# Harnessing Migrant Workers' Circular Knowledge for Sustainable Transformation:

## Building Renovations in The Hague

Master Thesis

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TU Delft

# Harnessing Migrant Workers' Circular Knowledge for Sustainable Transformation: Building Renovations in The Hague

by

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To obtain the degree of Master of Science

At the Delft University of Technology,

To be defended publicly on Friday, August 29, 2025, at 09:00 AM.

| | | |
|---|---|---|
| Student number | : 6048994 | |
| Project duration | : March 3, 2025 – August 29, 2025 | |
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# PREFACE

This thesis marks the final chapter of my academic journey in the Construction Management and Engineering (CME) program at Delft University of Technology. It is both a culmination of years of study and the beginning of new reflections on the role of people in shaping the built environment.

Industrialist Henry Ford once famously asked, “Why is it every time I ask for a pair of hands, they come with a brain attached?” For decades, this sentiment defined labour management, viewing the workforce as parts rather than partners. This statement resonates deeply with the essence of my thesis. My research, titled *"Harnessing Migrant Workers’ Circular Knowledge for Sustainable Transformation: Building Renovations in The Hague,"* explores how migrant workers are not merely labourers but knowledge bearers whose lived experiences and practical insights contribute significantly to sustainable and circular practices in the construction sector.

I would like to express my heartfelt gratitude to the individuals who have guided me throughout this journey. I thank Dr. Johan Ninan, my graduation committee chair, for his constant encouragement and insightful feedback; Dr. Audrey Esteban, my first supervisor, for her dedicated guidance and critical input; Dr. Reinout Kleinhans, my second supervisor, for his expertise and thoughtful reflections; and Dr. Antonella Maiello, my external supervisor, for her valuable perspectives and support throughout the process.

I am deeply grateful to my parents and sister for their unwavering love, encouragement, and prayers that have sustained me every step of the way.

I would also like to thank my fellow Indonesian peers in the CME program and my friends from the Indonesian Christian Church, who have shared this journey with me from the very beginning until the completion of this thesis. Your support and camaraderie have meant a great deal.

My sincere appreciation also goes to the Indonesia Endowment Fund for Education (LPDP) for providing the financial support that made my study at TU Delft possible.

Finally, I wish the reader an enjoyable and meaningful reading experience. I hope this thesis offers a new perspective on the value of migrants, not only as labourers but as important contributors to knowledge and sustainability in the construction industry.

Onesmus Hopijayanto Salokang
Delft, August 2025

# EXECUTIVE SUMMARY

The Netherlands has set ambitious national goals for achieving a fully circular economy by 2050, placing the building renovation sector at the heart of this sustainable transformation. Within this sector, particularly in urban areas like The Hague, migrant workers form an indispensable part of the workforce. However, a critical disconnect exists: while these workers possess valuable and practical circular knowledge, they are predominantly viewed and hired as a source of flexible, low-cost labour rather than as a repository of knowledge. This underutilization represents a significant missed opportunity for innovation and sustainability. This thesis, therefore, addresses the central question: **How can companies in the building renovation industry harness migrant workers' circular knowledge for sustainable transformation?**

This study employed a qualitative, case study methodology, focusing on the building renovation industry in The Hague as a bounded case. In-depth, semi-structured interviews were conducted with a range of key stakeholders, including contractors of various sizes, clients, and labour union representatives, to capture a multi-faceted view of the phenomenon. A thematic analysis, guided by the theoretical lens of Absorptive Capacity, was used to systematically identify the types of knowledge migrant workers possess, the barriers to its integration, and the mechanisms required to overcome them.

The findings reveal that migrant workers possess significant and diverse circular knowledge, particularly in practical material reuse (e.g., ceramics, paint) and the application of durable, efficient materials (e.g., insulation, plastic frames). However, this knowledge remains untapped mainly due to several key barriers. The most significant is the "linear employment" model, where the prevalent use of temporary, project-based contracts results in high staff turnover and critical knowledge loss when projects conclude. This is compounded by employer bias, which frames migrants as "hands, not heads," and contextual mismatches between workers' home-country experience and Dutch standards, alongside a lack of formal knowledge-sharing mechanisms, especially in smaller firms.

The discussion frames these challenges within the theory of Absorptive Capacity, arguing that many renovation firms, particularly smaller ones, are caught in a "cycle trap" of low innovation. To break this cycle, this thesis proposes a fundamental strategic shift from a labour-focused to a knowledge-focused employment model. Key recommendations are synthesised into a practical strategy (Figure 1) that offers companies a clear roadmap for integrating migrant workers' knowledge. This strategy provides actionable steps across the four key dimensions of absorptive capacity: (1) Acquisition: Proactively shifting hiring practices to value knowledge; (2) Assimilation: Implementing sustainable employment contracts and formalizing knowledge capture; (3) Transformation: Establishing feedback loops to adapt and integrate new ideas; and (4) Exploitation: Empowering workers as knowledge holder in pilot projects.

This research contributes to theory by developing a contextualised framework (Figure 2) that illustrates how external triggers (e.g., government policy) and specific knowledge sources (i.e., migrant workers) interact with a firm's internal absorptive capacity. This framework details the organisational integration mechanisms that are essential for building a firm's ability to learn and innovate from this untapped expertise.

Ultimately, this research concludes that harnessing migrant workers' knowledge is not merely an ethical consideration but a strategic imperative for the sustainable transformation of the building renovation industry. By systematically developing their absorptive capacity and fostering an open,

trusting culture, companies can unlock a vital, overlooked resource, turning a perceived labour pool into a powerful engine for circular innovation and competitive advantage.

