Adaptive Re-use of Industrial Heritage in Dutch Post-industrial Urban Area Development

The relation of the adaptive reuse and the added value in regards to the economic, social, and environmental sustainability

Personal information

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Graduation supervision

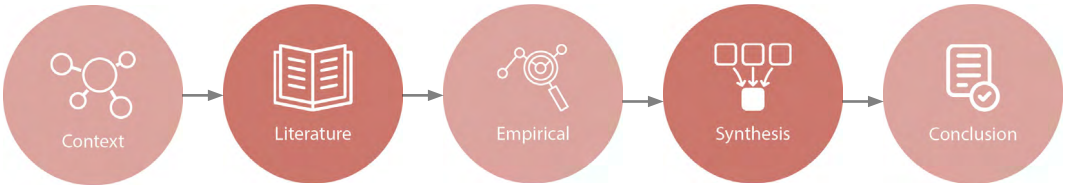
First Mentor: Yawei Chen
Second Mentor: Hilde Remøy
Delegate of the board of examiners: Arie Romein

TU Delft Department of Management in the Built Environment
BK Bouwkunde

“People feel that the building is aged, all footsteps set by others before resonate. It is a subconscious enthusiasm that cannot always be defined by people”.

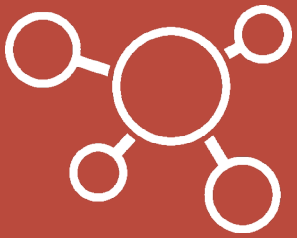
- Research participant AB (10) -

Structure



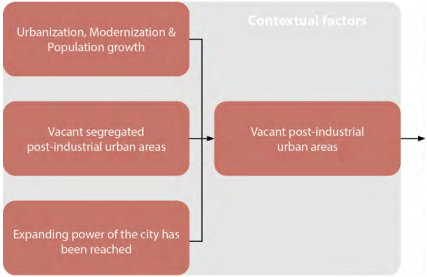
Central question of this research:

How does the adaptive reuse of industrial heritage, in post- industrial Dutch urban area development, relate to the added value, in regards to the economic, social, and environmental sustainability?



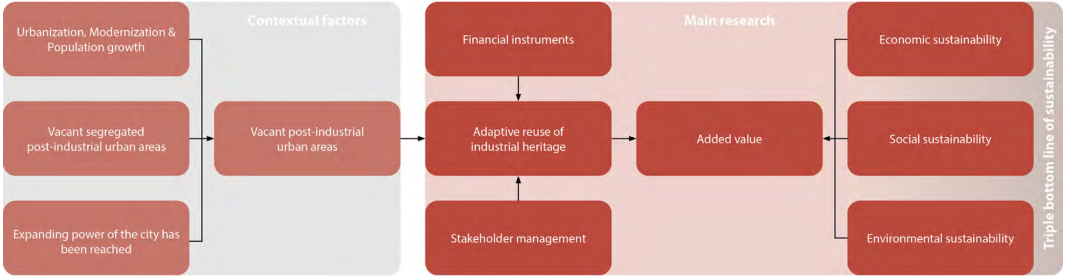
Context

Conceptual framework



Conceptual framework with the context factors that result in adaptive reuse and the main structure of the research (own illustration).

Conceptual framework



Conceptual framework with the context factors that result in adaptive reuse and the main structure of the research (own illustration).

Scope definition

Scope definition of the research (own figure)

