

# Digital Information Management System for the facilitation of construction and demolition waste management

RECONMATIC Workshop  
Shaoxing  
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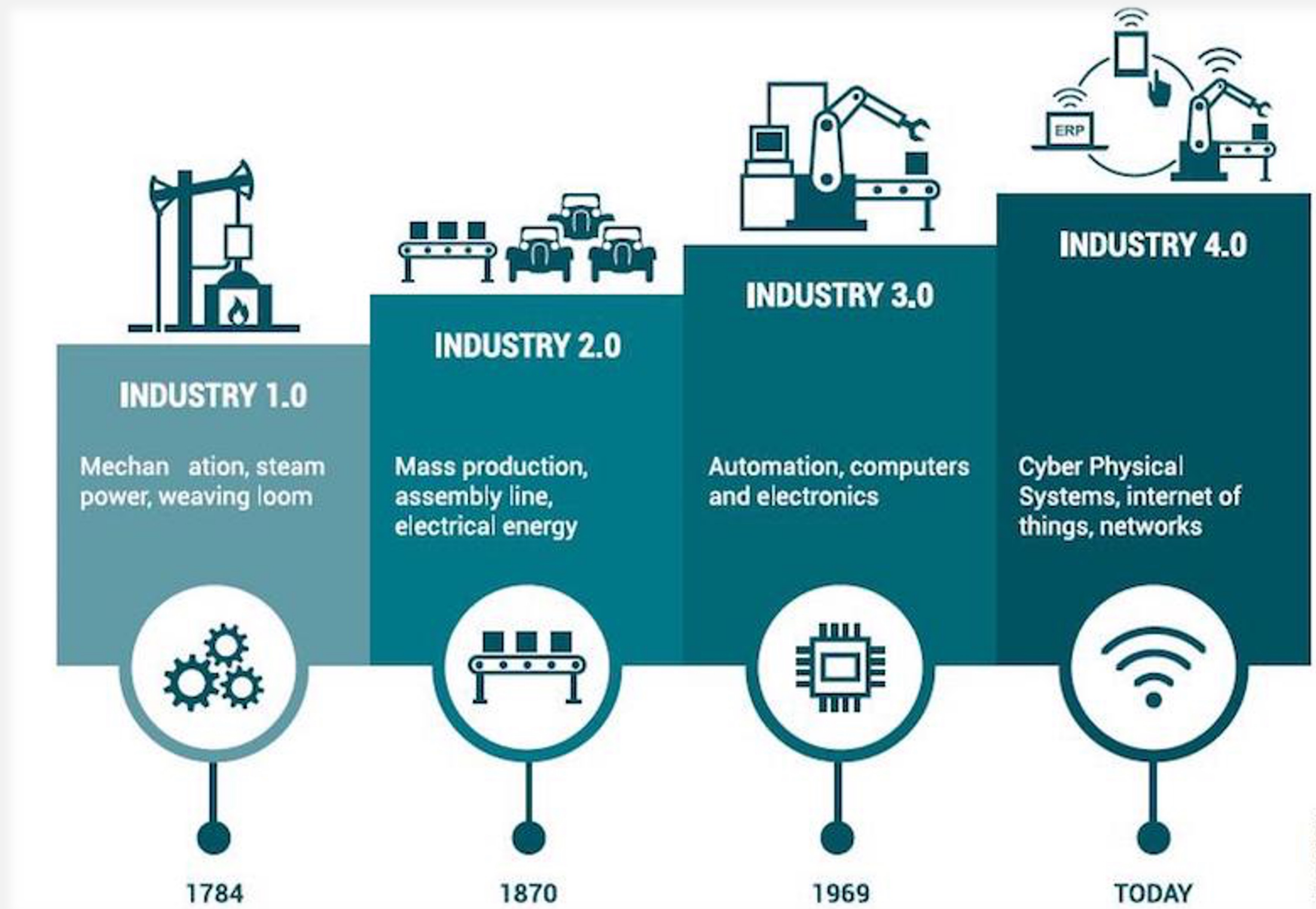
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PhD student