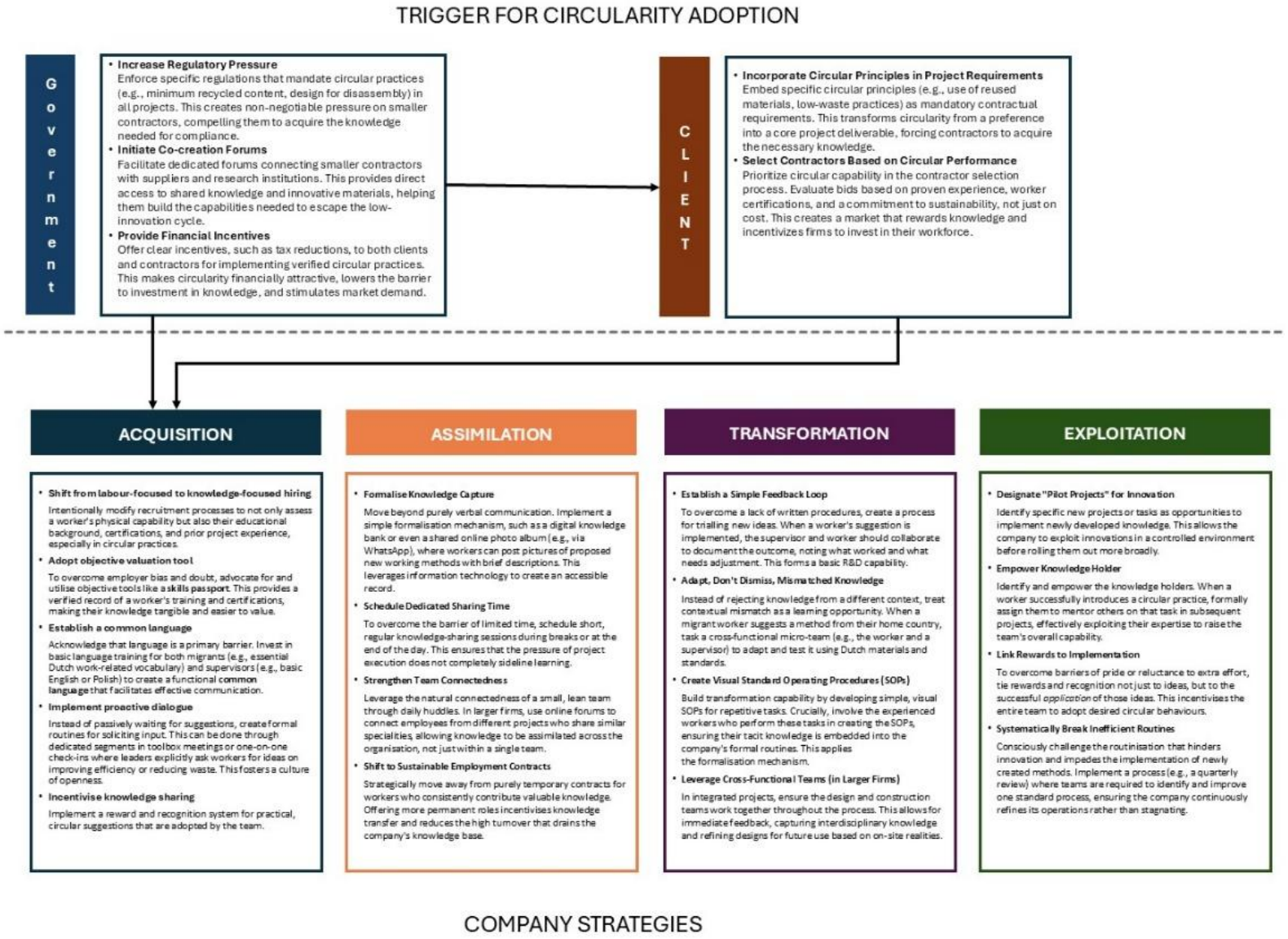


*Figure 1. Strategies for harnessing migrant workers' circular knowledge (author's own illustration)*

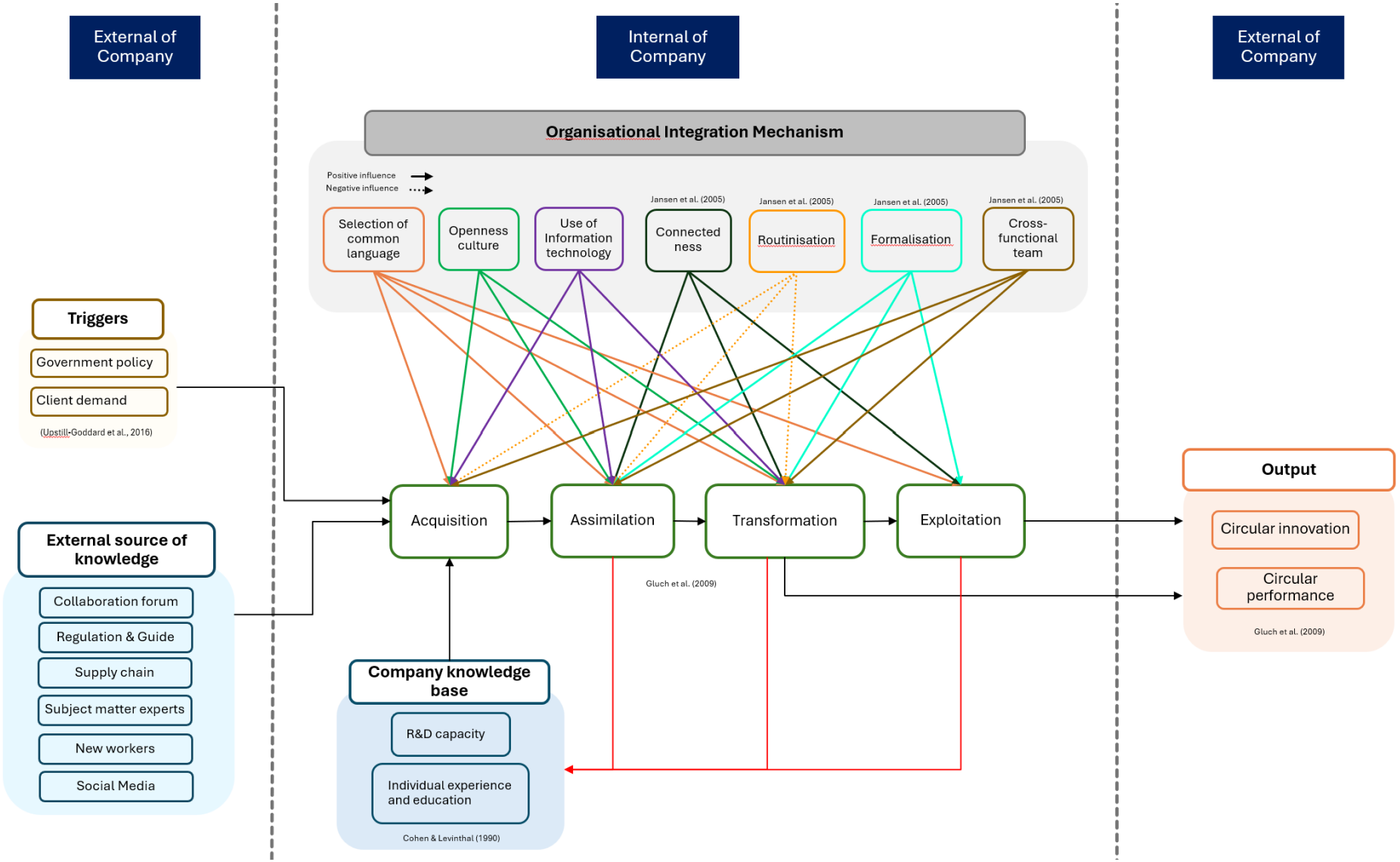


*Figure 2. Improvement for Absorptive Capacity for Circularity (author's own illustration)*

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# 1 Introduction

## 1.1 Background

### 1.1.1 Migration, buildings and urban landscape

Migration is defined as the movement of individuals from their usual place of residence to a new place either within country or across borders, for temporary or permanent settlement (Adger et al., 2024). Migration encompasses both involuntary movement and voluntary movement. Involuntary movement, is when individuals are compelled to move due to force, extreme poverty, persecution, or lack of viable alternatives, whereas voluntary movement is when individuals move without coercion, having viable alternatives and sufficient information about their decision (Blake, 2023). While migration is often drive by a search for better economic opportunities, safety or improved well-being, it also has broader social and spatial implications. One of the most significant outcomes of migration is its impact on urban landscapes, as cities increasingly serve as primary destinations for both voluntary and involuntary migrants.

Migration deeply affects urban landscapes, shaping cities in multiple ways. Migration serves as a key driver of urban growth, influencing demographic structures, socio-economic interactions and cultural diversity. By 2050, two-thirds of the world's population will live in cities, with migration playing a significant role in these transformations (Triandafyllidou et al., 2024). However, migration is not only about demographic change; it actively contributes to urban development and restructuring, creating spaces of cosmopolitanism, entrepreneurship, and cultural exchange (Lejeune et al., 2021). Migrants take part in shaping the city by forming ethnic neighbourhoods or cultural districts, bringing new uses and meanings to public spaces, and starting businesses in areas that may have previously been in decline. These contributions affect the built environment, economic activity, and governance structures of the city (Triandafyllidou et al., 2024). At the same time, governance of migration varies widely across urban settings, with some cities adopting inclusive policies that leverage migration for economic and social renewal, while others impose restrictive frameworks that limit migrant participation in urban economies (Lejeune et al., 2021).

