

The emergence of the building material hub

A STUDY IDENTIFYING BUILDING MATERIAL HUBS FOR A CIRCULAR BUILT ENVIRONMENT AND FACTORS EXPLAINING THEIR EMERGENCE

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Problem statement

Matching supply and demand of secondary materials in time and geographical location^[1]

- Adequate supply and demand^[2]
- Effective communication of supply and demand^[3]
- Temporary storage to bridge mismatch in time^[4]

A (circular) building material hub could be the solution

- Materials are checked, temporarily stored and bundled^[5]
- Fewer transport movements^[5]
- Smart use of materials promotes circular construction^[6]

[1] Hiete, Stengel, Ludwig, & Schultmann, 2011; [2] Loeber & Snoek, 2020; [3] Verhagen, Sauer, van der Voet, & Sprecher, 2021; [4] Van Merriënboer, Bastein, Rondaij, & Rabbie, 2022; [5] De Bes, et al., 2018; [6] Joensuu, Edelman, & Saari, 2020)

Research question

“What different building material hubs in relation to a circular built environment exist, and what factors explain their emergence?”

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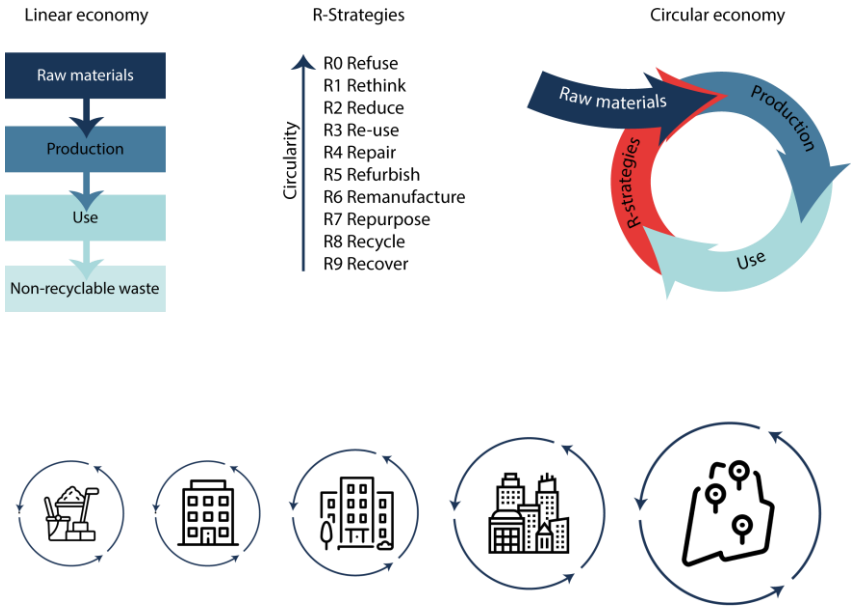
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Circular Built Environment



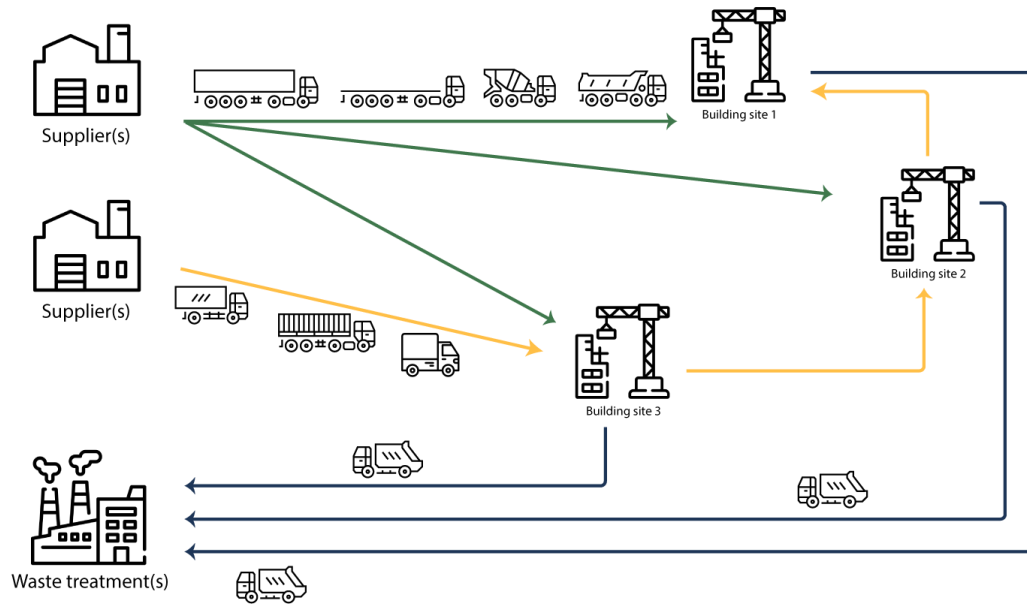
9-R framework^[7]