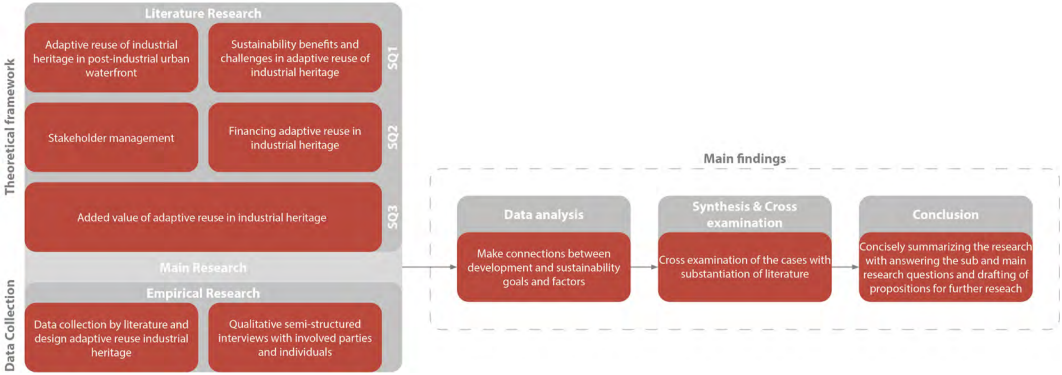
(Rotterdam Katendrecht, 2015)

(De Kaap Blijft Aantrekkelijk, n.d.)

Methodology

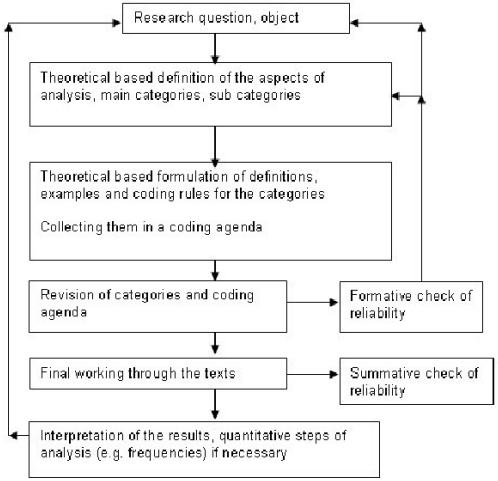
Research design/methods model that works as a guideline to answer the main research question (own illustration).

Methodology



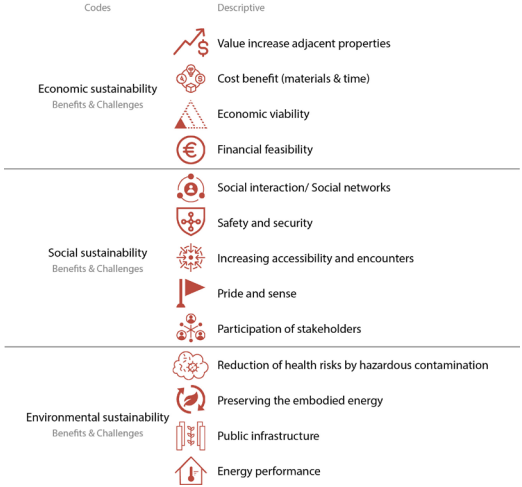
Research design/methods model that works as a guideline to answer the main research question (own illustration).

Data analysis



Process diagram for deductive qualitative case study research (Mayring, 2000)

Data analysis



Deductive coding scheme for the data analysis on the sustainability of the cases.

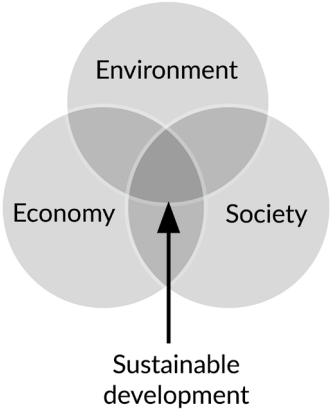
Literature

City - port interface

STAGE	SYMBOL ○ City ● Port	PERIOD	CHARACTERISTICS
I Primitive port/city		Ancient/medieval to 19th century	Close spatial and functional association between city and port.
II Expanding port/city		19th - early 20th century	Rapid commercial/industrial growth forces port to develop beyond city confines, with linear quays and break-bulk industries.
III Modern industrial port/city		mid - 20th century	Industrial growth (especially oil refining) and introduction of containers/ro-ro require separation/space.
IV Retreat from the waterfront		1960 s - 1980 s	Changes in maritime technology induce growth of separate maritime industrial development areas.
V Redevelopment of waterfront		1970 s - 1990 s	Large-scale modern port consumes large areas of land/water space; urban renewal of original core.
VI Renewal of port/city links		1980 s - 2000+	Globalization and intermodalism transform port roles; port-city associations renewed; urban redevelopment enhances port-city integration.