Besides migration, buildings play a crucial role in shaping the urban landscape. They serve as the primary structural elements of urban morphology that define the form and function of cities while influencing connectivity and accessibility (Ruivo et al., 2021). The placement and design of buildings impact urban density, spatial cohesion, and the organisation of public and private spaces, reinforcing their role in structuring the built environment (Ruivo et al., 2021). Beyond their functional attributes, buildings also carry cultural and historical significance, with heritage structures providing identity, influencing urban perception, and fostering sustainability and community attachment (Grazuleviciute-Vileniske et al., 2021; Tweed & Sutherland, 2007). Moreover, architecture is not merely a passive element but an active force shaping functionality, aesthetics, and social interactions (Relph, 2016), determining how people engage with and experience the city.

### 1.1.2 The Hague urban landscape

Figure 1-1 presents the distribution of migrant origins and population numbers in 2024. Approximately 59.2% of the residents in The Hague have a migration background. The growth in migrant residence has increased over the past decade, with most of this growth attributed to migrants coming from Eastern Europe. Since 2013, this group has expanded by approximately 110% (Den Haag, 2024b). As a

result, the large migrant population in The Hague is accompanied by a significant number of migrant workers, who contribute to various sectors of the local economy.

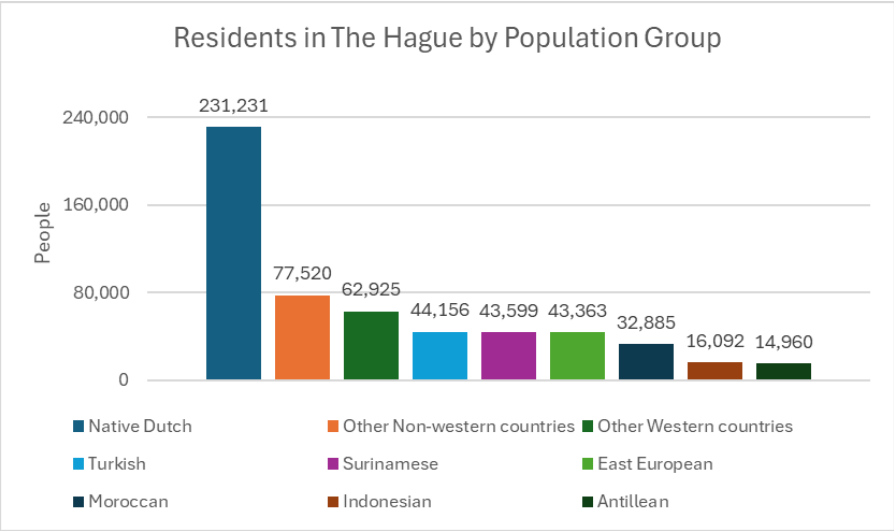


*Figure 1-1. Residents in The Hague by Population Group (Den Haag, 2024b)*

The relationship between buildings and the urban landscape is evident in The Hague, a historic and densely populated city where the built environment reflects centuries of urban development. Figure 1-2 shows the ages of buildings in The Hague and illustrates the building density in the area. The Hague is home to approximately 560,000 residents spread across 98.13 square kilometers (Den Haag, 2024c). On average, every square kilometer contains 3,380 residential houses and 340 non-residential buildings (Den Haag, 2024a). The city's buildings vary greatly in age, with construction dates ranging from as early as 1600 for heritage landmarks to as recent as 2015 for more modern structures. Most buildings in the city center were constructed between 1900 and 2000, while newer structures built after 2000 are primarily found on the city's perimeter, with only a few recent developments within the dense city center (3D Geoinformation Group, 2020). Given the city's ageing infrastructure and high building density, the building maintenance and renovation industry plays a vital role in ensuring structural safety and optimal performance. Additionally, this industry is crucial for implementing sustainability concepts, particularly through the practice of building preservation.

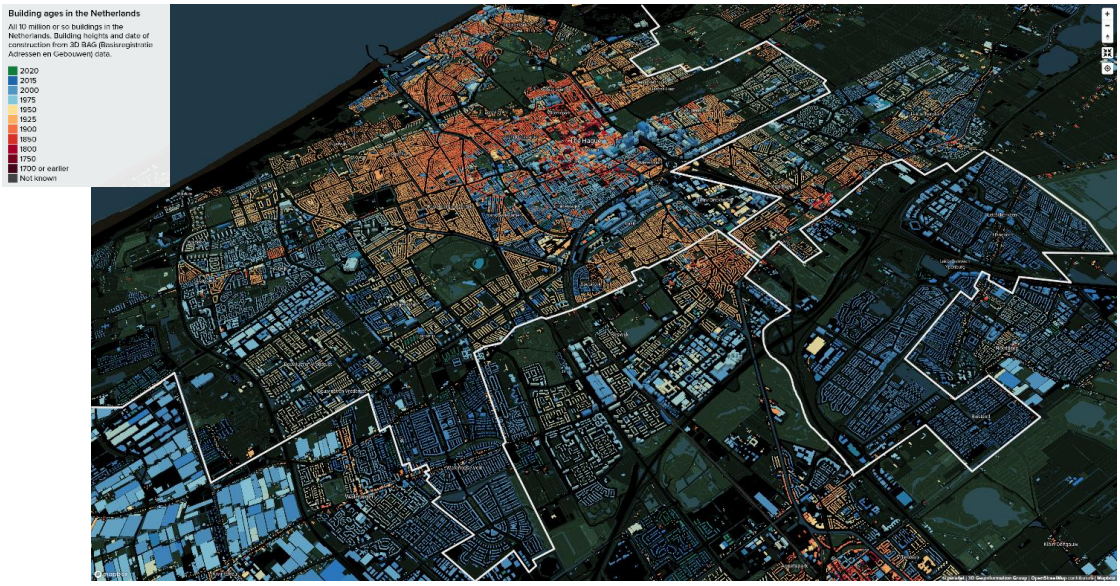


*Figure 1-2. Building ages in The Hague (within the white border)(3D Geoinformation Group, 2020)*

### 1.1.3 Migrant workers in the building renovation industry

Multiple institutions define migrant workers in various ways. Iskander (2021) defines migrant workers as individuals who move across borders to seek employment, often under regulatory systems that tie their political rights to their economic function. The International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families (1990) defines a migrant worker as "*a person who is to be engaged, is engaged, or has been engaged in a remunerated activity in a State of which he or she is not a national*" (Art. 2(1)). Similarly, the Migration for Employment Convention (ILO C097, Art. 11) describes a migrant worker as "*a person who migrates from one country to another with a view to being employed otherwise than on his own account and includes any person regularly admitted as a migrant for employment*". Across these definitions, a prominent similarity is that migrant workers are predominantly defined by their movement across borders for employment purposes. One of the key sectors that benefits from migrant labour and absorbs a significant portion of migrant workers is the building construction industry, which includes renovation and repair (Buckley et al., 2016; Peiró et al., 2020).

The nature of the construction industry leads employers in this sector to show a preference for migrant workers. These industries often rely on flexible contracts tailored to specific project types, meaning that workers are typically hired on a project-based basis and can be easily replaced once a project is completed, helping employers minimise labour costs (Buckley et al., 2016; N. Iskander, 2021; Kleinhas et al., 2024). Additionally, the construction industry is often perceived as low-status, poorly paid, physically demanding, and hazardous occupations, which many native Dutch workers tend to avoid, creating a labour gap that migrant workers help fill (Buckley et al., 2016; Kleinhas et al., 2024). Migrant workers also play a crucial role in addressing workforce shortages in an ageing and shrinking society, as is the case in The Hague (Buckley et al., 2016; Findlay & Wahba, 2013). Over the past decade, the native Dutch population in The Hague has declined by approximately 8.5% (Den Haag, 2024b), with the average age of the working population (18–67 years) now at 42 years (Centraal Bureau voor de Statistiek, 2024). In summary, migrant workers remain an indispensable component to the Hague construction industry.