Circular Built Environment on different scales^[8]

Maximize the use of building materials^[9]

90% of waste is cycled, but only 8% is from secondary sources^[10]

(^[7] Krichherr et al., 2017; ^[8] TU Delft, sd; ^[9] Ramli, 2020; ^[10] Circle Economy & Metabolic, 2022)



Construction logistics

Convergent supply chain to the building site^[11]

Building supply is instable and fragmented

Circular building material hub^[12]

- Logistical function
- Temporary storage of secondary materials
- Repository or marketplace

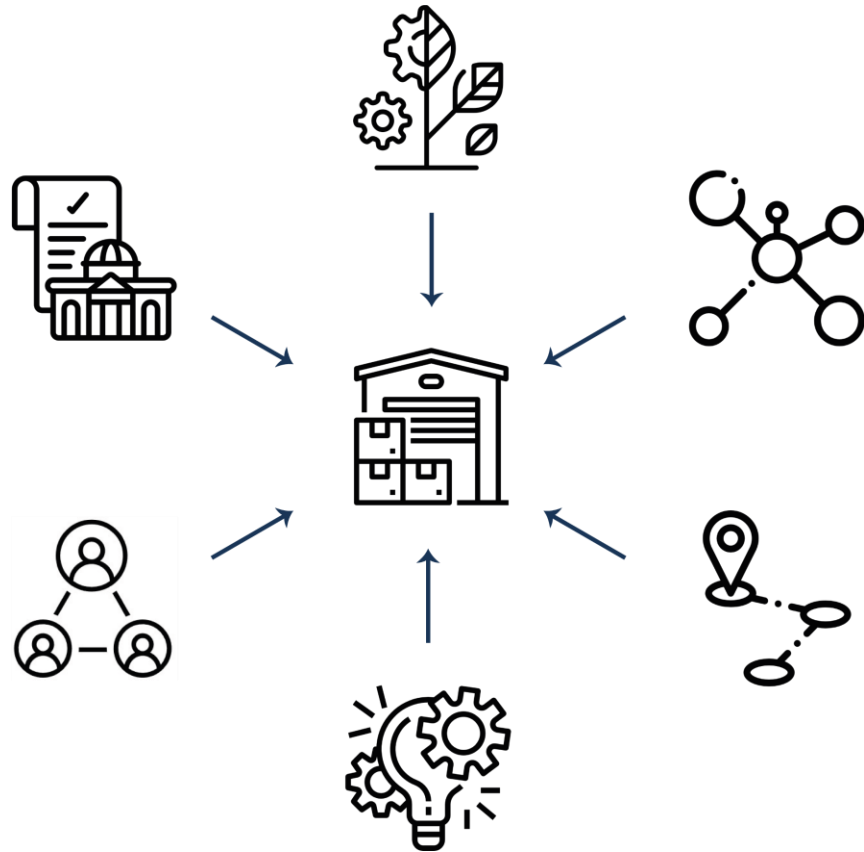


([11] Balm, Berden, Morel, & Ploos van Amstel, 2018; [12] Gemeente Amsterdam, 2022)

