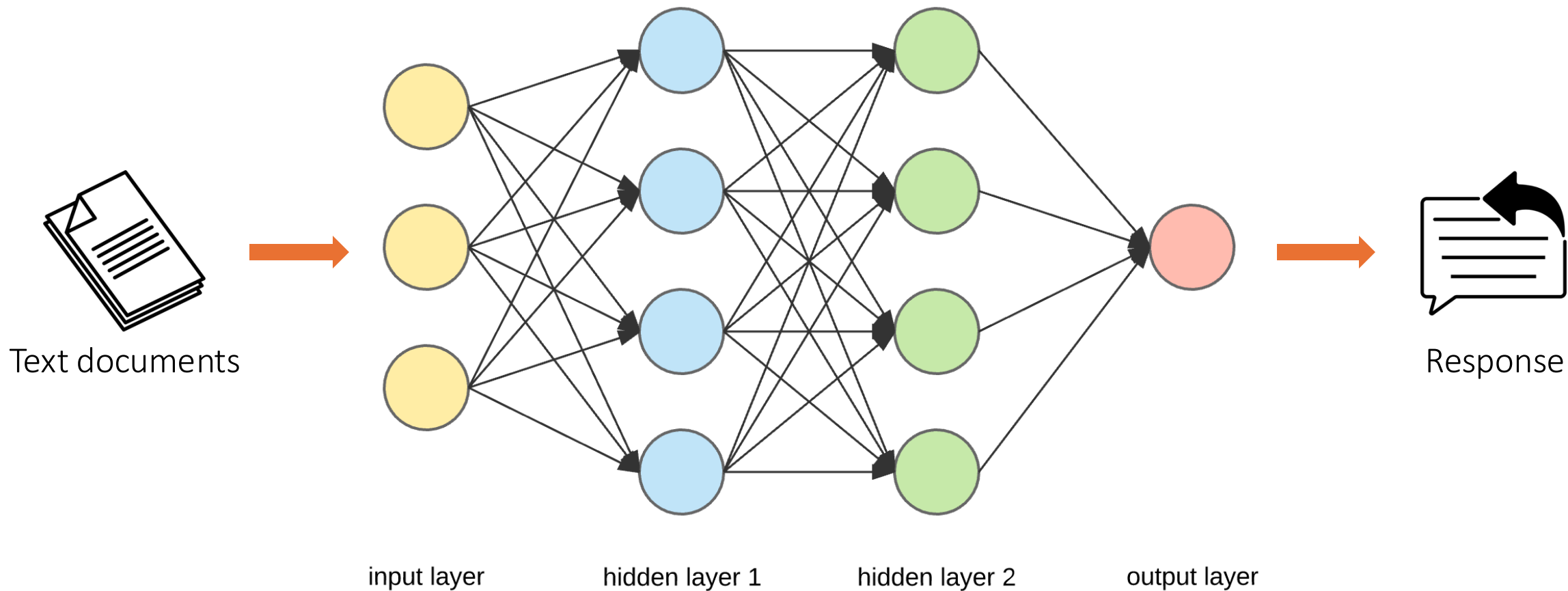
Large Language Model



Neural network-based model (Dertat, 2022)

Large Language model.

Large Language Model



Neural network-based model (Dertat, 2022)

Large Language model.

Tokens

Text:

My favorite color is red .

Token IDs: [3666, 4004, 3124, 318, 2266, 13]

Tokens; numerical representations of words (own work, based on Dertat (2022), 2024)

Large Language model.

500 billion Tokens

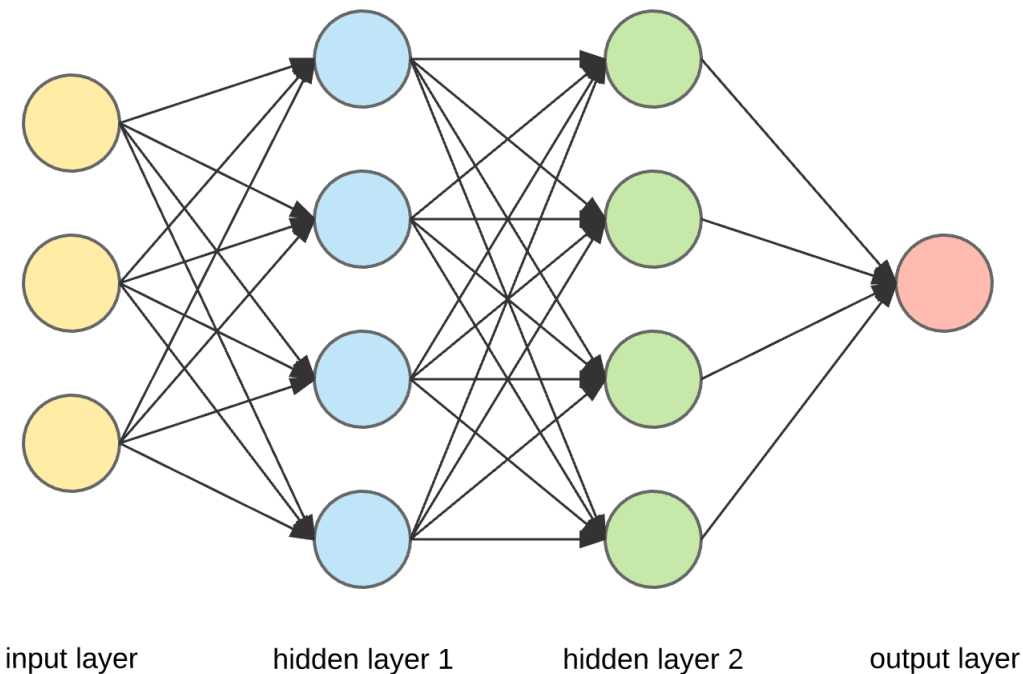
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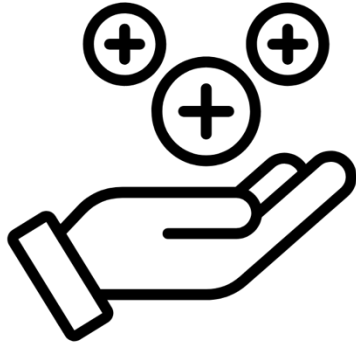


Artificial Intelligence.



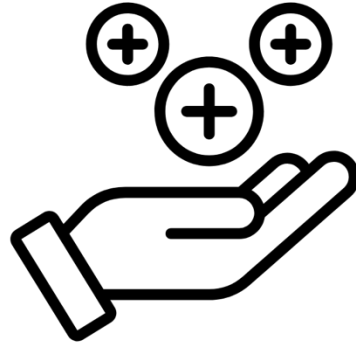
Benefits

Artificial Intelligence.



Benefits

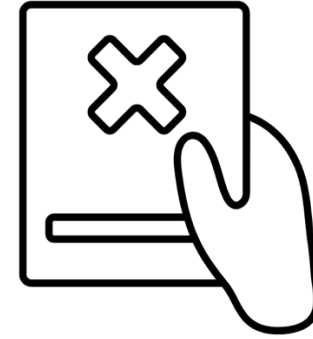
- Accessibility of information and knowledge
- Improved task efficiency
- Additional intelligence
- Time-efficiency



Benefits

- Accessibility of information and knowledge
- Improved task efficiency
- Additional intelligence
- Time-efficiency

Artificial Intelligence.



Ethical & societal considerations

- Behavior of ChatGPT
- Environmental impact
- Job displacement
- Misinformation

University real estate.