## 1.2 Problem Description

### 1.2.1 Problem statement

The Netherlands has committed to addressing climate change through its commitment to sustainability, which is evident in its two primary environmental goals: achieving net-zero carbon emissions and establishing a fully circular economy by 2050. These objectives form the foundation of the National Climate Agreement (2019) and the National Circular Economy Programme (2023-2030), which emphasise reducing greenhouse gas emissions, minimising raw material consumption, and promoting material reuse and waste reduction (Ministry of Climate Policy and Green Growth, 2019; Ministry of Infratsructure and Water management, 2023). As a result, building renovations must incorporate sustainability improvements, while maintenance and repair efforts should align with circular economy principles. Achieving these goals requires collaboration among all stakeholders in the building industry, including home and building owners, contractors, and government authorities.

Migrant workers play a critical role in these sustainability efforts. They constitute a significant portion of the building construction and renovation workforce, particularly in urban centers like The Hague. Many possess specialised knowledge, skills, and expertise in sustainable construction practices (Buckley et al., 2016) and contribute to innovation through social remittance (Adger et al., 2024). However, employers primarily seek migrant workers as a source of cheap labour and to overcome labour shortages rather than valuing the knowledge of sustainability that they possess (Buckley et al.,

2016; Findlay & Wahba, 2013; N. N. Iskander, 2021; Kleinhas et al., 2024). They are often underutilised by companies because they are merely seen as an additional set of helping hands without fully optimising their knowledge.

### 1.2.2 Research gap

Most research on migrant workers in the building construction, maintenance, and renovation industries primarily focuses on labour conditions, safety, and exploitation, rather than their positive contributions (Derakhshan & Chowdhury, 2024; N. N. Iskander, 2021; Peiró et al., 2020; Timmerman, 2024). Recent research has shown that migration plays a role in sustainability across social, economic, and environmental dimensions through demographic shifts, economic development, and environmental adaptation. However, the extent and nature of these contributions remain context-dependent (Adger et al., 2024; Gavonel et al., 2021). Furthermore, the research above lacks empirical data to support the theory. This research aims to fill the gap by providing empirical data regarding migrant workers' contributions to sustainability in the building maintenance and renovation industry.

## 1.3 Research Objective

The main aim of this thesis is to examine how companies in the building renovation industry can effectively utilise the knowledge of migrant workers in their sustainability transition. A range of strategies and recommendations will be suggested to guide companies within the industry.

Other than the above main objective, this research includes the following objectives:

1. Understand the role of migrant workers' knowledge in the context of sustainable transformation within the building renovation industry.
2. Identify the knowledge that migrant workers bring to the industry and how it complements the knowledge of native workers.
3. Analyse the current practices for integrating migrant workers' knowledge and compare how these practices vary between companies of different scales.
4. Examine the barriers that companies face in integrating migrant workers' knowledge into their resources.

## 1.4 Research Relevance

Migration is a continuous global phenomenon, with migrant workers playing a crucial role in the construction and renovation industry worldwide. This research addresses a critical intersection between migration, sustainability, and the building renovation sector. With the Netherlands aiming for a fully circular economy and net-zero emissions by 2050, sustainable practices in building renovation are increasingly important. Migrant workers, who form a significant portion of the labour force in this sector, possess valuable knowledge and skills that can contribute meaningfully to these goals. However, their potential remains underutilised due to institutional biases, project-based employment structures, and a lack of mechanisms to integrate their expertise into organisational learning.

By investigating how companies can harness migrant workers' knowledge in sustainable transformation, this research contributes to both academic and practical domains. Academically, it fills a notable gap in the literature by shifting the focus from exploitation and labour conditions to migrants' constructive contributions. Practically, it provides companies and policymakers with insights and strategies for integrating overlooked expertise into sustainability transitions. The research is particularly relevant for cities like The Hague, where high building density and a diverse, ageing urban infrastructure require innovative and inclusive approaches to renovation.

## 1.5 Research Questions

Main research question:

> "How can companies in the building renovation industry harness migrant workers' circular knowledge in sustainable transformation?"

Sub-Research questions:

1. What conceptual frameworks explain the role of migrant workers' knowledge in a company's sustainable transformation?
2. What knowledge do migrant workers bring to the company?
3. How do migrant knowledge integration practices vary in different company scales?
4. What are the barriers faced by the companies in integrating migrant workers' knowledge?

## 1.6 Research Design

This research will adopt a qualitative research approach using a single case study design, focusing on The Hague's building renovation industry as the bounded case. A case study is chosen because it facilitates an in-depth exploration of contemporary phenomena in the building renovation industry related to the utilisation of migrant workers' knowledge. It will provide insights into the 'how' and 'why' to better understand these phenomena (Yin, 2014). Semi-structured interviews will be used to capture diverse perspectives from professionals and stakeholders in the building renovation industry, providing insights into the challenges and strategies for integrating migrant workers' knowledge. The Hague is selected as the research setting due to its high proportion of migrant workers in the labour demographic and its dense and ageing structures.

Figure 1-3 provides a visual overview of the research design, which strategically combines a theoretical review with an empirical case study to comprehensively address the research objectives. The main research question is ultimately answered by synthesising the outputs of three empirical sub-research questions (RQ2, RQ3, and RQ4), which are guided by a conceptual framework established by the initial sub-research question (RQ1).

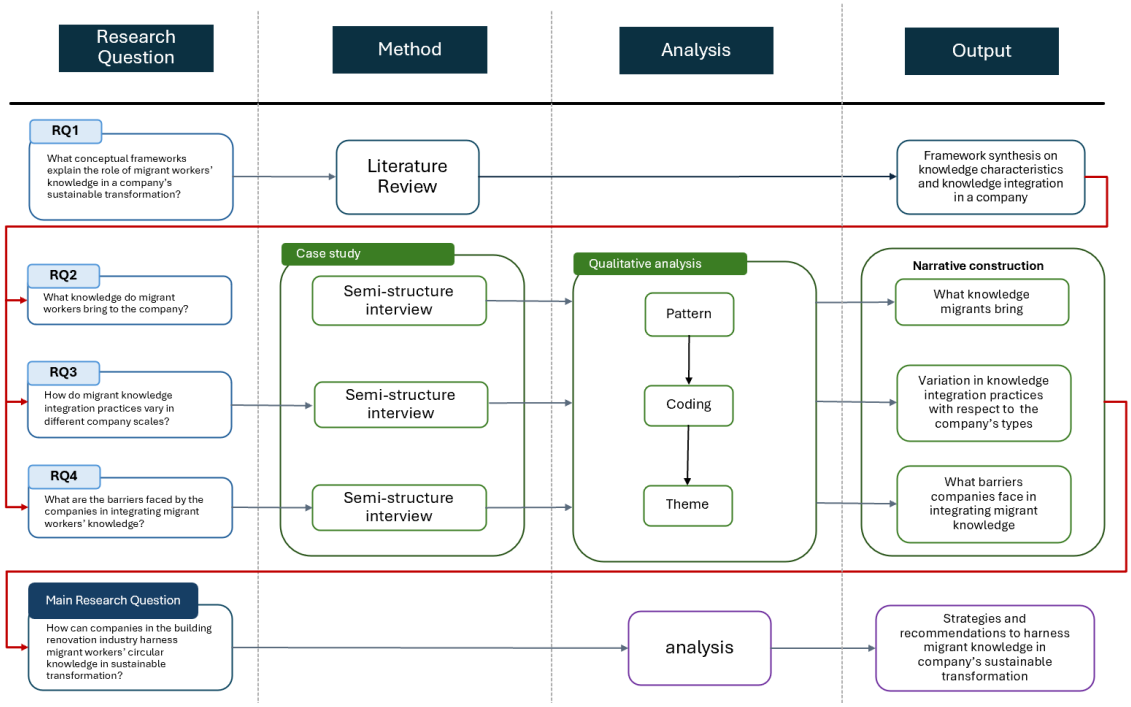


*Figure 1-3. Research methodology*

The literature review serves as the theoretical foundation of this research and addresses Sub-research question 1. This review is crucial for gaining insights into relevant theories, primarily focusing on the Absorptive Capacity framework to understand how companies integrate external knowledge. It will also identify the current circular practices within the building renovation industry. The outcomes of the literature review will guide the development of the interview questions for the subsequent case study and will provide the conceptual lens for the final qualitative analysis.