Type of BMH	Description	Circular function
Construction site hub[13; 14]	A dedicated location on the construction site where materials are temporarily stored.	No circular function is facilitated
Suppliers' building material hub[14; 15]	The location of a preselected supplier where construction materials and equipment are consolidated.	No circular function is facilitated
Floating building material hub[13; 16; 17]	A floating location that can be used for temporary storage and transshipment of building materials and equipment if the construction site is located adjacent to water.	No circular function is facilitated
Circular Craft Centre[18; 19]	A location where a collection of existing (or new) initiatives are cleverly situated and organized in relation to each other, to realize high-quality product and material reuse.	Repository and marketplace
Mandatory building material hub[21]	A location where building materials are consolidated for several construction flows and is that is made mandatory for large new construction projects in a city.	Construction logistics
Circular building material hub[4]	A location where the collection, sorting and processing of non-bulk waste into secondary materials takes place.	Secondary material storage and repository and marketplace
Multimodal material hub[21]	A location that, depending on the construction phase, type of transport flow and construction site, uses other modalities next to the road where possible to transport construction flows.	Construction logistic
Circular multimodal building material[4]	A location where the collection, sorting and processing of bulk and non-bulk waste into secondary materials take place.	Construction logistics and secondary material storage
Building material hub with urban development[21]	A location that coordinates construction logistics across multiple projects in an urban area.	Construction logistics
Raw building material hub[4]	A (production) location that is primarily used for the processing bulk flows, such as concrete, gravel and asphalt.	Construction logistics
Circular raw building material hub[4]	A (production) location where bulk construction and demolition materials are processed into circular (raw) building materials.	Construction logistics, secondary material storage
Prefabrication building material hub[21]	A production location where prefabricated elements are produced for modular construction.	Construction logistics

([13] Vrijhoef, 2022; [14] Ludema, 2013; [15] de Nijs en Zonen, 2022; [16] Fynly, 2021; [17] Mulder, 2020; [18] Neuberger, Weidner, & Steane, 2019; [20] Werner, Albers, Verschuurden & Dierdorp, 2020; [21] Van Rijn, Rondaij, Van Merriënboer, Kin, & Quak, 2020)

Factors shaping closed-loop systems^[22]



1. Land based factors
2. Economic factors
3. Logistical factors
4. Technological and knowledge factors
5. Social factors
6. Governance factors

([22] Tapia, Bianchi, Pallaske, & Bassi, 2021)

	Circular Craft Centre	Circular Multimodal BMH	Circular BMH + BMH with urban development	Circular raw BMH
Circular functions [12]	Repository and marketplace	Construction logistics, secondary material, storage, repository and marketplace	Construction logistics, repository and marketplace	Construction logistics, secondary material storage
Land Based				
Economic				
Logistical				
Technological & knowledge				
Social				
Governance				

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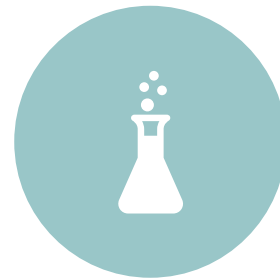
Explorative study