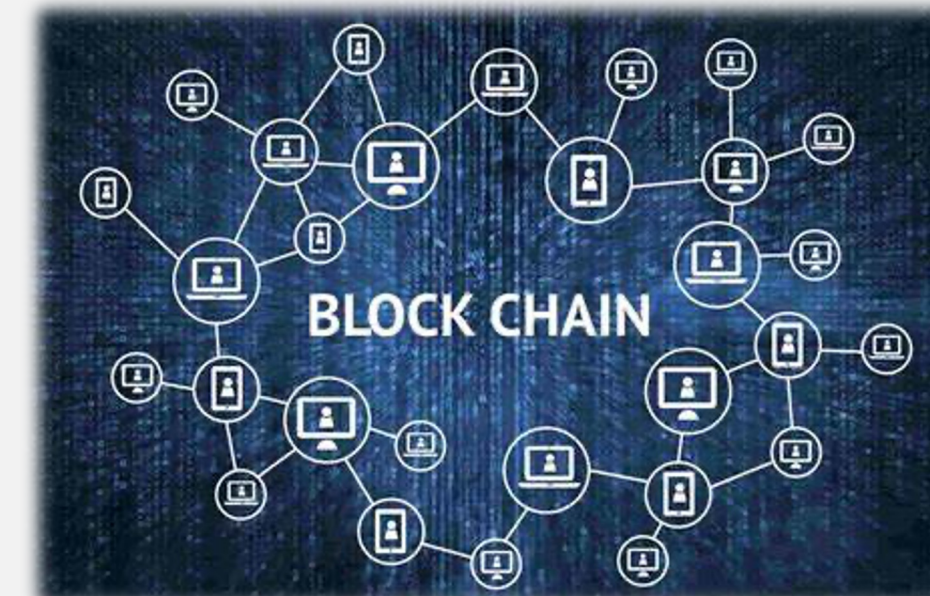
# Industry 4.0 for Construction & Demolition Waste Management



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IoT



Blockchain



BIM

# Industry 4.0 for Construction & Demolition Waste Management



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In a non-integrated scenario:

- Waste management practices remain fragmented.
- Collaboration and information sharing among stakeholders become difficult, which hinders effective decision-making and resource optimisation.
- Transparency and accountability are compromised, making it challenging to track waste generation, disposal, and recycling.