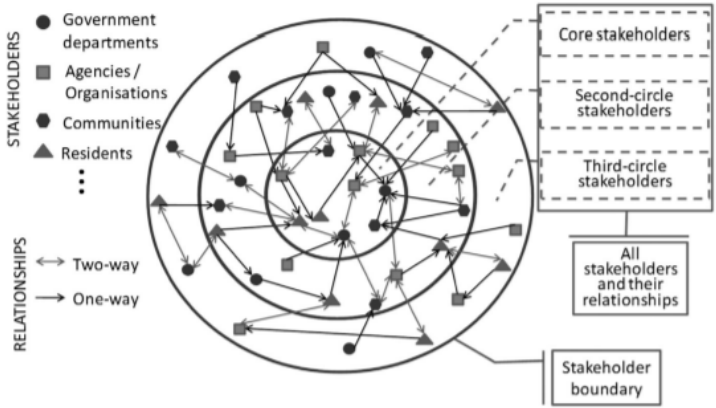
The different stages in the traditional port-city interface (Hoyle, 1998)

Sustainability in adaptive reuse



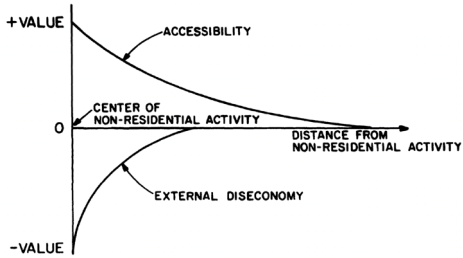
Venn diagram of sustainable development. The three sustainability pillars that comprise sustainable development (Parkin et al., 2003).

Stakeholder management

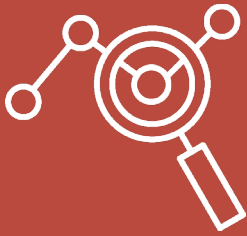


Schematic model on stakeholder relation within urban development (Yang, 2014).

Added value of adaptive reuse in industrial heritage



Reappraisal of industrial heritage and the catalyst effect (Persoon, 2019). Value dispersion of heritage buildings on its surroundings (Li & Brown, 1980).



Empirical

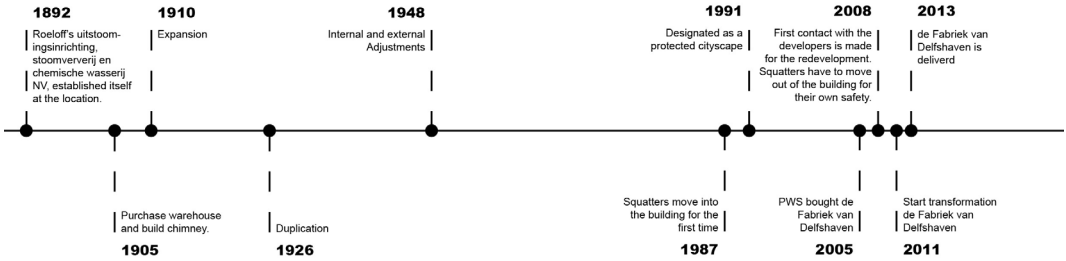
Case study selection

Map of Rotterdam with the location of the case studies (own image).