The primary empirical data for this study will be collected through a case study of the building renovation industry in The Hague. This case study involves semi-structured interviews with a range of stakeholders. These interviews are the main method of data collection. Since the focus of the interviews is to explore knowledge, practices and barriers within their real-world context, this approach is ideal for understanding the nuances of how knowledge is (or is not) harnessed.

After all the interview data has been collected and transcribed, it will serve as the input for the qualitative data analysis. This analysis phase involves a thematic analysis process of identifying patterns, applying codes, and developing overarching themes. The outcome of this analysis is a narrative construction that provides clear answers to Sub-research Questions 2, 3, and 4: identifying the types of knowledge migrants possess, detailing the variation in integration practices between company scales, and outlining the key barriers to integration.

In the final phase of the research, these empirical findings are synthesised to answer the Main Research Question. This synthesis involves integrating the themes from the qualitative analysis to develop a strategic framework with actionable recommendations. This framework, which is the ultimate research output, will provide strategies for companies to better harness migrant workers' circular knowledge for sustainable transformation.

# 2 Literature Review

The literature review chapter is divided into four sections to provide a comprehensive understanding of the underlying frameworks used in this research. The first section reviews the current developments in circularity and sustainability within the building renovation industry. The second section discusses the nature of knowledge and its value. The third section examines the mechanisms through which organisations integrate and utilise new knowledge. The final section synthesises insights from the previous parts to develop a conceptual framework that informs the data collection and analysis for this study.

## 2.1 Circular Economy

The construction industry is one of the largest consumers of natural resources and producers of waste, both globally and within the European Union. In 2023, it accounted for 34% of global $CO_2$ emissions, 34% of global energy consumption, and produced two billion tonnes of construction and demolition waste annually (United Nations Environment Programme, 2025). Within the European Union, 65% of all raw materials used are directed to the construction sector (European Environment Agency, 2024). Reducing waste and conserving natural resources through the adoption of circular economy practices has therefore become imperative to prevent further environmental degradation (European Environment Agency, 2024; United Nations Environment Programme, 2025).

The Ellen MacArthur Foundation defines the circular economy (CE) as an economic model aimed at eliminating waste and regenerating nature through processes such as maintenance, reuse, refurbishment, remanufacturing, recycling, and composting. It is built on three core principles: eliminating waste and pollution, circulating products and materials at their highest value, and regenerating natural systems. The circular model contrasts the traditional linear economy, which follows a take-make-waste approach, where products are disposed of after use.

The circular economy contributes to sustainability across all three pillars, with its most significant impact observed in the environmental dimension. It helps minimise environmental degradation by reducing the extraction of natural resources (Norouzi et al., 2021), lowering embodied carbon and associated emissions (Nußholz et al., 2023), and preventing the generation of construction waste (Ogunmakinde et al., 2022). In addition, it supports economic resilience through the development of new leasing-based business models (Timm et al., 2023), cost reductions over the building lifecycle (Fernandes & Ferrão, 2023a) and enhanced supply chain resilience by reducing dependency on raw materials (Hossain et al., 2020). The circular economy also fosters social welfare by creating green employment opportunities (Ogunmakinde et al., 2022) and promoting community engagement through collaborative housing planning and co-design (Çetin et al., 2021).

### 2.1.1 Practice of Circular Economy in Construction Industry

To support the objectives of the circular economy, the construction industry has begun to adopt a range of practices aligned with circular principles. Benachio et al. (2020), through an extensive literature review, identified a set of practices linked to different stages of the building life cycle that promote circularity. Table 2-1 presents these circular economy practices in relation to each life cycle stage.

*Table 2-1. Circular Economy practice in the construction industry (Benachio et al., 2020)*

| Life Cycle Stage | CE Practices |
|---|---|
| Project Design | Design and use of modular buildings<br>Design for adaptability of existing buildings<br>Design for Disassembly of building structures<br>Use of a scale to analyse the level of implementation of Circular Economy practices in the company<br>Use of a simulation in a BIM model to analyse the reuse potential of the materials of different types of designs early in the project<br>Use of Life-cycle analysis to find the benefits of reusing different types of materials in the design stage<br>Use of material stock data to help reuse of materials of a new building |
| Manufacture | Change of use of materials, by giving it ownership to the manufacturers to reuse the materials after the end of life of the first building<br>Development of material passports<br>Reuse of secondary materials in the production of building materials |
| Construction | Reuse of building materials in a new construction<br>Waste reduction<br>Off-site construction |
| Operation | Use of a tool to evaluate the state of materials during the lifespan and end of life of a building<br>Use of water management practices<br>Minimize recuperative maintenance with preventive maintenance |
| End of Life | Analyse the potential for reuse or recycling of existing materials and if it is feasible comparing to using new materials.<br>Management of demolition waste<br>Use of a circularity tool to evaluate existing buildings and give the best possible solutions to refurbishment<br>Deconstruction of building structures and parts |

Following the construction phase, building renovation also plays an important role in advancing circular economy goals. While construction focuses on creating new buildings, renovation extends the lifespan of existing ones, aligning with established frameworks such as the 9R Framework and the ReSOLVE Framework (McKinsey Center for Business and Environment et al., 2015; Potting et al., 2016). Renovation helps reduce the demand for new construction, which generally requires more material resources (European Environment Agency, 2022) and produce significant waste and emissions (Lucas & Löschke, 2025). Although construction and renovation differ in their characteristics, the circular economy practices applicable to each stage may vary, but are not entirely distinct.

Four studies have been identified that separately establish circular renovation practices, distinct from those related to construction. The European Environment Agency (2022) proposes a set of actions

based on the classification of circularity objectives. De Silva et al. (2023) present practices structured around the 5R Framework. Nußholz et al. (2023) derive their practices from observations of multiple circular building cases across Europe, while Çetin et al. (2021) obtain it from a session of expert questioning. Table 2-2 presents a compilation of circular renovation practices drawn from these three sources.

*Table 2-2. Circular Economy practice in building renovation*

| Practice | Explanation | Reference |
|---|---|---|
| Increase Intensity of Use | Renovating spaces to enable multi-purpose or shared use, thus maximising the utility of the existing building area. | EEA (2022), Çetin et al. (2021) |
| Material/Component Reuse | Reclaiming materials or components (e.g., bricks, fixtures, structural elements if viable) during renovation for direct reuse after cleaning/repair. | EEA (2022), Nußholz et al. (2023), Çetin et al. (2021), De Silva et al. (2023) |
| Use Materials with High Recycled Content | Incorporating secondary materials (e.g., recycled aggregates, insulation made from waste) into the renovation process. | EEA (2022), Nußholz et al. (2023), De Silva et al. (2023) |
| Use Bio-based / Renewable Materials | Selecting materials derived from renewable biological sources (like timber, plant-based insulation) for renovation elements. | EEA (2022), Nußholz et al. (2023), Çetin et al. (2021), De Silva et al. (2023) |
| Choose Long-lasting Materials/Products | Selecting components for renovation that have a longer technical lifespan, reducing the frequency of future replacements. | EEA (2022) |
| Design for Disassembly (in Renovation Works) | Incorporating components or connection methods in the *newly added* parts of the renovation that allow for easy future separation and reuse. | EEA (2022), De Silva et al. (2023) |
| Design for Adaptability (in Renovation Works) | Designing renovated spaces or using systems that allow for easier future modifications to layout or function. | De Silva et al. (2023), Nußholz et al. (2023) |
| Energy Efficiency Renovation | Upgrading the building's thermal envelope (insulation, windows) and energy systems (heating, renewables) to minimise operational energy use. | EEA (2022), Nußholz et al. (2023), Çetin et al. (2021) |
| Repair | Fixing existing components (structural or non-structural) rather than replacing them during the renovation process. | Çetin et al. (2021), De Silva et al. (2023) |
| Use Prefabricated Elements | Employing prefabricated components (e.g., facades) during renovation, potentially reducing material use compared to on-site construction. | EEA (2022) |
| Use Nature-Based Solutions | Integrating green roofs or green facades as part of the building renovation. | EEA (2022) |