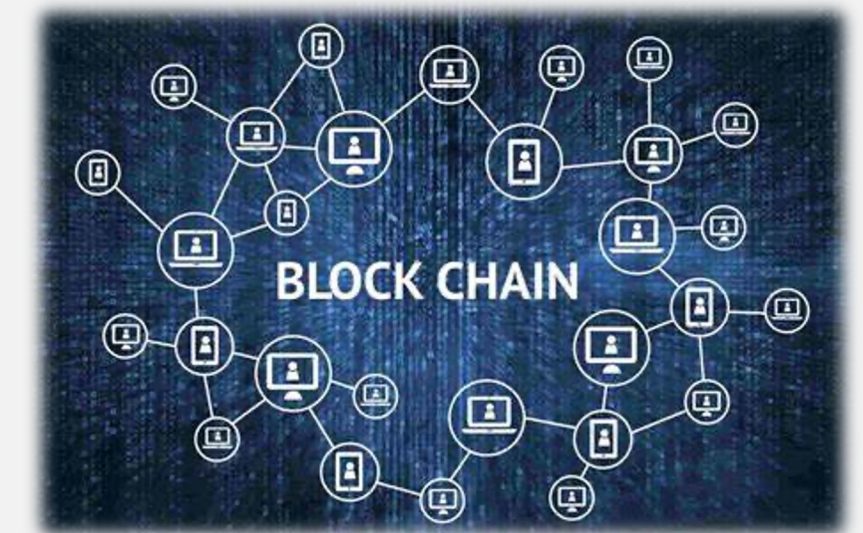
**BIM**



**IoT**



**Blockchain**



## State of the Art of Industry 4.0 Integration

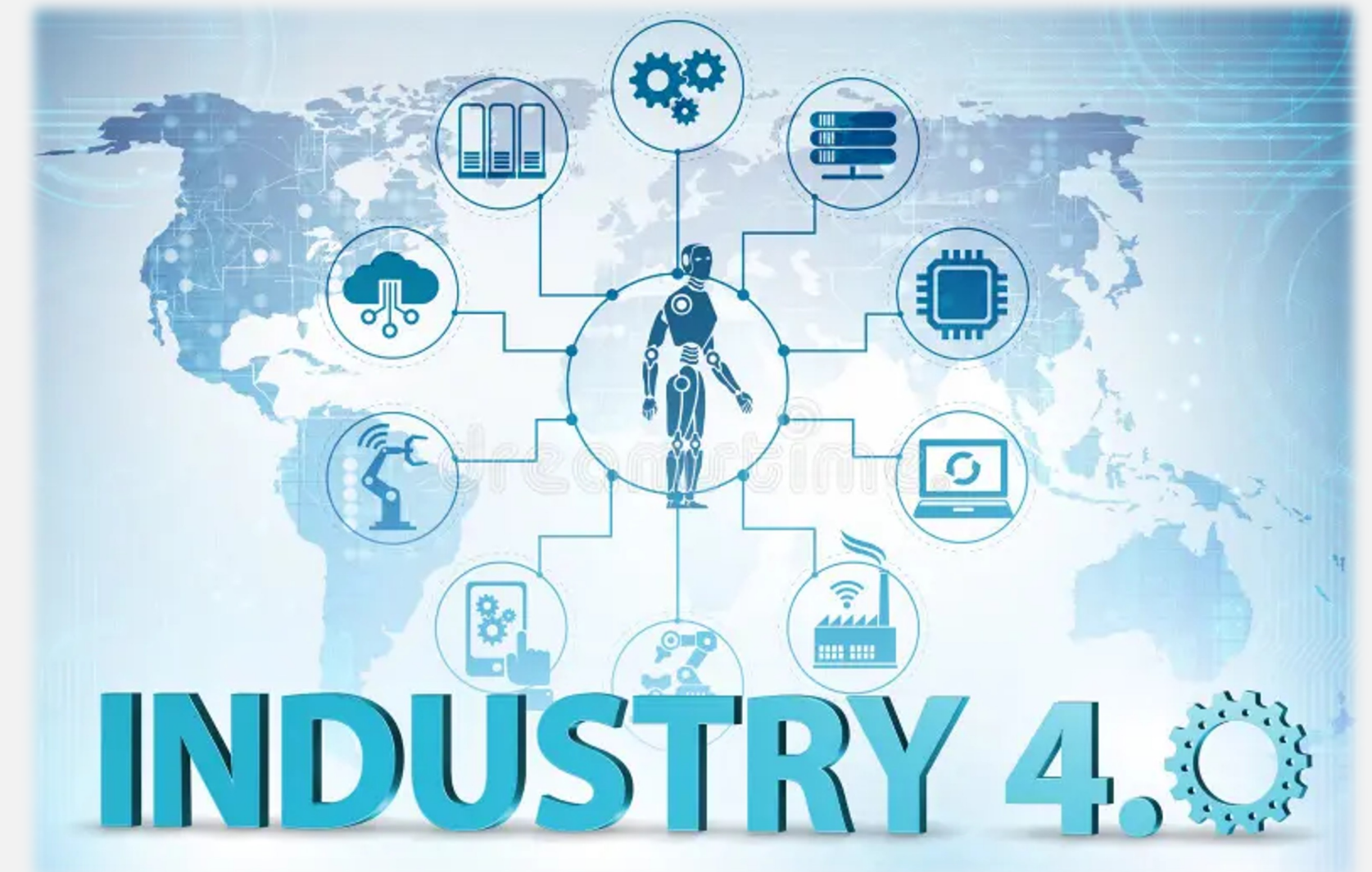


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Extant literature identified a research gap concerning the integration of Industry 4.0 technologies to support construction waste management:

- Absence of a comprehensive digital information management system that encompasses the entire project lifecycle
- Lack of clarity regarding the roles and engagement of various stakeholders within these digital systems.
- Lack of digital systems that focus on Material Flow Analysis and its utilisation for decision-making in moving towards a circular economy.