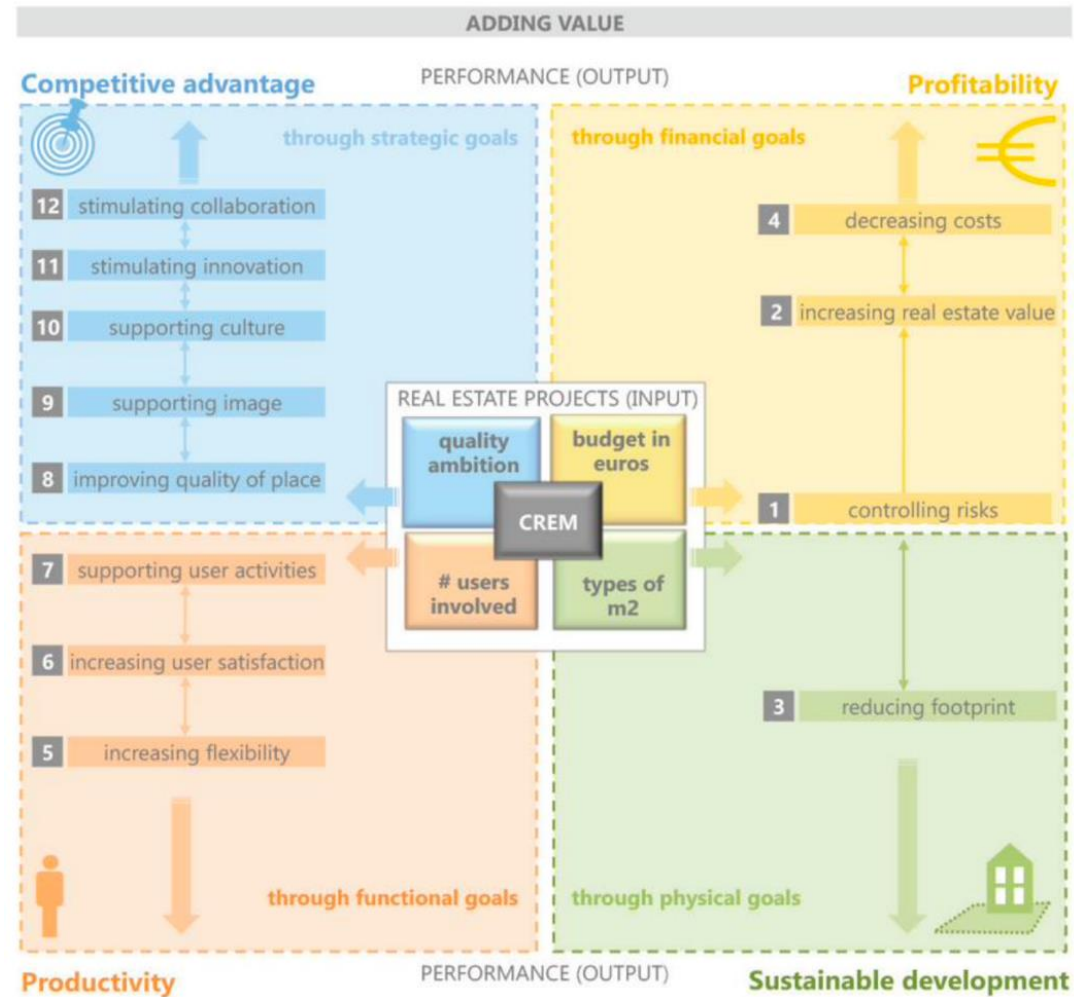
University real estate.



13 Dutch university campuses

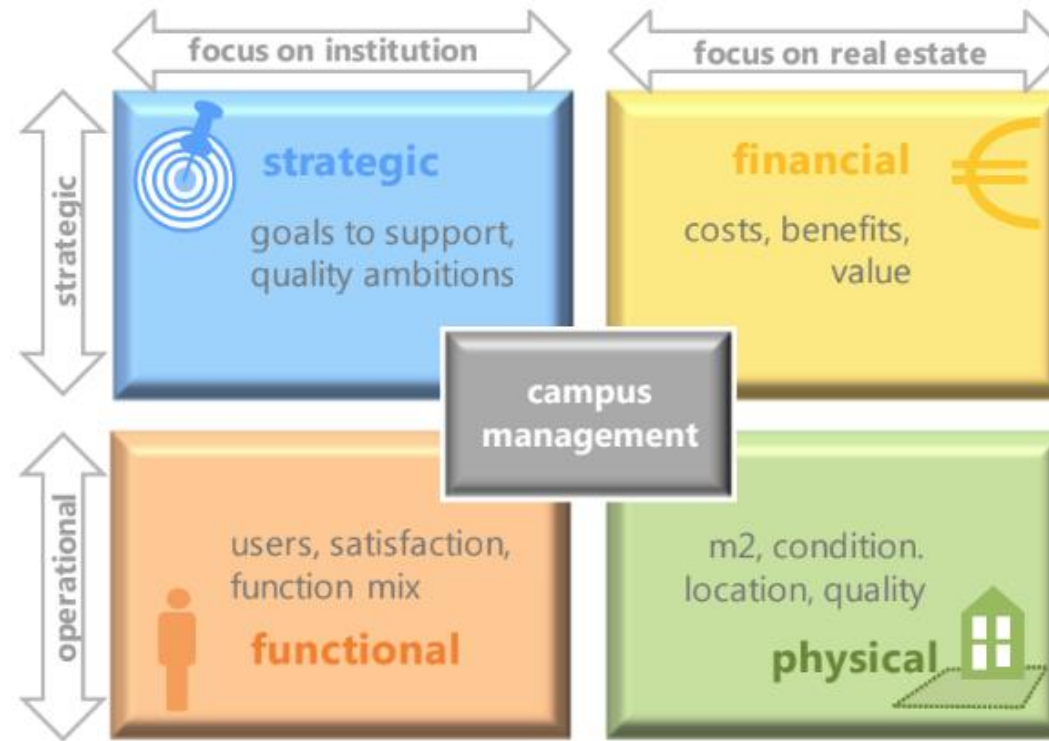
~ 1200 university buildings

University real estate.



The Corporate Real Estate Management (CREM) theory (Den Heijer, 2011)

University real estate.



Campus management framework (Den Heijer, 2011)

Existing database.

1 **EUR-1 J building**

new building project type | Woudestein campus | 1999 year | Rotterdam location

2 The 'J building' was built in 1999 to accommodate Rotterdam School of Management (RSM) and a number of EUR related research institutes. With post-experience students as the main user group the quality ambition – at that time – was higher than in the average EUR faculty building. The footprint per student was also relatively high, also adding to higher student expectations.

With nine floors of office space, meeting rooms and small lecture rooms this building is flexible in use – potentially suitable for many other (external) user groups. This adds to the EUR strategy to create a flexible campus. The ambition was to create a place to meet that supports the identity of RSM. Evaluations after five years showed an increase in user satisfaction.

Project profile

3

goals

- 1 support user goals more effectively / improve customer satisfaction
- 2 more quality for user (match with changing demand)
- 3 support identity university / attract (young) students & staff members

	annually	€/m ² /y	€/m ² /y
• maintenance	138.000	12,8	18,5
• energy & water	127.000	11,8	17,9
• cleaning	154.000	14,3	20,6

** in progress, maintenance costs including user costs*

	total (incl. €)	€/m ² /y	€/m ² /y
construction costs	15,2	1.438	2.030
investment costs	21,5	2.090	3.010

all costs price level October 2009

CREM

users	number	m ²
students	176	
staff (incl. count)	90	
staff (ft)	18	
educational space (m ² u/a) / student		11,7
office space (m ² u/a) / staff member		27,8
office space (m ² u/a) / ft		27,5

gross floor area	18.800	m ² /y
usable floor area	7.470	m ² /y
u/a / y/a	60%	
number of floors	9	
% office space	34%	(100% = m ² u/a)
% educational space	28%	
% specific space	2%	

target user
RSM - Rotterdam School of Management



Notes:

- text by author based on data provided by university for benchmark studies 2005-2010
- costs converted to price level October 2009 for comparison of projects
- photos and maps used with permission of university
- more information: <http://www.eur.nl/efb/cio>

Existing database.

1

EUR-1 J building

new building project type

Woudestein campus

1999 year

Rotterdam location

2

The 'J building' was built in 1999 to accommodate Rotterdam School of Management (RSM) and a number of EUR related research institutes. With post-experience students as the main user group the quality ambition – at that time – was higher than in the average EUR faculty building. The footprint per student was also relatively high, also adding to higher student expectations.

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3

Project profile

CREM

category	metric	value	unit
users	students	176	
	staff (total count)	80	
	staff (full)	58	
space	educational space (m ² ubo) / student	12,3	
	office space (m ² ubo) / staff member	23,8	
	office space (m ² ubo) / full	37,2	
building	gross floor area	18.800	m ² gfa
	usable floor area	7.470	m ² ubo
	ubo / gfa	80%	
	number of floors	8	
usage	% office space	90%	(100 % = m ² ubo)
	% educational space	20%	
	% specific space	2%	

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- Location
- Position on campus
- Project type
- Year of construction
- Main functions
- Building image

Existing database.

1

EUR-1 J building

new building project type

Woudestein campus

1999 year

Rotterdam location

- General description of the building

2

The 'J building' was built in 1999 to accommodate Rotterdam School of Management (RSM) and a number of EUR related research institutes. With post-experience students as the main user group the quality ambition – at that time – was higher than in the average EUR faculty building. The footprint per student was also relatively high, also adding to higher student expectations.

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3

Project profile

goals

- 1. support user goals more effectively / improve customer satisfaction
- 2. more quality for user search with changing demand
- 3. support identity university / attract private students & staff members

	annuity	€/m ² /y	€/m ² /y
• maintenance	118.000	12,8	18,3
• energy & water	127.000	13,8	17,9
• cleaning	114.000	14,3	20,6
Total (incl. user costs)			
construction costs	15,2	1.430	2.000
investment costs	21,9	2.090	3.000
all costs price level October 2009			

users

	number	m ²
students	176	
staff (total count)	80	
staff (net)	58	
educational space (m ² ubo) / student	12,3	
office space (m ² ubo) / staff member	23,8	
office space (m ² ubo) / m ²	37,5	

CREM

gross floor area	18.800 m ² gfa
usable floor area	7.470 m ² uba
ufa / gfa	40%
number of floors	9
% office space	90% (100% = m ² ubo)
% educational space	28%
% specific space	2%

target user
RSM - Rotterdam School of Management

Notes:

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Existing database.