Case studies



Semi structured
interviews



Graduation laboratory

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Cross-case analysis

	Factors of analysis	Circular Craft Centre – Hoeksche Waard	Circular multimodal BMH – 's Gravendeel	Circular BMH + BMH with urban development - Utrecht	Circular raw BMH - Zaandam
Land Based	Central to demolition and construction projects	Only to demand			
	Insights to available materials				
	Temporary or permanent character	Permanent	Permanent	Permanent	Temporary
	Use of existing hubs				
	Space to expand business				
Economic	Operational scale	Local	Regional	City	City
	Facilities (R-strategy)	R3, R4, R5 and R6	R3 and R8	R2, R3, R6, R7 and R8	R2 and R8
	Business case				
	Connecting supply and demand				
Logistical	Accessibility to main road network				
	Accessibility to water quay for transshipment				
	Zero emission last mile				
	Logistical information system				
Technical & knowledge	Changing construction method				
	Innovation and product development				
	Balanced mix of knowledge and skills				
	Resource sharing				
Social	Initiator	NGO, entrepreneur and recycling centre	Dura Vermeer	VolkerWessels & Bnext	Rutte Groep
	Public awareness/ societal pressure				
	White label hub				
	Type of clients/ consumers	B2B and B2C	B2B and B2C	B2B	B2B
Governance	Environmental zoning category	Zone 3	Zone 4	Zone 4	Zone 4
	Regulation	Certifying waste processes	ZE zones in Rotterdam	ZE zones in Utrecht	ZE zone in Amsterdam and Zone Heavy Traffic
	Market	Local entrepreneurs, recycling centre and NGO	Local government in prescribing efficient construction logistics	Local government in prescribing efficient construction logistics	Urban Mining Collective and Betonakkoord
	Financial	Initial grand from national and local government	Private financing and local subsidies	Private financing and local subsidies	Private financing, local and national subsidies



Important



Not important

	Circular Craft Centre	Circular Multimodal BMH	Circular BMH + BMH with urban development	Circular raw BMH
Circular functions [12]	Repository and marketplace	Construction logistics, secondary material, storage, repository and marketplace	Construction logistics, repository and marketplace	Construction logistics, secondary material storage
Land Based	Yellow	Green	Yellow	Red
Economic	Green	Green	Green	Green
Logistical	Red	Green	Green	Yellow
Technological & knowledge	Red	Yellow	Green	Yellow
Social	Green	Green	Yellow	Yellow
Governance	Green	Green	Green	Green

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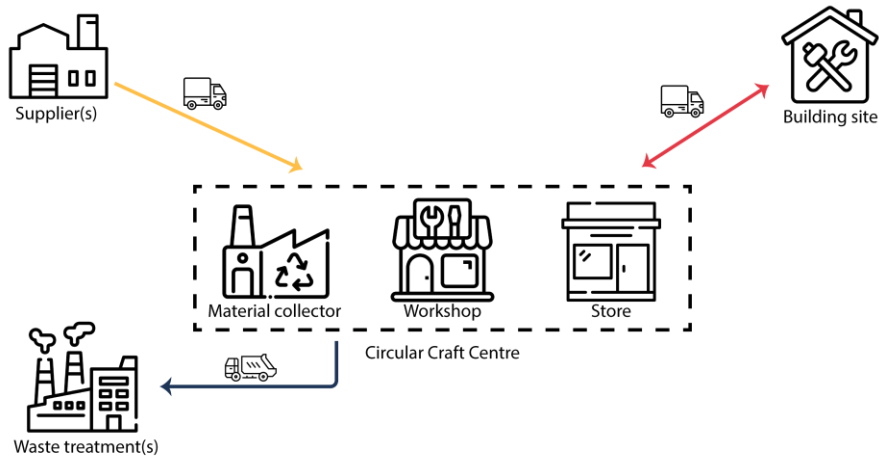
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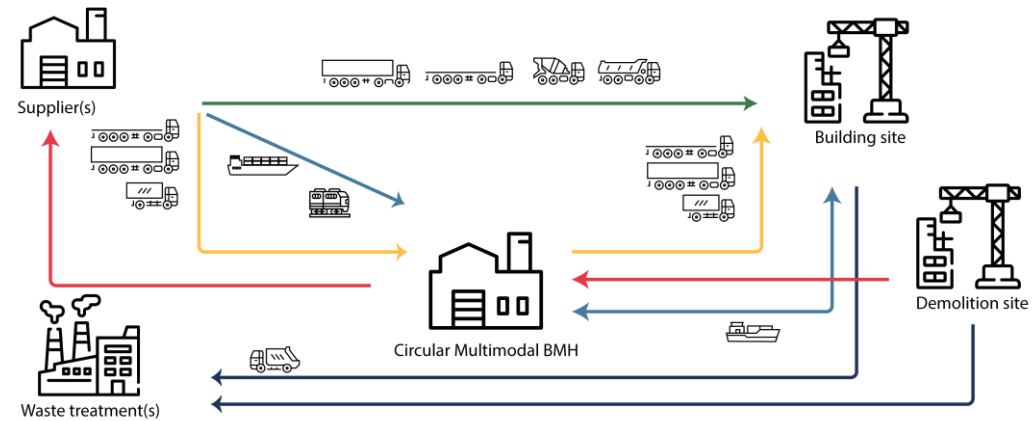
Conclusion