## Research Aim

... develop a Digital Information Management System (DIMS) that integrates Industry 4.0 Technologies to facilitate construction and demolition waste (CDW) management, to facilitate material flow analysis, as a decision-making tool for moving towards a circular economy.

... will address the identified gaps in the extant literature by providing a comprehensive digital solution that covers the entire lifecycle of the project, defines the roles of stakeholders, clarifies their engagement within the digital system, ensuring real-time data collection, and data security.





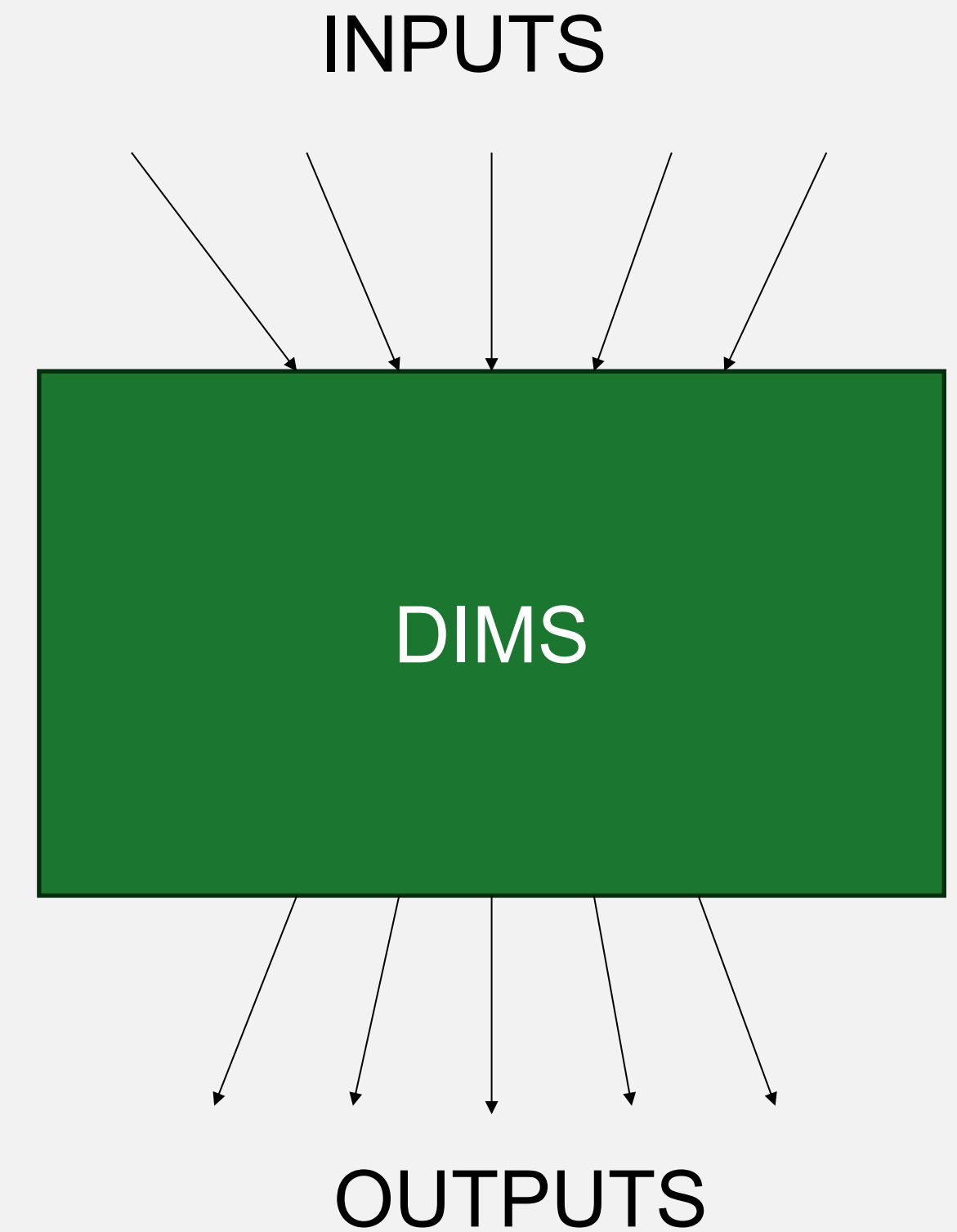
## Stages for this task

**Stage 1.** Development of waste data management framework and digital material flow protocol

**Stage 2.** Systems architecture (DIMS)

**Stage 3.** Validation

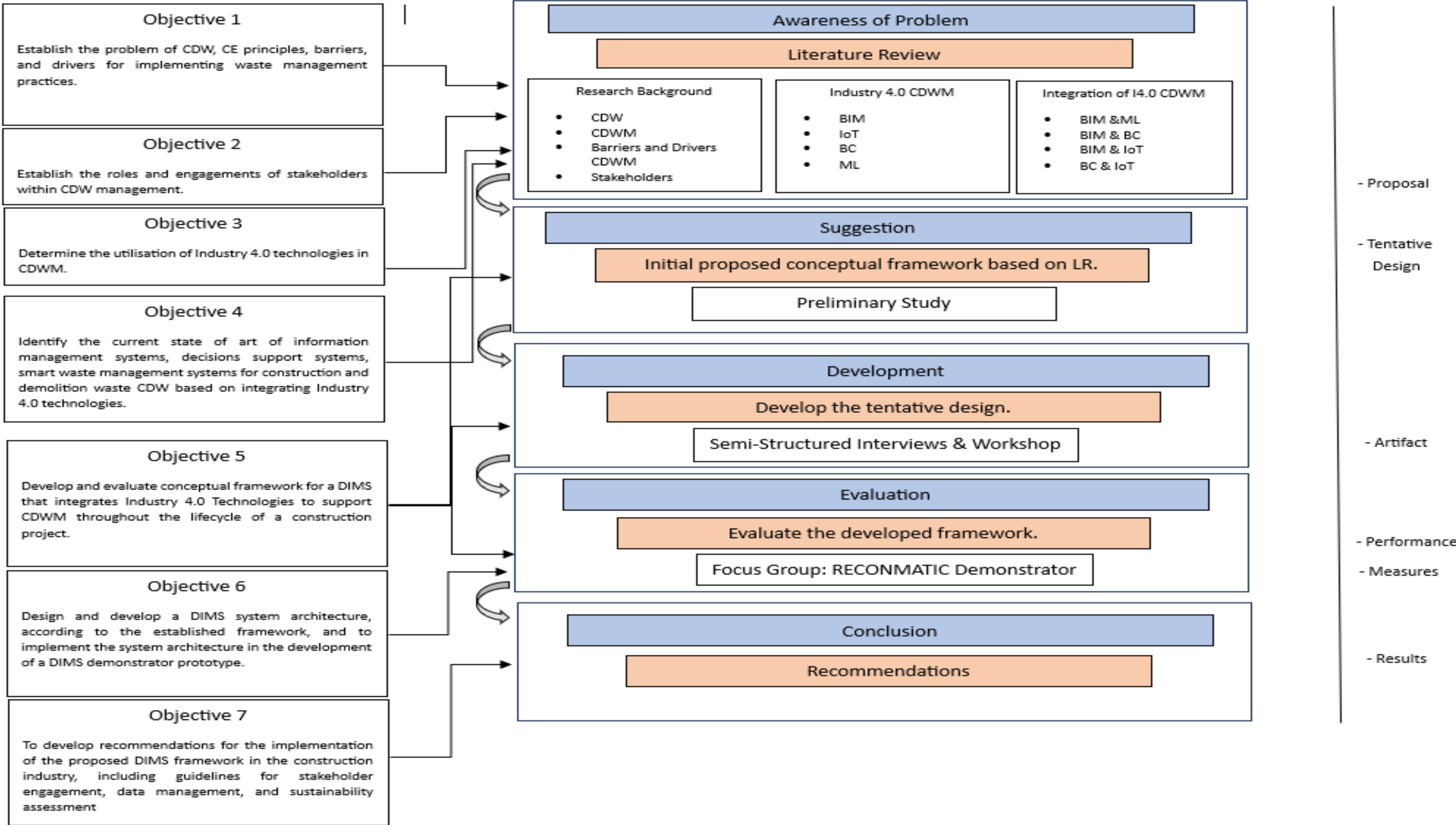
(This is NOT a RECONMATIC demonstrator)