1

EUR-1 J building

new building project type

campus Woudestein

year 1999

location Rotterdam

- Campus management framework
 - Strategic data
 - Financial data
 - Functional data
 - Physical data

2

The 'J building' was built in 1999 to accommodate Rotterdam School of Management (RSM) and a number of EUR related research institutes. With post-experience students as the main user group the quality ambition – at that time – was higher than in the average EUR faculty building. The footprint per student was also relatively high, also adding to higher student expectations.

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3

Project profile

goals

1 support user goals more effectively/improve customer satisfaction

2 more quality for user (match with changing demand)

3 support identity university / attract (young) students & staff members

CRIM

	number	m2
students	176	
staff (incl. count)	80	
staff (ft)	18	
educational space (m2 u/a)/student	11,7	
office space (m2 u/a)/staff member	27,4	
office space (m2 u/a)/ft	27,5	

	annually	€/m2/yr	€/m2/yr
• maintenance	138.000	12,8	18,5
• energy & water	127.000	11,8	17,9
• cleaning	134.000	14,3	20,6

* in progress, maintenance costs including user costs

	total (incl. ft)	€/m2/yr	€/m2/yr
construction costs	51,2	1.438	2.030
investment costs	21,5	2.090	3.010

all costs price level October 2009

gross floor area	18.800	m2/yr
usable floorarea	7.470	m2/yr
u/a / yr	80%	
number of floors	9	
% office space	34% (100% = m2 u/a)	
% educational space	28%	
% specific space	2%	

key user
RSM - Rotterdam School of Management



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Existing database.

case_no	project_name	link	area	year	location	architects	dominant_campus_theme	dominant_campus_theme_name	secondary_campus_eme_1	secondary_campus_eme_2	secondary_campus_eme_3	secondary_campus_eme_4	secondary_campus_eme_5	secondary_campus_eme_6	secondary_campus_eme_7	secondary_campus_eme_8	secondary_campus_eme_9	secondary_campus_eme_10	secondary_campus_eme_11	secondary_campus_eme_12	secondary_campus_eme_13	campus_scale	secondary_campus_theme_name	
1	Department of Mechanical & Manufacturing Engineering / Grafton Architects	www.archdaily.com/875404	850	2002	Ireland	Grafton Architects	3	Academic mixed-use		1		1				1								Learning environment, Laboratories, Circulation space
2	Polytechnic School / Iñaki Carnicero	www.archdaily.com/63567		2002	Madrid, Spain	Iñaki Carnicero	2	Learning environment	1							1								Working environment, Circulation space
3	Law School of Soochow University / ARTS Group	www.archdaily.com/944075	15061	2003	Suzhou, China	ARTS Group	3	Academic mixed-use								1								Circulation space
4	Chemical and Biological Library / Giuseppe Rebecchini	www.archdaily.com/252260	1500	2003	Ferrara, Italy	Giuseppe Rebecchini	2	Learning environment						1					1	1				Heritage, Silence, Storage
5	Waterloo School of Architecture / Levitt Goodman Architects	www.archdaily.com/43771	7897	2004	Cambridge, Canada	Levitt Goodman Architects	3	Academic mixed-use		1			1						1	1				Learning environment, Non-academic functions, Silence, Storage
6	AD Classics Glucksman Gallery / O'Donnell + Tuomey	www.archdaily.com/795443	2300	2005	Cork, Ireland	O'Donnell + Tuomey Architects	5	Non-academic functions		1						1						1		Learning environment, Circulation space, Showroom
7	Central Library of the PUC Campinas / Piratininga Arquitetos Associados	www.archdaily.com.br/600007	3200	2005	Campinas, Brazil	Piratininga Arquitetos Associados	2	Learning environment											1	1				Silence, Storage
8	Free University's Philology Library / Foster + Partners	www.archdaily.com/438400		2005	Berlin, Germany	Foster + Partners	2	Learning environment											1	1				Silence, Storage
9	Paichai University Appenzeller Memorial Hall / IARC Architects	www.archdaily.com/190850	9883	2005	South Korea	IARC Architects	5	Non-academic functions		1														Learning environment
10	Barbara Davis Center for Childhood Diabetes / Anderson Mason Dale Architects	www.archdaily.com/135412	110000	2005	Aurora, United States	Anderson Mason Dale Architects	4	Laboratories	1															Working environment
11	Sino-Italian Ecological and Energy Efficient Building / Mario Cucinella Architects	www.archdaily.com/880371	20000	2006	Haidian Qu, China	Mario Cucinella Architects	3	Academic mixed-use							1				1					Heritage, Sustainability
12	Faculty of Economics Ghent University / Xaveer De Geyter Architects + Stéphane Beel Architects	www.archdaily.com/430177	7241	2006	Ghent, Belgium	Stéphane Beel Architects, XAGA - Xaveer De Geyter	3	Academic mixed-use		1									1					Learning environment, Sustainability
13	Homage to Architects / Atelier Seraji	www.archdaily.com/207970	2000	2006	Lille, France	Atelier Seraji	3	Academic mixed-use																
14	Carroll A. Campbell Jr. Graduate Engineering Center at Clemson University / Mack Scogin Merrill Elam Architects	www.archdaily.com/128600	7897	2006	Greenville, United States	Mack Scogin Merrill Elam Architects	3	Academic mixed-use	1	1			1	1						1	1			Working environment, Learning environment, Laboratories, Non-academic functions, Silence, Storage
15	University of New South Wales Law Building / Lyons	www.archdaily.com/101835	12000	2006	Sydney, Australia	Lyons	3	Academic mixed-use	1	1										1	1			Working environment, Learning environment, Silence, Storage

Project database by Altinkaya Genel et al. (2023)

Existing database.

Database by Den Heijer (2011)

- 39 Dutch university buildings
- Buildings till 2010
- Developing time: 5 years

Database by Altinkaya Genel et al. (2023)

- 780 worldwide university buildings
- Only 14 Dutch university buildings
- Limited knowledge

Existing database.

Database by Den Heijer (2011)

- 39 Dutch university buildings
- Buildings till 2010
- Developing time: 5 years

Database by Altinkaya Genel et al. (2023)

- 780 worldwide university buildings
- Only 14 Dutch university buildings
- Limited knowledge

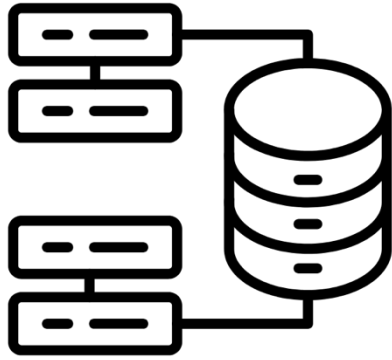
Barrier:

Lack of shared databases



Lack of updated and relevant shared databases
& the lack of time to update

AI facilitating Knowledge exchange.



Updated shared project database

- Facilitator for explicit knowledge exchange (Rego et al., 2009)



Tailored GPT model

- Easily accessible, retrievable, and exchangeable knowledge

3



Empirical
research

SQ3: What knowledge do the universities need in a project database?

SQ4: How can a Tailored GPT be developed to serve as a knowledge database about university real estate buildings?

Structure.

Structure.

1. Using AI to **find** university buildings in open project databases and websites.

Structure.

1. Using AI to find university buildings in open project databases and websites.
2. Using AI to **collect** university building information.

Structure.

1. Using AI to **find** university buildings in open project databases and websites.
2. Using AI to **collect** university building information.
3. Using AI to create an **overview** per building.

Structure.

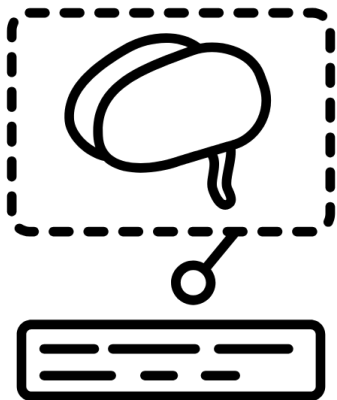
1. Using AI to **find** university buildings in open project databases and websites.
2. Using AI to **collect** university building information.
3. Using AI to create an **overview** per building.
4. Use AI to **analyze** and **identify** patterns, trends and innovations in university buildings.

Finding.

1. Using AI to **find** university buildings in open project databases and websites.

Finding.

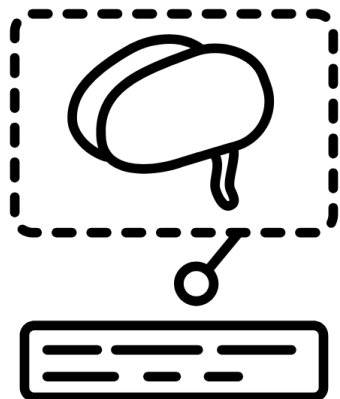
Prompt engineering



- List of Dutch university real estate (39 buildings)

Finding.

Prompt engineering



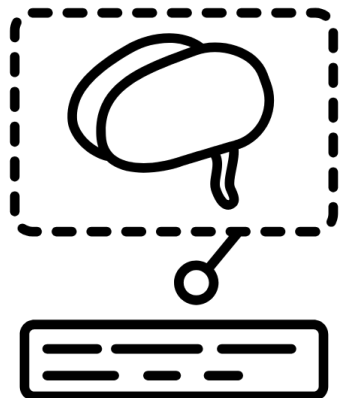
- List of Dutch university real estate (39 buildings)



Verifying reliability

Finding.