de Fabriek van Delfshaven

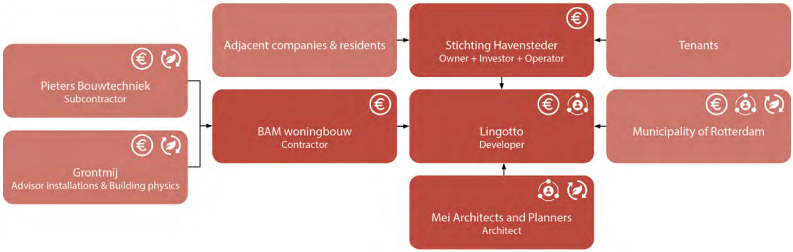
Location	Mathenesserdijk 410, 3026 GV, Rotterdam
Monumental status	Municipal monument
Old function	Factory
Year of construction	1892
Year of transformation	2013
Surface	3.560m2
Programme new function	Multi-tenant office building
Development costs	€4.000.000
Initiator development	Stichting Havensteder (Housing Association)

History timeline



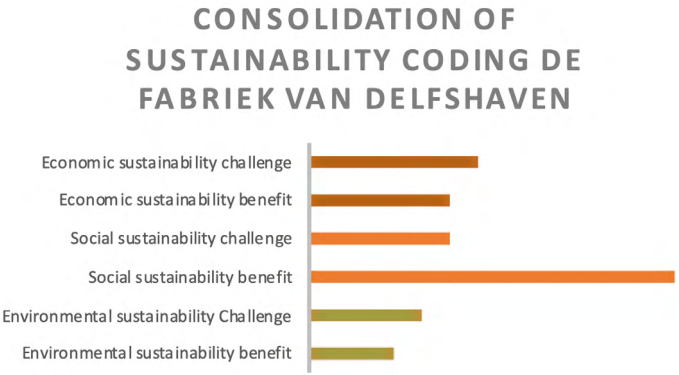
(Restauratie “de Fabriek” in Delfshaven, 2009)

Stakeholder management



Stakeholder relation diagram within the adaptive reuse of de Fabriek van Delfshaven and their sustainability goals (own image).

Sustainability overview



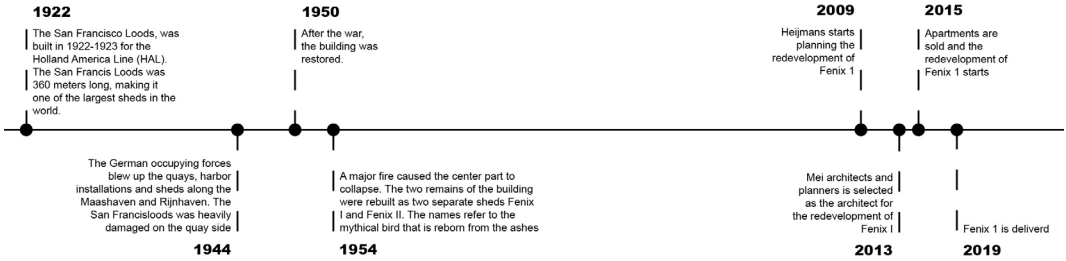
Deductive coding of the related interviews with de Fabriek van Delfshaven.