### 2.1.2 Barriers in Implementing CE in Building Renovation

Multiple barriers persist in implementing circular economy practices in the construction industry and building renovation. Recent studies have identified these barriers and categorised them into distinct dimensions. Fernandes and Ferrão (2023b) categorised it into five dimensions: Economic, Social, Organisational, Technical, Environmental, and Policy. Munaro and Tavares (2023) identified categories as Economic, Informational, Institutional, Political, and Technological. Wuni (2022) listed Cultural, Market, Knowledge, Financial, Management, Regulatory, Technological, Supply Chain, Stakeholder, Technical, and Organisational. Hossain et al. (2020) included Environmental, Social, Economical, Policy, Eco-efficiency indices, Management practices, and others. Giorgi et al. (2022) adopted a different approach by categorising them based on strategies: Resource/waste Management, Design for Reversible Building, and Business Strategies and Networking. This research compiles the barriers reported in the literature and classifies them into five key dimensions as proposed by Fernandes and Ferrão (2023b): economic, social, organisational, technical, and policy. This classification is chosen because it offers a comprehensive overview while avoiding excessive dimensions, in addressing circularity barriers related to the operation of a building renovation company.

#### Economic dimension

Economic barriers present significant challenges to the adoption of circular economy practices in the construction sector. High upfront investment costs, along with limited access to funding, financial incentives, and immediate economic returns, make circular approaches financially uncertain (Fernandes & Ferrão, 2023b; Wuni, 2022). Market conditions often exacerbate these challenges. The low cost of virgin materials undermines the competitiveness of secondary materials (Wuni, 2022), while markets and platforms for reclaimed products remain underdeveloped (Fernandes & Ferrão, 2023b; Wuni, 2022). Additionally, high processing costs further hinder economic feasibility (Fernandes & Ferrão, 2023b; Wuni, 2022). The absence of well-established and profitable circular business models adds to these financial constraints (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022).

#### Social dimension

Social barriers largely arise from limited awareness, entrenched cultural norms, and skill shortages within the labour market. A widespread lack of knowledge and understanding of circular economy principles, their benefits, and technical application persists among various stakeholders, including clients and the general public (Fernandes & Ferrão, 2023b; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022). This is compounded by the construction industry's general resistance to change and its aversion to risk (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Wuni, 2022). Additional obstacles include a lack of trust in the quality and performance of reused or recycled materials (Fernandes & Ferrão, 2023b; Wuni, 2022), insufficient consumer demand (Wuni, 2022), and labour market skill gaps that require targeted training to support the implementation of circular practices (Fernandes & Ferrão, 2023b; Wuni, 2022).

#### Organisational dimension

Organisational barriers are linked to internal structures, processes, collaboration, and management commitment. A lack of support and leadership from top management often prevents circular economy initiatives from being prioritised within firms (Hossain et al., 2020; Wuni, 2022). Fragmented collaboration, communication breakdowns, and poor integration across the supply chain hinder effective coordination efforts (Fernandes & Ferrão, 2023b; Munaro & Tavares, 2023; Wuni, 2022). Additional challenges include the absence of standardised performance metrics and assessment tools for circular economy implementation (Fernandes & Ferrão, 2023b; Wuni, 2022), the lack of established

business models and operational frameworks (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Wuni, 2022), insufficient organisational resources and capabilities (Wuni, 2022) and poor information-sharing practices (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Wuni, 2022).

### Technical dimension

Technical barriers relate to challenges associated with materials, processes, technologies, and infrastructure. There is a significant gap in technical expertise, proven technologies, and specialised equipment for circular economy activities such as selective deconstruction, material processing, and tracking (Fernandes & Ferrão, 2023b; Munaro & Tavares, 2023; Wuni, 2022). Effective data management also presents a major hurdle, particularly in relation to material traceability and the integration of Building Information Modelling (BIM) to support circular practices (Fernandes & Ferrão, 2023b; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022). Additional technical challenges include the lack of standardised practices and quality assurance for reclaimed materials (Fernandes & Ferrão, 2023b; Wuni, 2022), the complexity of managing existing buildings and materials (Fernandes & Ferrão, 2023b; Munaro & Tavares, 2023), and limited infrastructure for the collection, storage, and reprocessing of materials (Fernandes & Ferrão, 2023b; Wuni, 2022).

### Policy dimension

Policy barriers underscore the critical role of governance in enabling circular economy adoption. A key challenge is the absence of a consistent, clear, and supportive regulatory framework specifically tailored to the construction industry (Fernandes & Ferrão, 2023b; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022). This is often accompanied by a lack of financial support from governments, including insufficient tax incentives or subsidies to mitigate the economic challenges of implementing circular practices (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Munaro & Tavares, 2023; Wuni, 2022). Additional issues include weak regulatory pressure, the absence of clear national circular economy targets and vision (Wuni, 2022), poor enforcement of existing environmental regulations (Wuni, 2022), and existing legal frameworks that obstruct rather than facilitate circular solutions (Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022). Furthermore, complex administrative procedures contribute to the difficulty of transitioning to circular practices (Wuni, 2022).

In the specific context of the Dutch housing sector, Çetin et al. (2021) identify five barriers to implementing circular economy practices: (1) higher priority given to other issues; (2) operating within a linear system; (3) lack of awareness, knowledge, and experience with the CE; (4) high purchasing costs of circular materials (new and recycled); and (5) unclear business case.

Table 2-3 offers a comprehensive list of the identified barriers and enablers in implementing circular economy practices within the building renovation industry.

*Table 2-3. Barriers and proposed solutions in implementing CE practices*

| Dimension | Barriers | Proposed solution | Reference |
|---|---|---|---|
| **Economic** | High upfront investment costs for CE implementation, technologies, and reversible/circular buildings. | • Provide government financial support, tax incentives (e.g., reduced VAT for refurbishment), and subsidies.<br>• Increase the scope of green finance to cover CE initiatives.<br>• Develop lifecycle costing (LCC) methodologies to demonstrate long-term economic benefits and create a stronger financial business case. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022) |
| | Lack of funding, capital, and financial resources for CE initiatives and business models. | • Establish government funding programs and incentives for circular business models.<br>• Encourage public-private partnerships to fund CE infrastructure and innovation.<br>• Create a clear business case to attract private investment. | (Fernandes & Ferrão, 2023b; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of clear economic benefits in the short run; unpredictable financial returns. | • Quantify the long-term business benefits of CE (e.g., material value retention, new markets).<br>• Use lifecycle assessment (LCA) and LCC to make informed decisions.<br>• Support and publicise pilot projects to demonstrate economic viability and de-risk investment. | (Fernandes & Ferrão, 2023b; Wuni, 2022) |
| | Low prices of virgin raw materials compared to recycled/reused or eco-friendly materials. | • Introduce or increase taxes on virgin raw materials and landfill disposal.<br>• Create a stable and transparent market for secondary materials.<br>• Reduce the cost of eco-friendly and recycled materials through subsidies and process optimisation. | (Fernandes & Ferrão, 2023b; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Unclear or unconvincing financial business case for CE; difficulties in estimating lifecycle costs/benefits. | • Develop standardised methodologies and tools for assessing and quantifying the economic benefits of CE.<br>• Promote and showcase successful case studies and best practices.<br>• Train professionals in lifecycle cost and benefit analysis. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Wuni, 2022) |
| | Lack of developed market mechanisms, platforms, and demand for reused/recycled/refurbished products. | • Establish physical and online marketplaces for material circularity (e.g., for reclaimed materials).<br>• Improve reverse logistics and create urban-level material flow management systems.<br>• Use Green Public Procurement (GPP) to stimulate demand for circular products. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | High costs associated with deconstruction, sorting, treating, transporting, certifying, and storing CDW/reclaimed materials. | • Provide training to create a skilled labour force for selective deconstruction.<br>• Develop advanced sorting and recycling technologies to improve efficiency.<br>• Offer subsidies or tax reductions for deconstruction activities and establish proximity storage facilities. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Munaro & Tavares, 2023; Wuni, 2022) |