“What different building material hubs in relation to a circular built environment exist, and what factors explain their emergence?”



1. Circular craft centre

Economic, social and governance factors

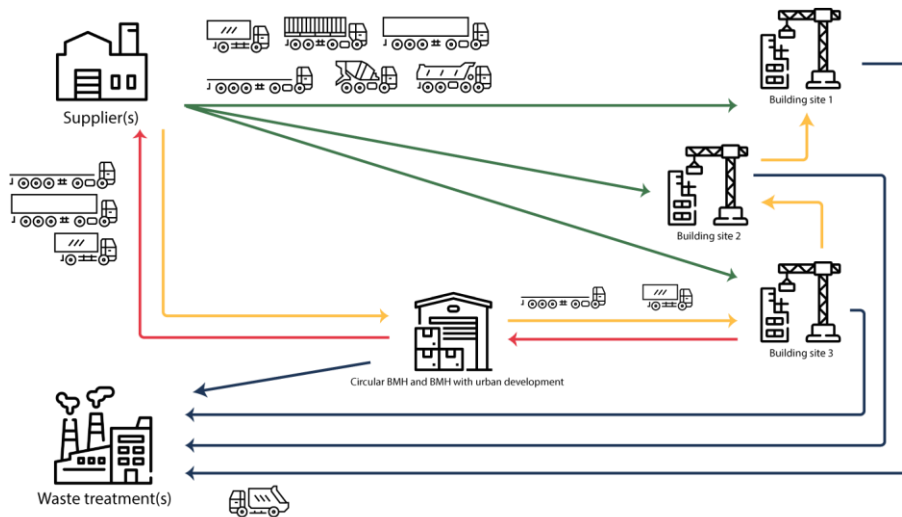


2. Circular multimodal BMH

Land-based, economic, logistical, social and governance factors