DE FABRIEK VAN DELFSHAVEN
410

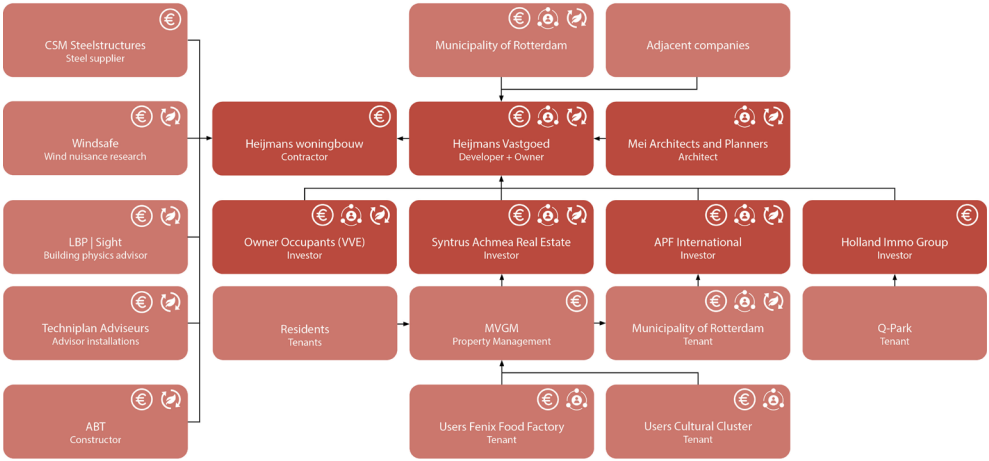
Fenix 1

Location	Veerlaan | Rijnhaven, 3072 ZP, Rotterdam
Monumental status	No monument
Old function	Warehouse
Year of construction	1922
Year of transformation	2019
Surface	40.500m2
Programme new function	Commercial, cultural, parking, loft apartments
Development costs	€48.000.000
Initiator development	Heijmans (Developer & Constructor)

History timeline

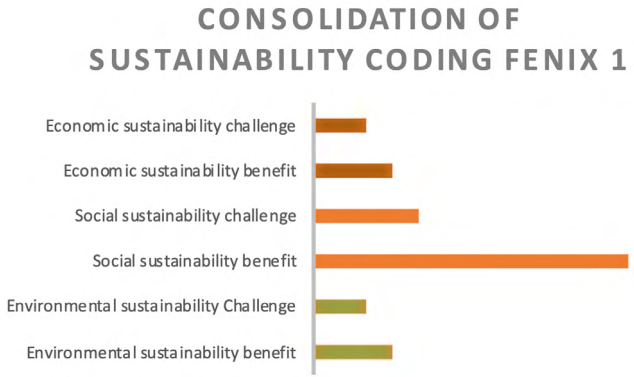


(Fenix 1 Opgeleverd, 2019)



Stakeholder relation diagram within the adaptive reuse of Fenix 1 and their sustainability goals (own image).

Sustainability overview



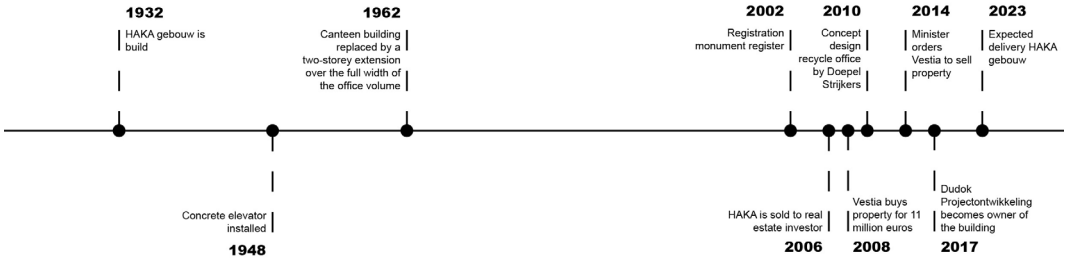
Deductive coding of the related interviews with Fenix 1.


DOCKS
CODARTS

HAKA

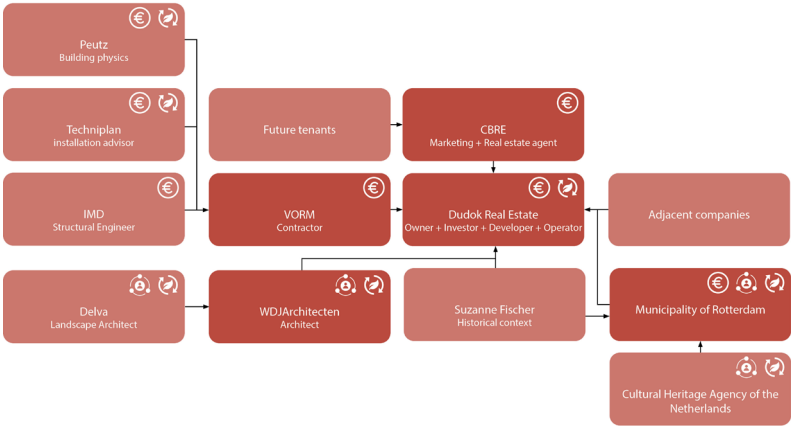
Location	Vierhavenstraat 38, 3029 BE, Rotterdam
Monumental status	National monument
Old function	Warehouse, factory, and office
Year of construction	1932
Year of transformation	2022/2023 (future)
Surface	10.500m2
Programme new function	Multi-company office building, catering industry
Development costs	€22.000.000
Initiator development	Dudok Projectontwikkeling (Developer & Investor)