Prompt engineering



- List of Dutch university real estate (39 buildings)

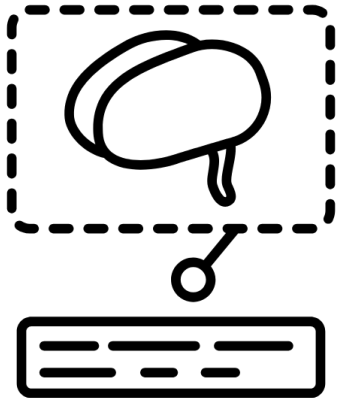


Verifying reliability

- List of European university real estate (149 buildings)

Finding.

Prompt engineering



- List of Dutch university real estate (39 buildings)



Verifying reliability

- List of European university real estate (149 buildings)



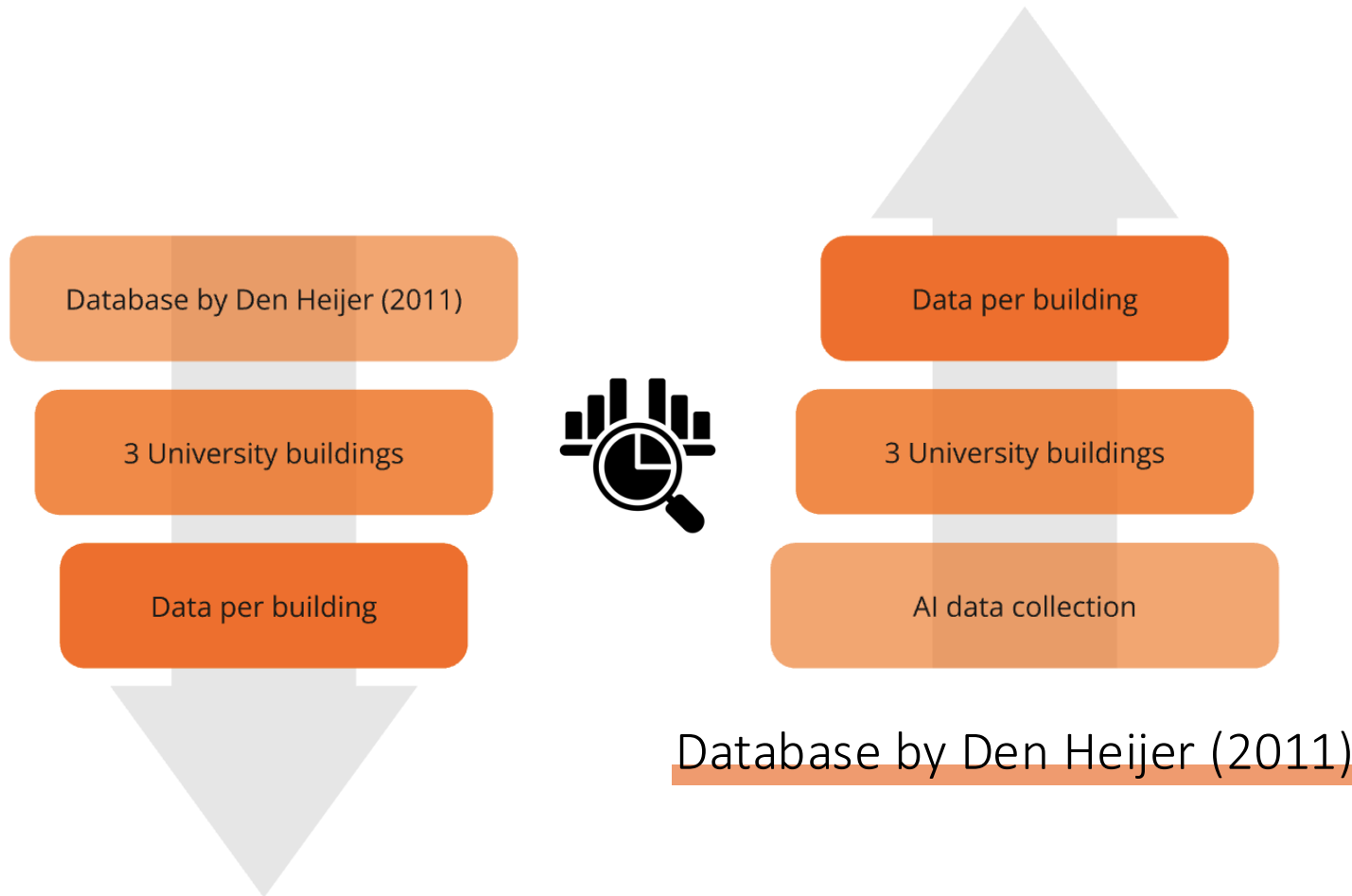
- List of worldwide university real estate



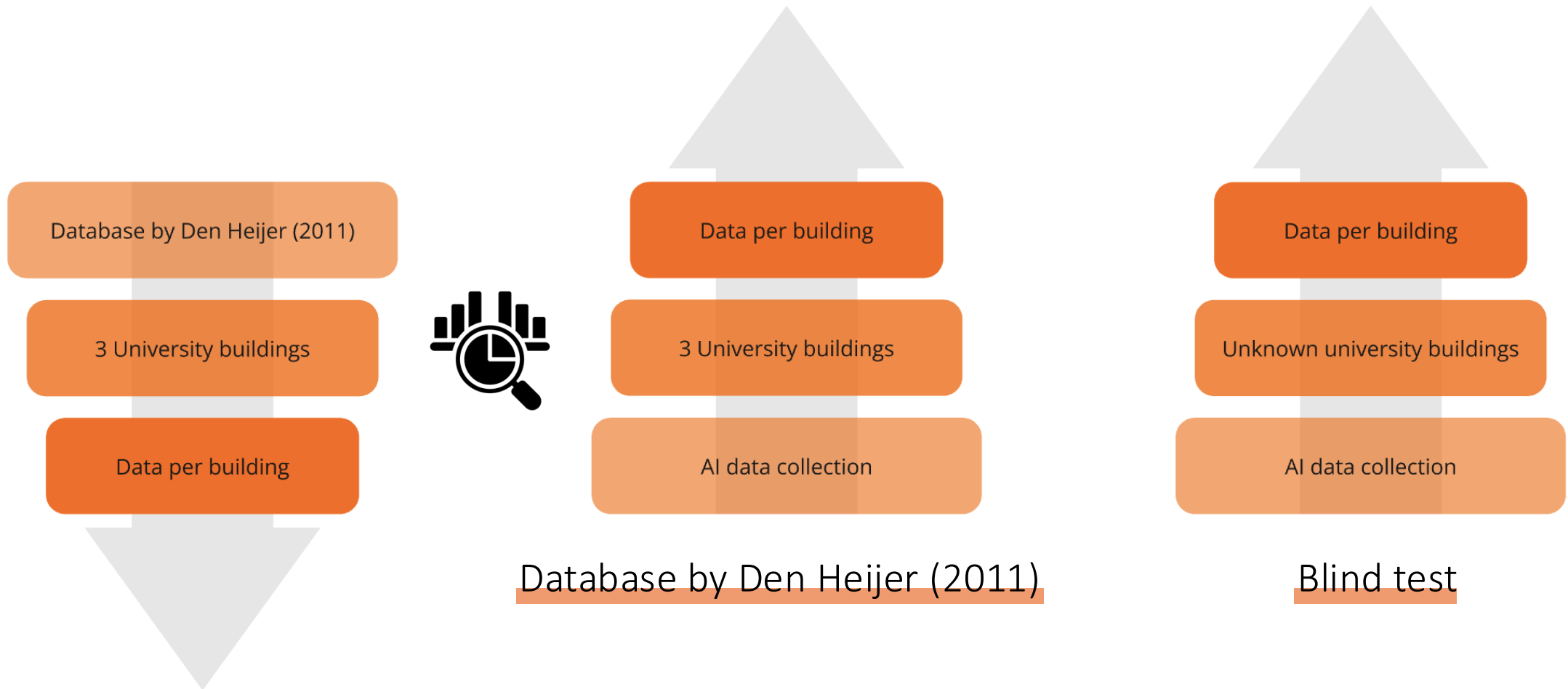
Collecting.

2. Using AI to **collect** university building information.

Verifying reliability.



Verifying reliability.



Verifying reliability.

Comparative analysis

Data per building	T Building Erasmus University	Huygens Building Radboud University	Bernoulliborg University of Groningen	Building O University of Antwerp
General building information				
Project description				
Strategic data				
Financial data				
Functional data				
Physical data				

Verifying reliability.

Comparative analysis

Data per building	T Building Erasmus University	Huygens Building Radboud University	Bernoulliborg University of Groningen	Building O University of Antwerp
General building information	✘	✘	✘	✘
Project description	✘	✘	✘	✘
Strategic data	✘	✘	✘	✘
Financial data				
Functional data	✘	✘	✘	✘
Physical data			✘	✘

Collecting.