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|---|---|---|---|
| | Immature market for CE technologies and services. | • Promote innovative business models like "product-as-a-service" (PaaS).<br>• Fund research and development (R&D) in circular technologies.<br>• Use demonstration projects to validate and promote new technologies and services. | (Hossain et al., 2020; Wuni, 2022) |
| | Lack of successful/established CE business models. | • Develop and disseminate frameworks and best practices for circular business models.<br>• Government and industry support for pilot projects to test and refine new business models<br>• Increase corporate social responsibility requirements for organizations. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022) |
| | Fiscal barriers and lack of incentives for service-oriented models (e.g., leasing, product-as-a-service). | • Implement policy-based incentives such as tax reductions or exemptions for projects adopting CE principles.<br>• Create new financial products and insurance models that support leasing and PaaS. | (Giorgi et al., 2022) |
| **Social** | Lack of awareness, understanding, and knowledge of CE principles, benefits, and practices among stakeholders (incl. clients, public). | • Establish CE training courses and include CE in professional and university curricula.<br>• Launch public awareness campaigns and workshops to educate clients and the public.<br>• Improve information sharing through digital platforms and building passports. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Hesitant company culture, resistance to change, risk aversion within the construction industry. | • Mandate stronger corporate social responsibility to drive cultural change.<br>• Implement government-led demonstration projects to de-risk CE and showcase its benefits.<br>• Develop appropriate risk governance frameworks for circular projects. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of trust in the quality and performance of recycled/reused/refurbished materials and components. | • Develop and enforce quality standards, testing protocols, and certification for secondary materials.<br>• Improve the quality of refurbished products through standardised processes.<br>• Increase data transparency on material properties through material passports. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Preference for virgin materials over reused/recycled alternatives. | • Combine economic instruments (taxing virgin materials) with quality assurance for secondary materials to build confidence and make them more competitive. | (Wuni, 2022) |
| | Lack of required skills, training, expertise, and skilled labour for CE practices (e.g., deconstruction, Dfd). | • Create specialised training and development programs for practitioners, designers, and construction workers in deconstruction, circular design, and material reuse. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |

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| | Lack of shared vision and consensus on CE definition, goals, and strategies. | • Establish clearly defined national goals, targets, and visions for CE in the construction sector.<br>• Facilitate multi-stakeholder dialogues to build consensus and a shared understanding. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Wuni, 2022) |
| | Insufficient consumer demand and acceptance for circular products/buildings/services. | • Increase consumer awareness through education and targeted communication.<br>• Ensure high quality and performance of circular products to build market confidence.<br>• Use public procurement to create initial, stable demand. | (Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022) |
| **Organisational** | Lack of top management commitment, support, and leadership for CE initiatives. | • Demonstrate a strong business case for CE to gain management buy-in.<br>• Integrate CE into corporate strategy, vision, and Key Performance Indicators (KPIs). | (Hossain et al., 2020; Wuni, 2022) |
| | Poor cooperation, collaboration, communication, and integration among stakeholders across the value/supply chain. | • Adopt collaborative contracts and delivery methods like Integrated Project Delivery (IPD).<br>• Create communities of practice and platforms for stakeholder networking.<br>• Use digital tools like BIM for transparent information sharing and integrated project delivery. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Fragmentation and complexity of the construction supply chain and processes. | • Create circular construction supply chain alliance networks.<br>• Use digital platforms to improve coordination and streamline processes.<br>• Promote vertical integration among supply chain partners. | (Fernandes & Ferrão, 2023b; Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of standardised indicators, metrics, and systems for CE performance assessment. | • Develop and mandate standardized CE performance indicators and metrics.<br>• Implement assessment frameworks (e.g., EU's Level(s)) and tools to quantify circularity. | (Fernandes & Ferrão, 2023b; Hossain et al., 2020; Wuni, 2022) |
| | Lack of established circular designs, business models, and frameworks for implementation. | • Develop and promote best practices for circular building designs and business models.<br>• Create policy-driven frameworks that guide refurbishment and construction from a CE perspective. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Complex planning requirements and increased organisational burden associated with CE. | • Streamline regulatory and approval processes for CE projects.<br>• Provide clear guidelines and support from local authorities. | (Wuni, 2022) |
| | Unsupportive business culture, organisational norms, and dominance of traditional linear models. | • Drive business re-engineering to incorporate circular principles into core operations.<br>• Promote a culture of innovation and sustainability through leadership and incentives. | (Wuni, 2022) |
| | Inadequate organisational resources and capabilities for CE adoption. | • Invest in building organizational capacity and resources for CE implementation. | (Wuni, 2022) |

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| | Lack of appropriate partners and participative networks. | • Establish stakeholder networks and digital platforms to connect potential partners.<br>• Facilitate cross-sector collaboration to build robust circular ecosystems. | (Giorgi et al., 2022; Wuni, 2022) |
| | Lack of data transparency and information sharing among stakeholders. | • Mandate the use of digital building logbooks and material passports<br>• Use BIM as a central information model accessible to all project stakeholders. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Wuni, 2022) |
| | Issues with manufacturers' responsibility (e.g., take-back systems, end-of-life management). | • Establish and enforce Extended Producer Responsibility (EPR) schemes and take-back systems. | (Hossain et al., 2020; Wuni, 2022) |
| | Lack of strategic organisational planning for CE. | • Integrate CE into long-term business strategy, supported by clear roadmaps and targets. | (Wuni, 2022) |
| **Technical** | Lack of technical know-how, technologies, and equipment for CE (e.g., DfD, recycling, tracking). | • Invest in R&D and support the adoption of proven CE technologies and equipment.<br>• Provide technical guidance and training on circular design, disassembly, and material recovery. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Difficulties in material traceability, data availability, quality, exchange, and management (incl. MPs, BIM integration). | • Implement mandatory digital building logbooks and material passports to track materials through their lifecycle.<br>• Use BIM to manage information about building components and their potential for reuse.<br>• Experiment with technologies like blockchain to ensure data integrity and traceability. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of standardised practices, methods, and quality standards for CDW management, EOL processes, CE design, and reclaimed materials/products. | • Develop harmonised standards for end-of-waste criteria, material quality, and selective disassembly.<br>• Create operational methodologies for CE design and selective deconstruction. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Technical challenges related to disassembly, selective demolition, and material separation. | • Promote and incentivize Design for Disassembly (DfD) and Design for Adaptability (DfA).<br>• Invest in developing advanced and less destructive demolition and separation techniques. | (Fernandes & Ferrão, 2023b; Munaro & Tavares, 2023) |
| | Issues with quality, quantity, consistency, and technical properties of reclaimed/recycled materials. | • Establish robust quality control, testing, and certification systems for reclaimed materials.<br>• Create regional material banks and platforms to manage inventory and ensure consistent supply. | (Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022) |
| | Building-related barriers (e.g., complexity, long lifespan, modifications during use, existing structure constraints). | • Design new buildings for flexibility, adaptability, and disassembly using modular and prefabricated components.<br>• For existing buildings, conduct thorough "mapping" to understand constraints and potential before refurbishment. | (Fernandes & Ferrão, 2023b; Munaro & Tavares, 2023) |