History timeline



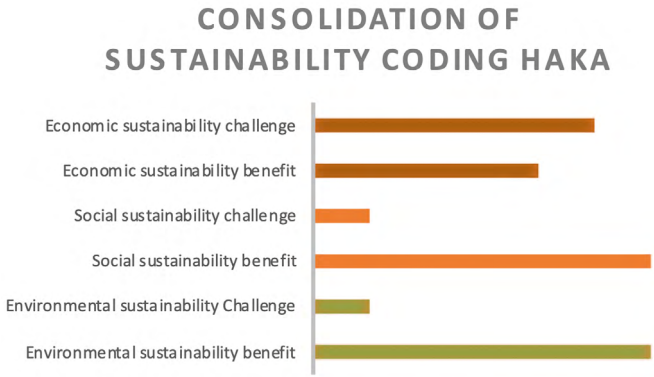
(Herbestemming HAKA Gebouw, Rotterdam, n.d.)

Stakeholder management



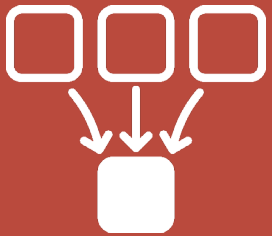
Stakeholder relation diagram within the adaptive reuse of HAKA and their sustainability goals (own image).

Sustainability overview



Deductive coding of the related interviews with HAKA.

(Herbestemming HAKA Gebouw, Rotterdam, n.d.)



Synthesis

Sustainability adaptive reuse of industrial heritage

Sankey diagram of de Fabriek van Delfshaven and Fenix 1 with the general prospect of adaptive reuse of industrial heritage on sustainability.

Economic sustainability

- Alteration of the existing structure which impacts on the cost-benefit
- Spreading risks by different financing

Economic sustainability case- code occurrence table of de Fabriek van Delfshavenand Fenix 1 with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	de Fabriek van Delfshaven Gr=49; GS=3			Fenix 1 Gr=85; GS=4			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
• Economic sustainability benefit	5	9,091	45,45%	7	9,333	46,67%	8	8	40,00%
• Economic sustainability challenge	6	10,909	54,55%	8	10,667	53,33%	12	12	60,00%
Totals	11	20	100,00%	15	20	100,00%	20	20	100,00%

Social sustainability

- Difference in function and the abundance of stakeholders

Social sustainability case- code occurrence table of de Fabriek van Delfshavenand Fenix 1 with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	de Fabriek van Delfshaven Gr=49; GS=3			Fenix 1 Gr=85; GS=4			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
• Social sustainability benefit	15	29,211	75,00%	34	34	79,07%	15	35,833	83,33%
• Social sustainability challenge	5	9,737	25,00%%	9	9	20,93%	3	7,167	16,67%
Totals	20	43	100,00%	43	43	100,00%	18	43	100,00%