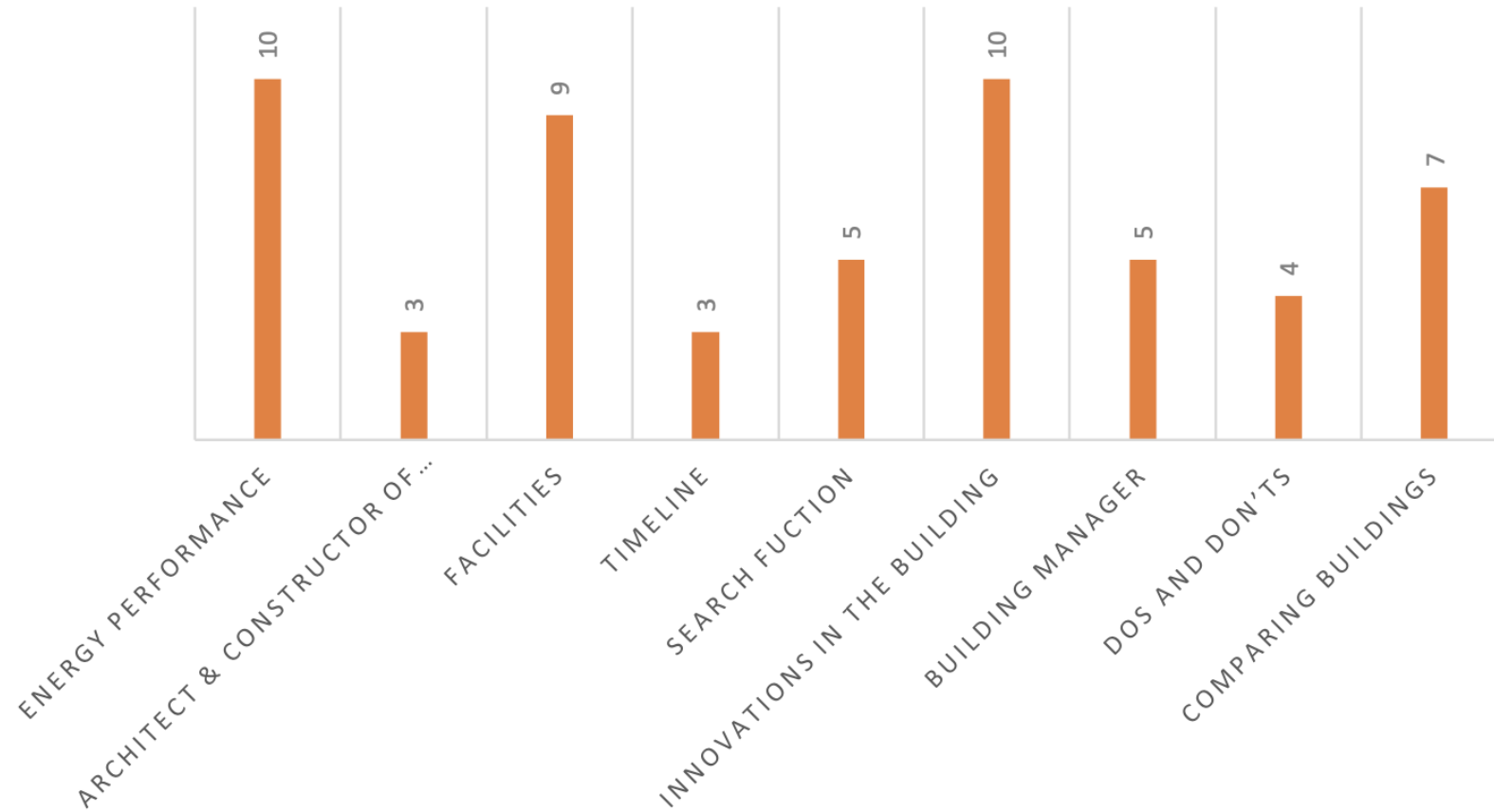
SQ3: What knowledge do the universities need in a project database?

Necessary knowledge.

Necessary (5 to 7)	Important (3 to 4)	Supportive (1 to 2)
Energy performance of the building	Architect & Constructor of the building	Timeline of the building process
Facilities in the building	Spatial data	Search function
Comparing buildings		Innovations in the building
Building costs		Dos and don'ts
General building information		Function division
Building function		Project image
		Comment function
		Building manager

Categorization of the types of knowledge (own work, 2025)

Necessary knowledge.



Necessary knowledge.

- General building information
- Building function
- Project description
- Strategic data
- Functional data
- Physical data
- Energy performance
- Facilities
- Innovations
- Architect & constructor

Creating an overview.

3. Using AI to create an **overview** per building.

Building Title: Echo Building

Project type: new building Campus: TU campus Year: 2022 Location: Delft



Creating an overview.

Project description

The Echo Building at TU Delft, completed in May 2022, is an innovative, energy-generating interfaculty education facility designed by UNStudio. It is considered the most sustainable building on the TU Delft campus, contributing significantly to the university's goal of becoming fully sustainable by 2030. The building houses a variety of multifunctional teaching spaces and study areas, designed to accommodate diverse teaching methods, from lectures to project-based learning and self-study for around 1,700 students.

Architecturally, Echo promotes openness and transparency, integrating natural light and creating strong visual connections with the surrounding campus. Its innovative design earned the Prix Versailles award for its ecological efficiency and architectural unity.

Functions: Education

Architect: UNStudio

Constructor: BAM Bouw en Techniek

Project profile

<p>Goals:</p> <p>Accommodate Growing Student Numbers: Echo provides additional educational spaces to meet the increasing demand, featuring seven teaching rooms with flexible layouts. Including a 700-seat lecture hall that can be divided into three separate rooms.</p> <p>Enhance Educational Flexibility: The building supports various teaching methods and study styles, offering over 100 study places for group work and self-study, thereby building a dynamic learning environment.</p> <p>Advance Sustainability: Echo Echo is an energy-producing building, contributing to TU Delft's ambition to create a CO2-neutral and circular campus by 2030. It incorporates solar panels, efficient insulation, and a thermal storage system to generate more energy than it consumes, including renewable energy for laptops, lighting, and catering.</p> <p>Promote Interfaculty Collaboration: As an interfaculty educational building, Echo facilitates collaboration among different departments, providing spaces for education, debates, self-study, and offices, thereby enhancing interdisciplinary interaction.</p> <p>Create an Open and Inviting Environment: The building's transparent design allows visibility of educational activities from the outside, fostering a sense of community and engagement among students, staff, and visitors.</p>	<p>Costs (€):</p>
<p>Users:</p> <p>The building serves a diverse group of users:</p> <ul style="list-style-type: none"> Students: Echo provides over 300 study spaces for group work and self-study along with seven teaching rooms designed to accommodate various teaching methods and study styles. Faculty Members: Instructors utilize seven flexible teaching rooms, including a 700-seat lecture hall that can be divided into three separate rooms, to deliver lectures, facilitate group discussions, and conduct project-based learning. Administrative Staff: The building includes office spaces for staff involved in the coordination and support of educational activities, contributing to the efficient operation of teaching programs. Visitors and External Partners: Echo's design encourages engagement with the broader community, hosting debates, seminars, and collaborative events that attract visitors and industry partners. <p>By accommodating these groups, Echo fosters a vibrant and collaborative environment that enhances the educational experience and supports TU Delft's commitment to sustainability and innovation.</p>	<p>Square meters:</p> <p>GFA 8,844 m² UFA is not specified in sources, but UFA/GFA ratio is typically around 70% in educational buildings Number of floors: 4</p> <p>% of Educational Space: The majority of the space is allocated for educational purposes.</p> <p>% of Specific Space: Echo provides some specialized spaces for debates, project-based learning, and case-study rooms.</p> <p>The building encompasses approximately 8,844 square meters, providing educational spaces for around 1,700 students.</p>
<p>Energy performance:</p> <p>Energy Generation: Echo is the first energy-positive university building in the Netherlands, equipped with approximately 1,200 solar panels on its roof. These panels generate more energy than the building consumes, covering all operational needs, including lighting, equipment, and user devices.</p> <p>Ventilation System: The building employs an innovative displacement ventilation system that supplies fresh air from the floor, ensuring efficient air circulation and maintaining a healthy indoor environment.</p> <p>Daylight Optimization: Echo's design maximizes natural light through extensive glass facades, reducing reliance on artificial lighting and enhancing occupant well-being. Deep aluminum eaves and climbing plants on the exterior help control solar heat gain, contributing to the building's energy efficiency.</p>	<p>Building facilities:</p> <p>Flexible Teaching Spaces: Echo houses seven adaptable teaching rooms that can be reconfigured to support various educational formats, accommodating between 150 to 700 people. The flexibility allows for a range of teaching methods and collaborative learning experiences.</p> <p>Study Areas: The building offers diverse study environments, including quiet zones for individual work and open areas for group collaboration, catering to different student preferences.</p> <p>Sustainable Materials: In line with its sustainability goals, Echo incorporates materials such as bamboo and recycled PET bottles in its construction. Notably, 90% of the furniture used in the building has been repurposed, emphasizing resource efficiency.</p>

Building Title: Echo Building

Project type: new building Campus: TU campus Year: 2022 Location: Delft



Creating an overview.