# Stage 1. Design Science Research Process



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# Preliminary Study Survey



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- Issues and barriers in C&DWM.
- Importance of Material Flow Analysis and its application in C&DWM to facilitate moving towards a circular economy.
- Potential utilisation of Industry 4.0 technologies and their integration to support material flow analysis.

**Digital Information Management System for Facilitating CDWM**

The aim of this project is to develop a Digital Information Management System to facilitate the implementation of Construction and Demolition Waste Management, as part of a PhD study and the Horizon Europe Project RECONMATIC. The purpose of this questionnaire is to conduct a preliminary study to assess the existence of problems and the applicability of suggested solutions in this field before proceeding to the development of the system.

**\* Required**

**Participant Information Sheet**

Thank you for considering participating in this study 'Digital Information Management System for facilitating Construction and Demolition Waste Management' as part of a PhD study and Horizon Europe RECONMATIC Project. This PhD is taking place under the supervision of the university of Salford. Please carefully read the following information, ask me if there is anything that is not clear or if you would like to get more information, and decide if you would like to contribute. This survey is expected to take between 10-15 minutes.

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**Digital Information Management System for Facilitating CDWM**

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**Problems in Construction & Demolition Waste Management (CDWM)**

4. Please indicate your level of agreement with the following statements in Construction and Demolition Waste Management (CDWM) \*

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
There is poor cooperation, collaboration, and communication among stakeholders in (CDWM)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is lack of data transparency and information sharing within (CDWM)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is absence of participative networking, along with a lack of trust and support among stakeholders within (CDWM)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is insufficient Integrated (CDWM) processes, tools, and practices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is lack of efficient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Preliminary Study results