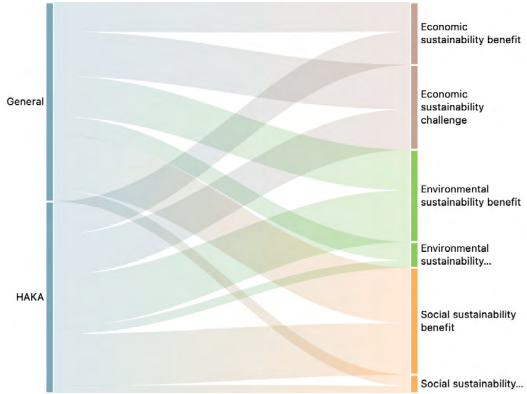
Environmental sustainability

- Preserving embodied energy
- Public infrastructure

Environmental sustainability case- code occurrence table of de Fabriek van Delfshavenand Fenix 1 with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	de Fabriek van Delfshaven Gr=49; GS=3			Fenix 1 Gr=85; GS=4			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
• Environmental sustainability benefit	4	9,143	57,14%	10	10,00	62,50%	11	11,00	68,75%
• Environmental sustainability challenge	3	6,857	42,86%	6	6,00	37,50%	5	5,00	31,25%
Totals	7	16,00	100,00%	16	16,00	100,00%	16	16,00	100,00%

Sustainability in design and decision-making process



Sankey diagram of HAKA with the general prospect of adaptive reuse of industrial heritage on sustainability.

Economic sustainability

- The complexity lies in the initiation of the project
- Great impact on the economic viability and the catalyst of the area
- Finding tenants can be difficult and results in a need to revize the plan

Economic sustainability case- code occurrence table of HAKA with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	HAKA Gr=71; GS=3			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
• Economic sustainability benefit	8	8,889	44,44%	8	8,00	40,00%
• Economic sustainability challenge	10	11,111	55,56%	12	12,00	60,00%
Totals	18	20	100,00%	20	20	100,00%

Social sustainability

- The function of the case enhances social interaction and social networks and increases the accessibility and encounters in the area
- The monumental status of the building contributes to the pride and sense of the place

Social sustainability case- code occurrence table of HAKA with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	HAKA Gr=71; GS=3			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
• Social sustainability benefit	12	15,429	85,71%	15	15,00	83,33%
• Social sustainability challenge	2	2,571	14,29%	3	3,00	16,67%
Totals	14	18	100,00%	18	20	100,00%

Environmental sustainability

- Allocated in an active industrial area which comes with pollution and nuisance
- The monumental status of the asset ensures high preservation of the embodied energy
- Incorporated many alterations for the development of the public infrastructure
- High energy performance due to the target group

Environmental sustainability case- code occurrence table of HAKA with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	HAKA Gr=71; GS=3			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
• Environmental sustainability benefit	12	13,714	85,71%	11	11,00	68,75%
• Environmental sustainability challenge	2	2,286	14,29%	5	5,00	31,25%
Totals	14	16	100,00%	16	16	100,00%

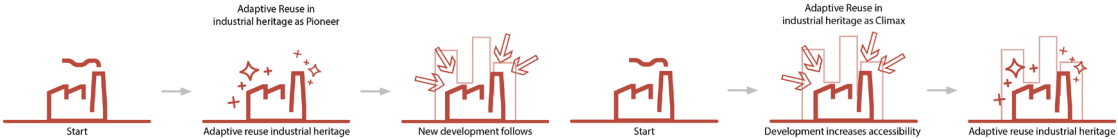
Conclusion

Central question of this research:

How does the adaptive reuse of industrial heritage, in post- industrial Dutch urban area development, relate to the added value, in regards to the economic, social, and environmental sustainability?

Conclusion

- Adaptive reuse of industrial heritage greatly improves the social and environmental sustainability
- There is no clear correlation between the industrial heritage and improved economic sustainability
- The degree to which sustainability is enhanced is dependent on various sustainability benefits and challenges
- This research begins to understand the factors that impact the degree of added value on sustainability



Visualization of the initiation phase of adaptive reuse in industrial heritage (own image).