Type of knowledge

- General building information

Project description

The Echo Building at TU Delft, completed in May 2022, is an innovative, energy-generating interfaculty education facility designed by UNStudio. It is considered the most sustainable building on the TU Delft campus, contributing significantly to the university's goal of becoming fully sustainable by 2030. The building houses a variety of multifunctional teaching spaces and study areas, designed to accommodate diverse teaching methods, from lectures to project-based learning and self-study for around 1,700 students.

Architecturally, Echo promotes openness and transparency, integrating natural light and creating strong visual connections with the surrounding campus. Its innovative design earned the Prix Versailles award for its ecological efficiency and architectural unity.

Functions: Education
Architect: UNStudio
Constructor: BAM Bouw en Techniek

Project profile

<p>Goals</p> <p>Accommodate Growing Student Numbers: Echo provides additional educational spaces to meet the increasing demand, featuring open learning rooms with flexible layouts, including a 700-seat lecture hall that can be divided into three separate rooms.</p> <p>Enhance Educational Flexibility: The building supports various teaching methods and study styles, offering over 100 study groups for group work and self-study, thereby fostering a dynamic learning environment.</p> <p>Advance Sustainability: Delft Echo is an energy-producing building, contributing to TU Delft's ambition to create a CO2-neutral and circular campus by 2030. It incorporates solar panels, efficient insulation, and a thermal storage system to generate heat, among other features, including geothermal energy for heating, lighting, and catering.</p> <p>Promote Interfaculty Collaboration: As an interfaculty educational building, Echo facilitates collaboration among different departments, providing spaces for education, debates, self-study, and office, thereby fostering interdisciplinary research.</p> <p>Create an Open and Inviting Environment: The building's transparent design allows visibility of educational activities from the outside, fostering a sense of community and engagement among students, staff, and visitors.</p>	<p>Costs (€)</p>
<p>Users</p> <p>The building serves a diverse group of users:</p> <ul style="list-style-type: none"> Students: Echo provides over 300 study spaces for group work and self-study as well as lecture theatres, specifically designed to accommodate various teaching methods and study styles. Faculty Members: Includes office for flexible teaching rooms, including a 700-seat lecture hall that can be divided into three separate rooms, to deliver lectures, facilitate group discussions, and conduct project-based learning. Administrative Staff: The building includes office spaces for staff involved in the maintenance and support of educational activities, contributing to the efficient operation of academic programs. Visitors and External Partners: Echo's design encourages engagement with the broader community, hosting debates, seminars, and educational events that attract visitors and industry partners. <p>By accommodating these groups, Echo fosters a vibrant and collaborative environment that enhances the educational experience and supports TU Delft's commitment to sustainability and innovation.</p>	<p>CREM</p> <p>Square meters:</p> <ul style="list-style-type: none"> GFA 8,844 m² UFA is not specified in sources, but UFA/GFA ratio is typically around 70% in educational buildings Number of floors: 4 % of Educational Space: The majority of the space is allocated for educational purposes. % of Specific Space: Echo provides some specialized spaces for debates, project-based learning, and case-study rooms. The building encompasses approximately 8,844 square meters, providing educational spaces for around 1,700 students.
<p>Energy performance</p> <p>Energy Generation: Echo is the first energy-positive university building in the Netherlands, equipped with approximately 1,200 solar panels on its roof. These panels generate more energy than the building consumes, covering all operational needs, including lighting, equipment, and user devices.</p> <p>Ventilation System: The building employs an innovative displacement ventilation system that supplies fresh air from the floors, ensuring efficient air circulation and maintaining a healthy indoor environment.</p> <p>Daylight Optimization: Echo's design maximizes natural light through extensive glass facades, reducing reliance on artificial lighting and enhancing occupant well-being. Deep overhang eaves and climbing plants on the exterior help control solar heat gain, contributing to the building's energy efficiency.</p>	<p>Building features</p> <p>Flexible Teaching Spaces: Echo houses seven adaptable teaching rooms that can be reconfigured to support various educational formats, accommodating between 150 to 700 people. The flexibility allows for a range of teaching methods and collaborative learning experiences.</p> <p>Study Areas: The building offers diverse study environments, including quiet zones for individual work and open areas for group collaboration, catering to different student preferences.</p> <p>Sustainable Materials: In line with sustainability goals, Echo incorporates materials such as bamboo and recycled PET bottles in its construction. Notably, 90% of the furniture used in the building has been repurposed, emphasizing resource efficiency.</p>

Building Title: Echo Building

Project type: new building Campus: TU campus Year: 2022 Location: Delft



Creating an overview.

Type of knowledge

- Project description

Project description

The Echo Building at TU Delft, completed in May 2022, is an innovative, energy-generating interfaculty education facility designed by UNStudio. It is considered the most sustainable building on the TU Delft campus, contributing significantly to the university's goal of becoming fully sustainable by 2030. The building houses a variety of multifunctional teaching spaces and study areas, designed to accommodate diverse teaching methods, from lectures to project-based learning and self-study for around 1,700 students.

Architecturally, Echo promotes openness and transparency, integrating natural light and creating strong visual connections with the surrounding campus. Its innovative design earned the Prix Versailles award for its ecological efficiency and architectural unity.

Functions: Education

Architect: UNStudio

Constructor: BAM Bouw en Techniek

Project profile

Goals	Costs (€)
<p>Accommodate Growing Student Numbers: Echo provides additional educational spaces to meet the increasing demand, featuring open-plan learning rooms with flexible layouts, including a 700-seat lecture hall that can be divided into three separate rooms.</p> <p>Enhance Educational Flexibility: The building supports various teaching methods and study styles, offering over 100 study groups for group work and self-study, thereby fostering a dynamic learning environment.</p> <p>Advance Sustainability: Delft Echo is an energy-producing building, contributing to TU Delft's ambition to create a CO2-neutral and circular campus by 2030. It incorporates solar panels, efficient insulation, and a thermal storage system to generate more energy than it consumes, including geothermal energy for heating, lighting, and catering.</p> <p>Promote Interfaculty Collaboration: As an interfaculty educational building, Echo facilitates collaboration among different departments, providing spaces for education, debates, self-study, and office, thereby fostering interdisciplinary research.</p> <p>Create an Open and Inviting Environment: The building's transparent design allows visibility of educational activities from the outside, fostering a sense of community and engagement among students, staff, and visitors.</p>	
Users	CREM
<p>Users: The building serves a diverse group of users.</p> <p>Students: Echo provides over 300 study spaces for group work and self-study or one-on-one teaching, reimagined for an accessible, diverse teaching methods and study styles.</p> <p>Faculty Members: Echo offers faculty flexible teaching rooms, including a 700-seat lecture hall that can be divided into three separate rooms, to deliver lectures, facilitate group discussions, and conduct project-based learning.</p> <p>Administrative Staff: The building includes office spaces for staff involved in the coordination and support of educational activities, contributing to the efficient operation of academic programs.</p> <p>Visitors and External Partners: Echo's design encourages engagement with the broader community, hosting debates, seminars, and seminars. The events that attract visitors and industry partners.</p> <p>By accommodating these groups, Echo fosters a vibrant and collaborative environment that enhances the educational experience and supports TU Delft's commitment to sustainability and innovation.</p>	<p>Scale metrics:</p> <p>GFA 8,844 m²</p> <p>UFA is not specified in sources, but UFA/GFA ratio is typically around 70% in educational buildings</p> <p>Number of floors: 4</p> <p>% of Educational Space: The majority of the space is allocated for educational purposes.</p> <p>% of Specific Space: Echo provides some specialized spaces for debates, project-based learning, and case-study rooms.</p> <p>The building encompasses approximately 8,844 square meters, providing educational spaces for around 1,700 students.</p>
Energy performance	Building features
<p>Energy Generation: Echo is the first energy-positive university building in the Netherlands, equipped with approximately 1,200 solar panels on its roof. These panels generate more energy than the building consumes, covering all operational needs, including lighting, equipment, and user devices.</p> <p>Ventilation System: The building employs an innovative displacement ventilation system that supplies fresh air from the floor, ensuring efficient air circulation and maintaining a healthy indoor environment.</p> <p>Daylight Optimization: Echo's design maximizes natural light through extensive glass facades, reducing reliance on artificial lighting and enhancing occupant well-being. Deep overhang awnings and climbing plants on the exterior help control solar heat gain, contributing to the building's energy efficiency.</p>	<p>Flexible Teaching Spaces: Echo houses seven adaptable teaching rooms that can be reconfigured to support various educational formats, accommodating between 150 to 700 people. The flexibility allows for a range of teaching methods and collaborative learning experiences.</p> <p>Study Areas: The building offers diverse study environments, including quiet zones for individual work and open areas for group collaboration, catering to different student preferences.</p> <p>Sustainable Materials: In line with sustainability goals, Echo incorporates materials such as bamboo and recycled PET bottles in its construction. Notably, 90% of the furniture used in the building has been repurposed, emphasizing resource efficiency.</p>

Building Title: Echo Building

Project type: new building Campus: TU campus Year: 2022 Location: Delft



Project description

The Echo Building at TU Delft, completed in May 2022, is an innovative, energy-generating interfaculty education facility designed by UNStudio. It is considered the most sustainable building on the TU Delft campus, contributing significantly to the university's goal of becoming fully sustainable by 2030. The building houses a variety of multifunctional teaching spaces and study areas, designed to accommodate diverse teaching methods, from lectures to project-based learning and self-study for around 1,700 students.