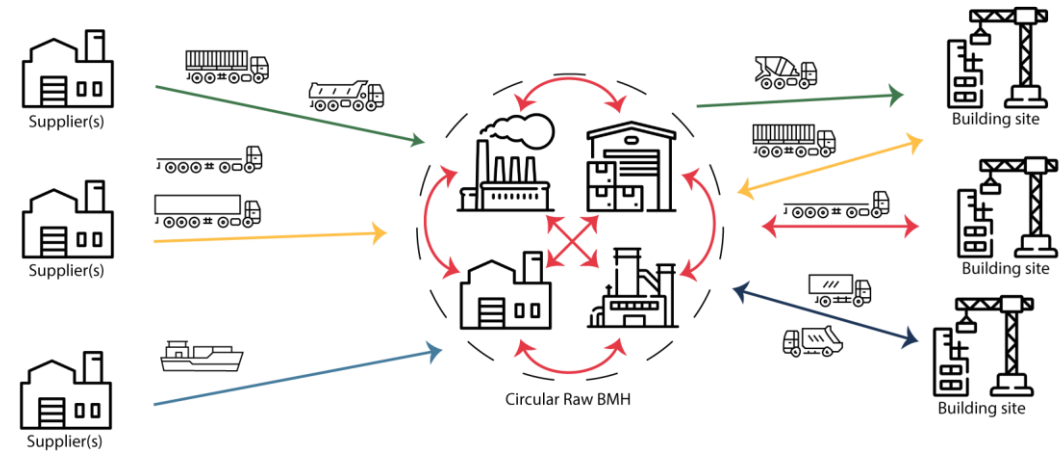
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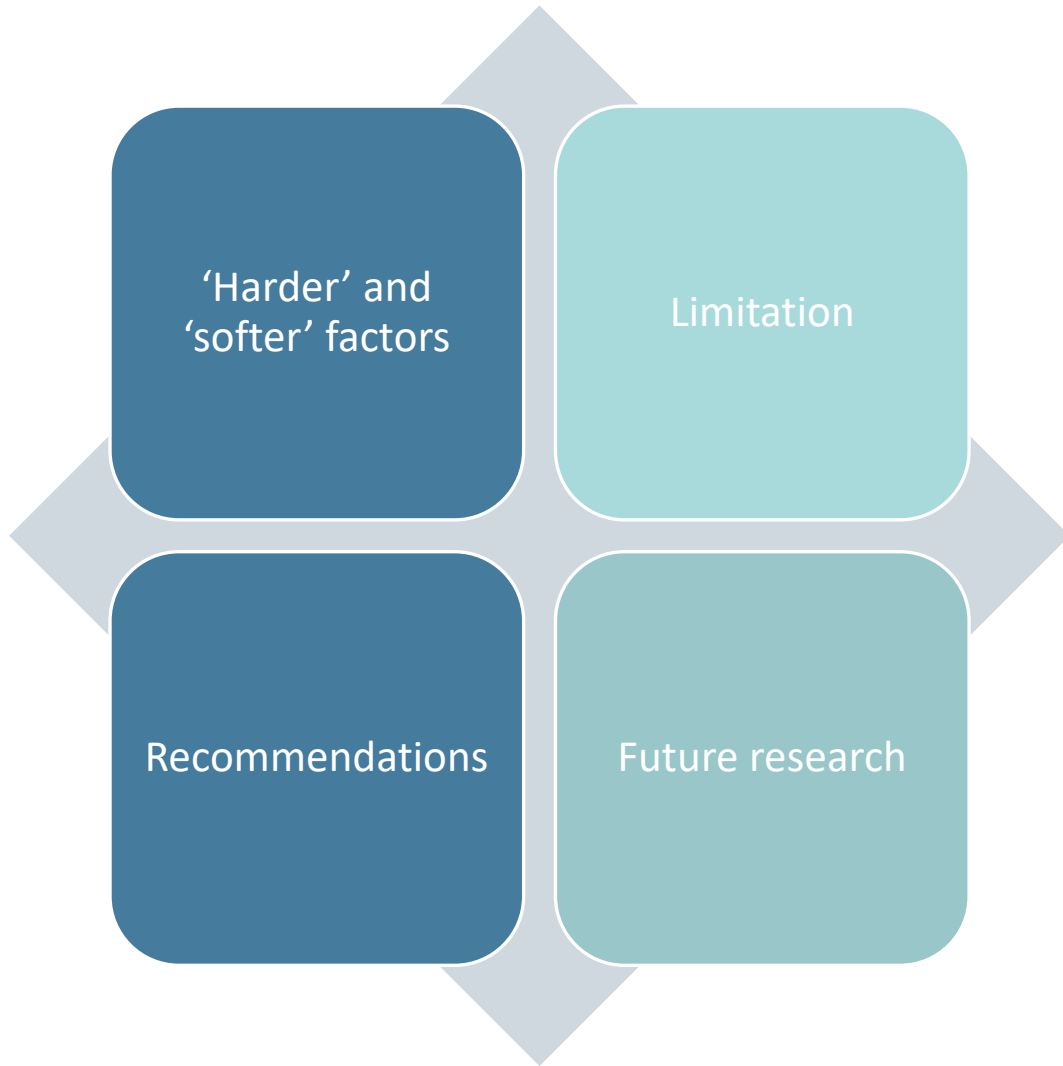
3. Circular BMH and BMH with urban development

Economic, logistic, technological & knowledge and governance factors



4. Circular raw BMH

Economic and governance factors



Discussion

Q&A

Thank you for
your attention