Conclusion

Factors that impact the degree of added value on sustainability

- Alteration of the existing structure impacts the cost-benefit and the embodied energy preservation
- Spreading risks increases the financial continuity of the redevelopment
- The new function enhances social interaction and increases the accessibility and encounters
- Adaptive reuse in industrial heritage greatly improves the economic viability of the area
- The monumental status of the building contributes to the pride and sense and the preservation of embodied energy

Limitations

- Scope of the cases limits the credibility of framework and conclusion
- The number of case studies limits the validity and significance of the conclusion
- The case studies are not entirely comparable which limits the validity and significance of the conclusion
- Old cases limit the possibility to find proper unambiguous data
- Limited qualitative data makes the assessment biased and multi-interpretable
- The majority of the qualitative data is sourced from interviews that can be steered by the interviewer and the interview protocol

Recommendations

- Furthering the research and understanding the impact factors presented, the benefits and the process of adaptive reuse of industrial hertiage can be optimized to ensure more sustainable and successful end products.

- Incorporating an assessment tool for sustainability in adaptive reuse within practice can make the actual sustainability of redevelopment projects more sophisticated.

Presentation image references

De kaap blijft aantrekkelijk. (n.d.). [Photograph]. Havenkwartier-Katendrecht. https://www.havenkwartier-katendrecht.nl/katendrecht/

Fenix 1 opgeleverd. (2019, November 28). [Photograph]. Nieuws Top010. https://nieuws.top010.nl/fenixloodsen-rotterdam.htm

Herbestemming HAKA gebouw, Rotterdam. (n.d.). [Photograph]. Wdjarchitecten. https://www.wdjarchitecten.nl/projecten/herbestemming-haka-gebouw/

Restauratie “de Fabriek” in Delfshaven. (2009, August 13). [Photograph]. Skyscrapercity. https://www.skyscrapercity.com/threads/rotterdam-restauratie-de-fabriek-in-delfshaven.934262/

Rotterdam Katendrecht. (2015, March 8). [Photograph]. Fotos Serc. http://fotos.serc.nl/zuid-holland/rotterdam/rotterdam-28223/

Thank you for your attention

Personal information

Name: Corné de Broekert
Student Number: 4571231

Graduation supervision

First Mentor: Yawei Chen
Second Mentor: Hilde Remøy
Delegate of the board of examiners: Arie Romein

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Sustainability adaptive reuse of industrial heritage

Case- code occurrence table of de Fabriek van Delfshaven and Fenix 1 with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	de Fabriek van Delfshaven Gr=49; GS=3			Fenix 1 Gr=85; GS=4			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
● Economic sustainability benefit	5	9,737	13,16%	7	7	9,46%	8	10,963	14,81%
● Economic sustainability challenge	6	11,684	15,79%	8	8	10,81%	12	16,444	22,22%
● Environmental sustainability benefit	4	7,789	10,53%	10	10	13,51%	11	15,074	20,37%
● Environmental sustainability challenge	3	5,842	7,89%	6	6	8,11%	5	6,852	9,26%
● Social sustainability benefit	15	29,211	39,47%	34	34	45,95%	15	20,556	27,78%
● Social sustainability challenge	5	9,737	13,16%	9	9	12,16%	3	4,111	5,56%
Totals	38	74	100,00%	74	74	100,00%	37	74	100,00%

Sustainability in design and decision-making process

Case- code occurrence table of HAKA with the general prospect of adaptive reuse of industrial heritage on sustainability.

Codes	HAKA Gr=71; GS=3			General Gr=117; GS=5		
	Absolute	Normalized	Column relative	Absolute	Normalized	Column relative
• Economic sustainability benefit	8	9,391	17,39%	8	8	14,81%
• Economic sustainability challenge	10	11,739	21,74%	12	12	22,22%
• Environmental sustainability benefit	12	14,087	26,09%	11	11	20,37%
• Environmental sustainability challenge	2	2,348	4,35%	5	5	9,26%
• Social sustainability benefit	12	14,087	26,09%	15	15	27,78%
• Social sustainability challenge	2	2,348	4,35%	3	3	5,56%
Totals	46	54	100,00%	37	54	100,00%