Architecturally, Echo promotes openness and transparency, integrating natural light and creating strong visual connections with the surrounding campus. Its innovative design earned the Prix Versailles award for its ecological efficiency and architectural unity.

Functions: Education

Architect: UNStudio

Constructor: BAM Bouw en Techniek

Project profile

<p>Goals</p> <p>Accommodate Growing Student Numbers: Echo provides additional educational spaces to meet the increasing demand, featuring seven teaching rooms with flexible spaces, including a 700-seat lecture hall that can be divided into three separate rooms.</p> <p>Enhance Educational Flexibility: The building supports various teaching methods and study styles, offering over 100 study places for group work and self-study, thereby building a dynamic learning environment.</p> <p>Advance Sustainability Goals: Echo is an energy-producing building, contributing to TU Delft's ambition to create a CO2-neutral and circular campus by 2030. It incorporates solar panels, efficient insulation, and a thermal storage system to generate more energy than it consumes, including geothermal energy for heating, lighting, and catering.</p> <p>Promote Interfaculty Collaboration: As an interfaculty educational building, Echo facilitates collaboration among different departments, providing spaces for education, debates, self-study, and offices, thereby enhancing interdisciplinary interaction.</p> <p>Create an Open and Inviting Environment: The building's transparent design allows visibility of educational activities from the outside, fostering a sense of community and engagement among students, staff, and visitors.</p>	<p>Costs (€):</p>
<p>Users</p> <p>The building serves a diverse group of users:</p> <ul style="list-style-type: none"> Students: Echo provides over 300 study spaces for group work and self-study along with seven teaching rooms designed to accommodate various teaching methods and study styles. Faculty Members: Teachers utilize flexible teaching rooms, including a 700-seat lecture hall that can be divided into three separate rooms, to deliver lectures, facilitate group discussions, and conduct project-based learning. Administrative Staff: The building includes office spaces for staff involved in the coordination and support of educational activities, contributing to the efficient operation of academic programs. Visitors and External Partners: Echo's design encourages engagement with the broader community, hosting debates, seminars, and collaborative events that attract visitors and industry partners. <p>By accommodating these groups, Echo fosters a vibrant and collaborative environment that enhances the educational experience and supports TU Delft's commitment to sustainability and innovation.</p>	<p>Square meters</p> <p>GFA 8,844 m² UFA is not specified in sources, but UFA/GFA ratio is typically around 70% in educational buildings Number of floors: 4</p> <p>% of Educational Space: The majority of the space is allocated for educational purposes</p> <p>% of Specific Space: Echo provides some specialized spaces for debates, project-based learning, and case-study rooms</p> <p>The building encompasses approximately 8,844 square meters, providing educational spaces for around 1,700 students.</p>
<p>Energy performance</p> <p>Energy Generation: Echo is the first energy-positive university building in the Netherlands, equipped with approximately 1,200 solar panels on its roof. These panels generate more energy than the building consumes, covering all operational needs, including lighting, equipment, and user devices.</p> <p>Ventilation System: The building employs an innovative displacement ventilation system that supplies fresh air from the floor, ensuring efficient air circulation and maintaining a healthy indoor environment.</p> <p>Daylight Optimization: Echo's design maximizes natural light through extensive glass facades, reducing reliance on artificial lighting and enhancing occupant well-being. Deep aluminum awnings and climbing plants on the exterior help control solar heat gain, contributing to the building's energy efficiency.</p>	<p>Building features</p> <p>Flexible Teaching Spaces: Echo houses seven adaptable teaching rooms that can be reconfigured to support various educational formats, accommodating between 150 to 700 people. The flexibility allows for a range of teaching methods and collaborative learning experiences.</p> <p>Study Areas: The building offers diverse study environments, including quiet zones for individual work and open areas for group collaboration, catering to different student preferences.</p> <p>Sustainable Materials: In line with its sustainability goals, Echo incorporates materials such as bamboo and recycled PET bottles in its construction. Notably, 90% of the furniture used in the building has been repurposed, emphasizing resource efficiency.</p>

Creating an overview.

Type of knowledge

- Strategic data
- Functional data
- Physical data

Not retrievable

- Financial data

Building Title: Echo Building

Project type: new building Campus: TU campus Year: 2022 Location: Delft



Project description

The Echo Building at TU Delft, completed in May 2022, is an innovative, energy-generating interfaculty education facility designed by UNStudio. It is considered the most sustainable building on the TU Delft campus, contributing significantly to the university's goal of becoming fully sustainable by 2030. The building houses a variety of multifunctional teaching spaces and study areas, designed to accommodate diverse teaching methods, from lectures to project-based learning and self-study for around 1,700 students.

Architecturally, Echo promotes openness and transparency, integrating natural light and creating strong visual connections with the surrounding campus. Its innovative design earned the Prix Versailles award for its ecological efficiency and architectural unity.

Functions: Education
Architect: UNStudio
Constructor: BAM Bouw en Techniek

Project profile

Goals
 Accommodate Growing Student Numbers: Echo provides additional educational space to meet the increasing demand, featuring open-plan learning rooms with flexible layouts, including a 700-seat lecture hall that can be divided into three separate rooms.
 Enhance Educational Flexibility: The building supports various teaching methods and study styles, offering over 100 study groups for group work and self-study, thereby fostering a dynamic learning environment.
 Achieve Sustainability Goals: Echo is an energy-generating building, contributing to TU Delft's ambition to create a CO2-neutral and circular campus by 2025. It incorporates solar panels, efficient insulation, and a thermal storage system to generate more energy than it consumes, including renewable energy for laptops, lighting, and catering.
 Promote Interfaculty Collaboration: As an interfaculty educational building, Echo facilitates collaboration among different departments, providing spaces for education, debates, self-study, and office, thereby enhancing interdisciplinary research.
 Create an Open and Inviting Environment: The building's transparent design allows visibility of educational activities from the outside, fostering a sense of openness and engagement among students, staff, and visitors.

Costs (€)

Users
 The building serves a diverse group of users:
 Students: Echo provides over 300 study spaces for group work and self-study or group work, with some teaching rooms designed for an extended lecture teaching methods and study styles.
 Faculty Members: Echo offers flexible teaching rooms, including a 700-seat lecture hall that can be divided into three separate rooms, to deliver lectures, host group discussions, and conduct project-based learning.
 Administrative Staff: The building includes office spaces for staff involved in the coordination and support of educational activities, contributing to the efficient operation of academic programs.
 Visitors and External Partners: Echo's design encourages engagement with the broader community, hosting debates, seminars, and seminars. The events that attract visitors and industry partners.
 By accommodating these groups, Echo fosters a vibrant and collaborative environment that enhances the educational experience and supports TU Delft's commitment to sustainability and innovation.

CREM
Volume metrics
 GFA 8,844 m²
 UFA is not specified in sources, but UFA/GFA ratio is typically around 70% in educational buildings
 Number of floors: 4
 % of Educational Space: The majority of the space is allocated for educational purposes.
 % of Specific Space: Echo provides some specialized spaces for debates, project-based learning, and case-study rooms.
 The building encompasses approximately 8,844 square meters, providing educational spaces for around 1,700 students.

Energy performance
Energy Generation: Echo is the first energy-positive university building in the Netherlands, equipped with approximately 1,200 solar panels on its roof. These panels generate more energy than the building consumes, covering all operational needs, including lighting, equipment, and user devices.
Ventilation System: The building employs an innovative displacement ventilation system that supplies fresh air from the floor, ensuring efficient air circulation and maintaining a healthy indoor environment.
Daylight Optimization: Echo's design maximizes natural light through extensive glass facades, reducing reliance on artificial lighting and enhancing occupant well-being. Deep aluminum eaves and climbing plants on the exterior help control solar heat gain, contributing to the building's energy efficiency.

Building facilities
Flexible Teaching Spaces: Echo houses seven adaptable teaching rooms that can be reconfigured to support various educational formats, accommodating between 150 to 700 people. The flexibility allows for a range of teaching methods and collaborative learning experiences.
Study Areas: The building offers diverse study environments, including quiet zones for individual work and open areas for group collaboration, catering to different student preferences.
Sustainable Materials: In line with its sustainability goals, Echo incorporates materials such as bamboo and recycled PET bottles in its construction. Notably, 90% of the furniture used in the building has been repurposed, emphasizing resource efficiency.

Creating an overview.

Additional knowledge

- Building functions
- Energy performance
- Facilities
- Innovations
- Architect & constructor

Creating an overview.