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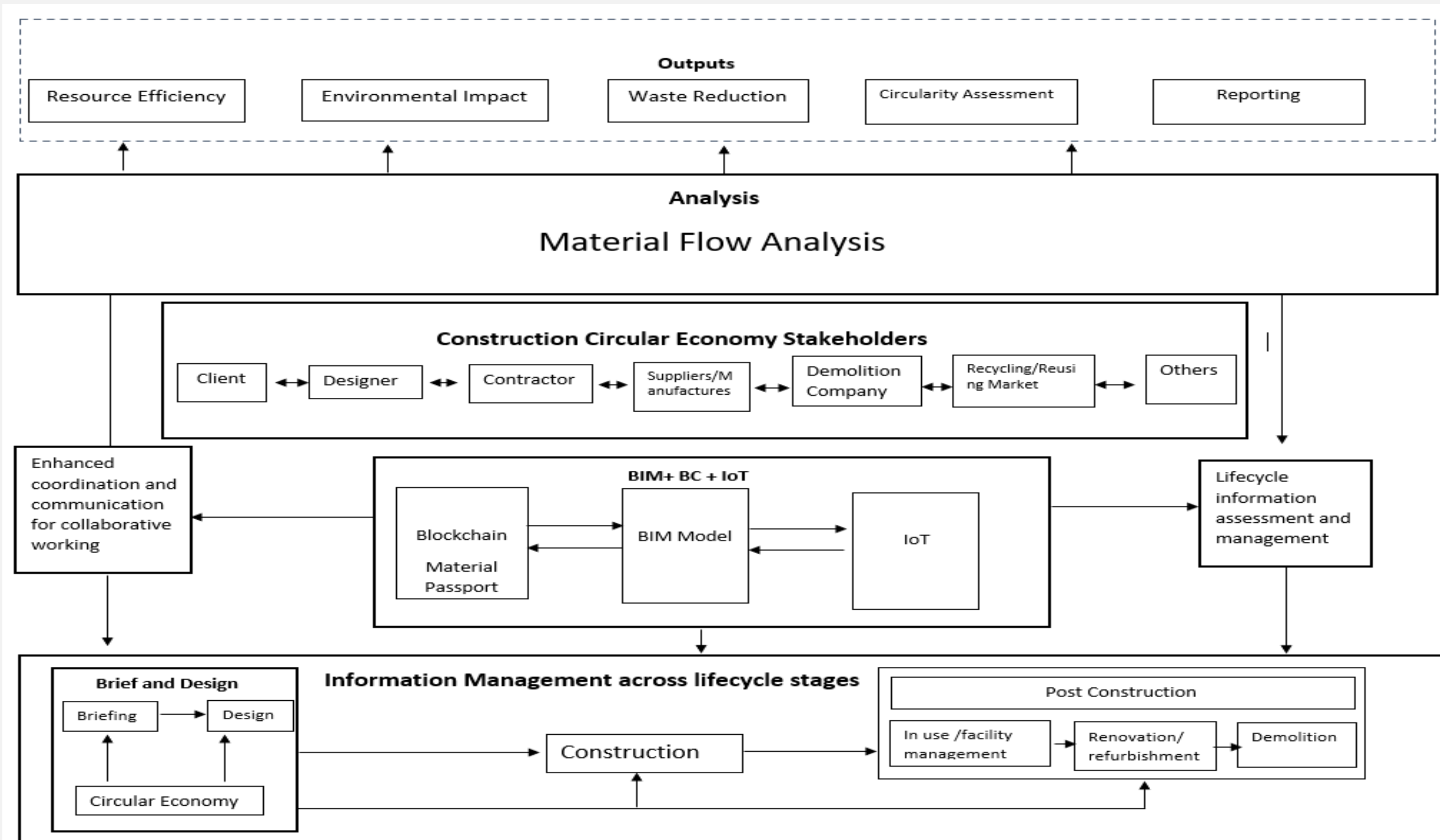


- *The use of block-chain is not necessarily the way forward. Using a cloud relational database is a better, reliable and efficient data storage that could be integrated with various other cloud resources seamlessly and securely. New technologies such as Microsoft Fabric, would allow seamless integrations between data engineering, analytics and predictive insights resources.*
- *Should not be used as data transfer (and storage) protocol as it is not feasible (requires sharing and storing the information on many computers, high energy demands associated)*
- *If used, only to increase trust of stakeholders, centralized solutions provided by technology leaders can be trusted as well (e.g., Microsoft/Google/Amazon cloud services are well secured and not expensive).*

# Stage 1. Initial proposal



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# Development phase. Data collection

- Workshop with industry and academia
  - Manchester Open Day (7<sup>th</sup> May 2024)
- Interviews with professionals
  - 20 interviews completed so far
  - RECONMATIC consortium
  - Industry

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## Digital Information Management System for Facilitating CDWM

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**Problems in Construction & Demolition Waste Management (CDWM)**