Database by Den Heijer (2011)

- 39 Dutch university buildings
- Buildings till 2010
- Developing time: 5 years

Database by Altinkaya Genel et al. (2023)

- Only 14 Dutch university buildings
- Limited knowledge



Updated database

- 39 Dutch university buildings
- 149 European university buildings
- Buildings from 2011 till 2024
- Developing time: within a week

Analyzing & identifying.

4. Use AI to **analyze** and **identify** patterns, trends and innovations in university buildings.

Analyzing & identifying.



Tailored GPT model

Analyzing & identifying.



Tailored GPT model

Evaluation criteria

- Task-specific performance
- Domain expertise
- Contextual understanding
- Factual accuracy and reliability
- User experience

Analyzing & identifying.



Tailored GPT model

Evaluation criteria

- Task-specific performance → ✓
- Domain expertise → ✓
- Contextual understanding → ✗
- Factual accuracy and reliability → ✓
- User experience → ✓

What are some recent innovations in energy generating technologies in university real estate, and in which buildings has this been applied?



Recent Innovations in Energy-Generating University Real Estate

1. **Energy Academy Europe (EAE), University of Groningen:**
 - **Features:** The building is energy-positive, producing more energy than it consumes. Key innovations include:
 - A **solar chimney** for natural ventilation.
 - A **thermal labyrinth** for air pre-conditioning and energy storage.
 - A large roof covered with approximately 2,000 solar panels.
 - **Recognition:** Achieved BREEAM 'Outstanding' certification.
2. **Echo Building, TU Delft:**
 - **Features:**
 - Incorporates **1,200 solar panels**, effective insulation, and a thermal energy storage system.
 - The building produces surplus energy, including for user-related activities like lighting and laptop use.
 - **Purpose:** Supports the goal of creating a CO2-neutral and circular campus by 2030.
3. **Langeveld Building, Erasmus University Rotterdam:**
 - **Features:**
 - Operates energy-neutrally through a combination of solar panels, heat pumps, and underground thermal energy storage.
 - Features an innovative **Earth, Wind & Fire ventilation system** powered by natural elements.
 - **Recognition:** BREEAM 'Outstanding' certification.

These innovations highlight the commitment of universities to integrating advanced energy solutions into their real estate projects, driving sustainability while setting examples for eco-friendly construction.

Analyzing & identifying.

Can you give two reference projects in which adaptive reuse has been applied, one in the Netherlands and one outside the Netherlands?



Here are two reference projects highlighting **adaptive reuse**, one in the Netherlands and one outside:

1. Atlas Building (Eindhoven University of Technology, Netherlands)

- **Completion Year:** 2019
- **Adaptive Reuse Highlights:**
 - Transformed a 1960s-era university building into a sustainable and innovative educational hub.
 - Achieved **BREEAM Outstanding certification** with a score of 96.01%, significantly improving energy efficiency and reducing CO2 emissions by 80%.
 - Incorporates advanced technologies like a high-performance climate façade and intelligent lighting systems.
- **Usage:** Serves as a central education and research facility, showcasing how older buildings can meet modern academic and sustainability needs.

2. Mylly Building (University of the Arts Helsinki, Finland)

- **Completion Year:** 2021
- **Adaptive Reuse Highlights:**
 - Repurposed a historic industrial building into a state-of-the-art art and design education facility.
 - Retained elements of the original structure, including exposed brickwork and industrial features, while integrating modern studios and lecture spaces.
 - Focuses on blending historical character with cutting-edge facilities for creative disciplines.
- **Usage:** A vibrant academic space that respects its industrial heritage while supporting contemporary educational practices.

These projects demonstrate how adaptive reuse can preserve history while meeting the demands of modern university environments, with a strong focus on sustainability and innovation. Let me know if you need more information!

Added value AI.

AI incorporated tools

- Time-efficient
- Human-like responses
- Overcoming barrier lack of time
- Keeping up to date

Non-AI incorporated tools

- Requires human input
- Structured data inputs and outputs
- Further enabling barrier lack of time

Synthesis.

Expert evaluation and testing

Database evaluation.

Evaluation criteria:

1. Accuracy

2. Completeness

3. Relevance

Database evaluation.

Evaluation criteria:

1. Accuracy

Results

- Knowledge is correct

Improvements

- Data presentation
- More precise definitions

2. Completeness

3. Relevance

Database evaluation.

Evaluation criteria:

1. Accuracy

Results

- Knowledge is correct

Improvements

- Data presentation
- More precise definitions

2. Completeness

Results

- Static data / explicit knowledge
- Overall complete

Improvements

- Dynamic data
- Numerical data
- Further enhancing data scope

3. Relevance

Database evaluation.

Evaluation criteria:

1. Accuracy

Results

- Knowledge is correct

Improvements

- Data presentation
- More precise definitions

2. Completeness

Results

- Static data / explicit knowledge
- Overall complete

Improvements

- Dynamic data
- Numerical data
- Further enhancing data scope

3. Relevance

Results

- Presented knowledge is relevant

Improvements

- Numerical data
- Real-time data

Tailored GPT testing.

Tailored GPT testing.

Evaluation criteria:

1. Clarity

2. Usefulness

3. Accuracy

4. Limitations

Tailored GPT testing.

Evaluation criteria:

1. Clarity

2. Usefulness

3. Accuracy

4. Limitations

Results

- Easy to understand
- Well-structured

Improvements

- No indication of knowledge gap

Tailored GPT testing.

Evaluation criteria:

1. Clarity

Results

- Easy to understand
- Well-structured

Improvements

- No indication of knowledge gap

2. Usefulness

Results

- Gathering knowledge
- Time saving

Improvements

- Data update frequency

3. Accuracy

4. Limitations

Tailored GPT testing.

Evaluation criteria:

1. Clarity

Results

- Easy to understand
- Well-structured

Improvements

- No indication of knowledge gap

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Results

- Gathering knowledge
- Time saving

Improvements

- Data update frequency

3. Accuracy

Results

- Mixed accuracy
- Accurate in handling general and qualitative knowledge

Improvements

- Handling numerical data
- No indication of knowledge gap

4. Limitations

Tailored GPT testing.

Evaluation criteria:

1. Clarity

Results

- Easy to understand
- Well-structured

Improvements

- No indication of knowledge gap

2. Usefulness

Results

- Gathering knowledge
- Time saving

Improvements

- Data update frequency

3. Accuracy

Results

- Mixed accuracy
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Improvements

- Handling numerical data
- No indication of knowledge gap

4. Limitations

Results

- Numerical data
- Tendency to provide an answer

Improvements

- Indicating when it does not possess knowledge

4



Discussion &
conclusion

*“How can **Artificial Intelligence (AI)** be utilized to enhance **knowledge exchange** about **university real estate buildings**?”*

Discussion.

Theory

- Lack of shared databases
- Lack of time
- Two existing Dutch databases
- Lack of updated shared databases

Discussion.

Theory

- Lack of shared databases
- Lack of time
- Two existing Dutch databases
- Lack of updated shared databases

Practice

- All the potential to overcome barriers
- Shared database as stepping stool for knowledge exchange
- Up to date and relevant project database

Discussion.

Theory

- Lack of shared databases
- Lack of time
- Two existing Dutch databases
- Lack of updated shared databases

Practice

- All the potential to overcome barriers
- Shared database as stepping stool for knowledge exchange
- Up to date and relevant project database

Evaluation

- Explicit knowledge
- Stepping stool for tacit knowledge
- No numerical and dynamic data

Conclusion.

“How can Artificial Intelligence (AI) be utilized to enhance knowledge exchange about university real estate buildings?”

Conclusion.

“How can Artificial Intelligence (AI) be utilized to enhance knowledge exchange about university real estate buildings?”

- The lack of updated and relevant shared databases

Conclusion.

“How can Artificial Intelligence (AI) be utilized to enhance knowledge exchange about university real estate buildings?”

- The lack of updated and relevant shared databases
- AI is time-efficient and useful for updating

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Conclusion.

“How can Artificial Intelligence (AI) be utilized to enhance knowledge exchange about university real estate buildings?”

- The lack of updated and relevant shared databases
- AI is time-efficient and useful for updating
- Quick and easily access to explicit knowledge
- Stepping stool for tacit knowledge
- Facilitator for the enhancement of knowledge exchange

Conclusion.

“How can Artificial Intelligence (AI) be utilized to enhance knowledge exchange about university real estate buildings?”

- The lack of updated and relevant shared databases
- AI is time-efficient and useful for updating
- Quick and easily access to explicit knowledge
- Stepping stool for tacit knowledge
- Facilitator for the enhancement of knowledge exchange
- However, not capable to process numerical and dynamic data and knowledge

5



Limitations & Recommendations

Limitations.

- Interviewees & experts

Limitations.

- Interviewees & experts
- University real estate from the rest of the world

Limitations.

- Interviewees & experts
- University real estate from the rest of the world
- Limitations to Artificial Intelligence

Recommendations.



Different real estate

Recommendations.



Different real estate



Rest of the world

Recommendations.



Different real estate



Rest of the world



Collaborative platform

Recommendations.



Different real estate



Rest of the world



Collaborative platform



Other barriers

Thank you.

Menno in 't Veld
P5 presentation
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