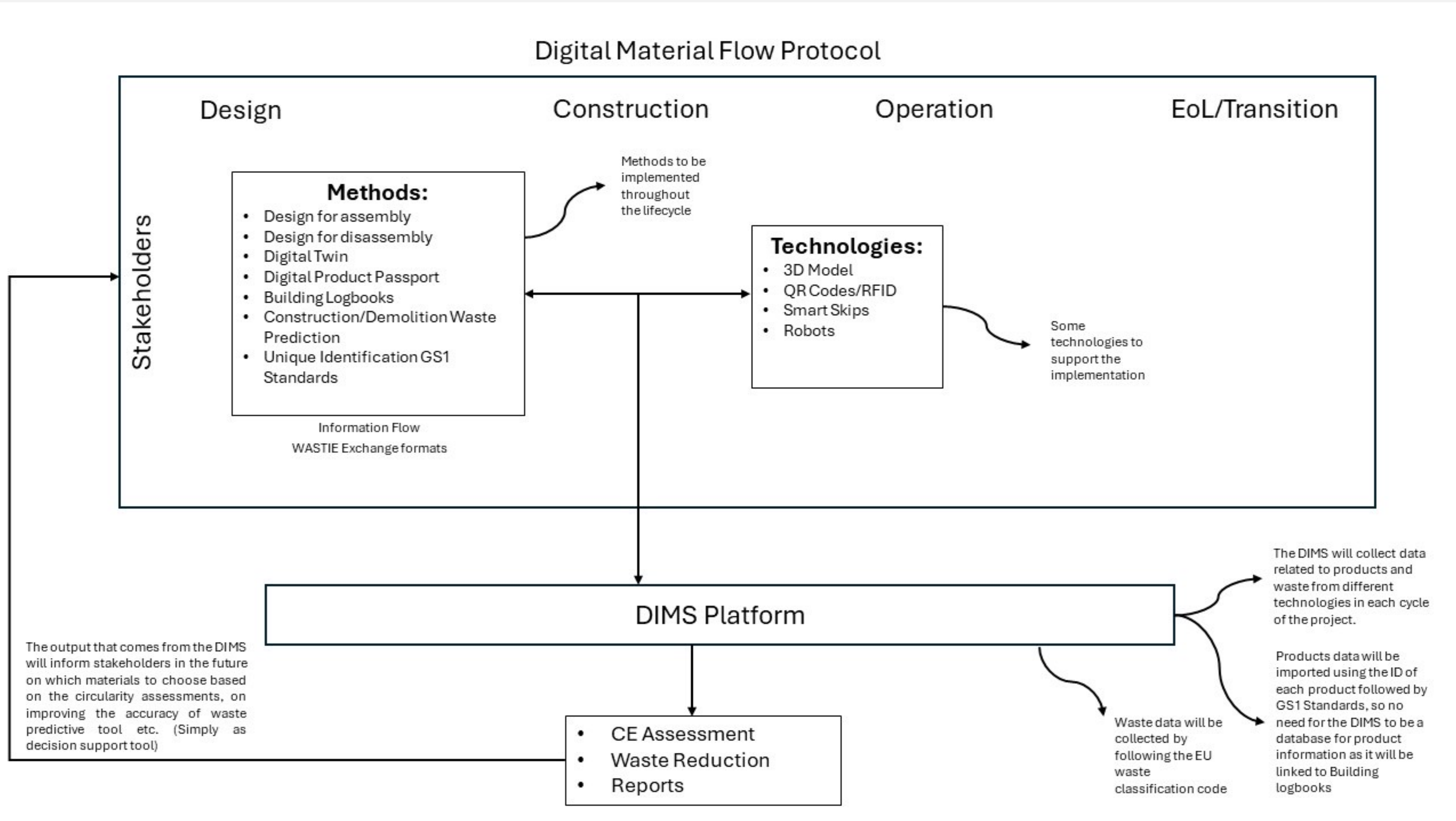
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# Stage 1. Development. Draft in progress



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## Next steps



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- Complete the stage 1 (waste management framework and digital material flow protocol)
- Validate the waste management framework
- Work stage 2
  - define basic initial operations of DIMS
  - Develop the systems architecture
- Validation (stage 3)
  - Application to 1 or 2 RECONMATIC demonstrators

# DIMS

## Research Contribution



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- Bridge the gap between CDW management and cutting-edge digital technologies.
- Deep dive into the integration of Industry 4.0 principles to facilitate the tracking of construction materials and construction waste, a topic of paramount importance in the industry's ongoing digital transformation.
- Develop a complete understanding of stakeholders' roles within this DIMS, facilitating its implementation by the industry professionals.
- Validation through a real-world case study will provide practical insights into the potential impact and feasibility of DIMS.
- Build a foundation for future researchers to start from and add to, ensuring ongoing progress in the field.





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the European Union**

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# THANK YOU FOR YOUR ATTENTION

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