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| | Lack of enabling digital technologies (e.g., BIM for CE, digital platforms, tracking systems). | • Increase investment in and adoption of digital tools.<br>• Provide training and support to ensure the workforce can effectively use these technologies. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Technical complexity of transitioning from linear to CE models and processes. | • Support the transition with technical guidance, pilot projects, and knowledge-sharing platforms.<br>• Benchmark best practices to create clear pathways for adoption. | (Wuni, 2022) |
| | Scaling difficulties for CE implementation in construction. | • Foster technological innovation to improve the scalability of CE solutions.<br>• Start with smaller, manageable pilot projects to build expertise before scaling up. | (Wuni, 2022) |
| | Lack of infrastructure readiness for CE (e.g., collection centres, recycling plants, storage facilities). | • Promote public and private investment in essential CE infrastructure.<br>• Conduct urban-level material flow analysis to strategically plan infrastructure needs. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| **Policy** | Lack of a consistent, supportive, and clear regulatory framework, appropriate policies, and sound legislation for CE. | • Develop sound, consistent, and long-term CE policies, legislations, and regulations.<br>• Ensure coordination between different levels of government and policy areas. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of government financial support, tax incentives, and subsidies for CE practices and business models. | • Implement targeted financial support mechanisms, including grants, subsidies, and tax incentives (e.g., reduced VAT, property tax exemptions) for CE projects. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of regulatory pressure and stringent regulations to drive CE adoption. | • Increase regulatory pressure with clear, stringent, and enforceable regulations that mandate circular practices (e.g., minimum recycled content). | (Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022) |
| | Lack of clearly defined national goals, targets, and visions for CE in the construction sector. | • Establish clear and ambitious national/regional goals, targets, and visions for CE to provide a clear direction for the industry. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Weak enforcement of existing environmental rules and regulations. | • Strengthen monitoring and enforcement of environmental and waste management regulations, including penalties for non-compliance. | (Wuni, 2022) |

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| | Obstructive laws and regulations (e.g., low landfill taxes/fees, restrictive building codes). | • Revise and adapt existing building codes and regulations to facilitate the use of secondary materials and circular design principles.<br>• Significantly increase landfill taxes and fees to make reuse and recycling more economically attractive. | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Hossain et al., 2020; Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of specific incentives for Design for End-of-Life (DfEoL) or disassembly. | • Introduce specific policy incentives, such as faster permit delivery or tax benefits, for projects that demonstrate superior DfD principles. | (Munaro & Tavares, 2023; Wuni, 2022) |
| | Lack of standardised end-of-waste criteria. | • Define and legally establish clear and harmonised end-of-waste criteria to facilitate the creation of secondary raw material markets. | (Giorgi et al., 2022) |
| | Limited use of circular criteria in Green Public Procurement (GPP). | • Mandate the inclusion and prioritisation of ambitious circular criteria in all public tenders to leverage public spending power to drive market transformation. | (Giorgi et al., 2022; Wuni, 2022) |
| | Poor institutional support and frameworks for CE implementation. | • Strengthen institutional capacity and provide clear, supportive frameworks for CE implementation at local and national levels. | (Wuni, 2022) |
| | Complex administrative and legal procedures for CE initiatives. | • Streamline administrative, permitting, and legal procedures to reduce burdens and timeframes for circular projects. | (Wuni, 2022) |

## 2.2 Knowledge

The definition of knowledge has been widely debated among scholars, with no clear consensus reached (R. Grant & Phene, 2022). Two prominent conceptualisations of knowledge were proposed by Grant (1996b) and Spender (1996). Grant (1996b), adopting an objective perspective, defines knowledge as "that which is known," focusing on its characteristics that are essential for management and value creation within the firm. In contrast, Spender (1996) emphasises the need for a clear epistemology, highlighting the multifaceted nature of knowledge through various typologies and presenting it as inherently embedded within individual and collective activity systems.

Nonaka (1994) provides another seminal conceptualisation of knowledge. He classifies knowledge into two forms: tacit and explicit. Tacit knowledge is personal, deeply rooted in action and experience, hard to formalise and communicate, and often described as 'know-how' (Kogut & Zander, 1992; Nonaka, 1994). Its transfer is slow, costly and uncertain (R. M. Grant, 1996b). Explicit knowledge refers to knowledge that is codifiable, transmittable in formal language and can be easily communicated (Kogut & Zander, 1992; Nonaka, 1994).

### 2.2.1 Resource-based View

Barney (1991) proposed the seminal Resource-based View (RBV) conceptualisation, which departs from the notion that a firm's ability to achieve and sustain competitive advantage lies not primarily in its industry positioning but in the unique resources and capabilities it controls. Within this view, he defines a firm's resources to "*include all assets, capabilities, organisational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness".* However, he argued that simply possessing resources is not enough. He proposed the VRIN framework, Valuable – Rare – Imperfectly Imitable – Non-substitutable, to assess whether a firm's resource holds the potential to be a source of sustained competitive advantage

- Valuable
  A resource is valuable if it helps the firm enhance its performance by exploiting market opportunities or neutralising environmental threats. It must enable the firm to implement strategies that improve its overall efficiency and effectiveness.
- Rare
  A resource must be rare, meaning it is possessed by a few current or potential competitors, to contribute to a competitive advantage. Common resources cannot yield an advantage as all firms can leverage them similarly, even if valuable.
- Imperfectly Imitable
  A resource must be difficult or costly for competing firms to duplicate if the advantage it provides is to be sustained over time. This difficulty often stems from unique historical paths, ambiguous causes of success, or socially complex phenomena like culture and trust.
- Non-substitutable
  For sustained advantage, there must not be substitutes or strategic equivalents available for the resource that competitors could use to achieve the same results. If competitors can bypass the resource using different means, its unique strategic contribution is diminished.

Within the resource-based view, knowledge is interpreted as a crucial type of resource and is often considered an intangible resource (Spender, 1996).

### 2.2.2 Knowledge-based View

Building from the RBV, Grant (1996b) proposed Knowledge-based View (KBV) that conceptualises the firm as an institution primarily focused on knowledge. It proposed that knowledge is the most strategically important resource of the firm and a key driver for competitive advantage. This view suggests that the primary role of a firm is to integrate the specialised knowledge held by individual members to produce goods and services, as organisations cannot generate knowledge without individuals (Nonaka, 1995).

The Knowledge-based View highlights several characteristics of knowledge that are critical for management as follows:

- Transferability
  Explicit knowledge is easily communicated and transferred, while tacit knowledge, revealed through application, is slow, costly, and uncertain to transfer.
- Aggregability
  The efficiency of knowledge aggregation depends on its expression in a common language, with explicit knowledge being more readily aggregated (especially with IT), while tacit or idiosyncratic knowledge is difficult to aggregate at a single location.
- Appropriability
  Knowledge lacks clear property rights, making appropriability complex. Tacit knowledge is indirectly appropriated through its application, while explicit knowledge faces challenges due to its nonrivalrous nature; this means that once codified knowledge is shared, it can be replicated and used by competitors at almost no cost, making it difficult for the original firm to protect its competitive advantage.

KBV extends its concerns beyond the RBV, strategic choice and competitive advantage, to encompass fundamental aspects of the theory of the firm, such as the nature of coordination, organisational structure, the role of management and decision-making authority, firm boundaries, and innovation. Based on the KBV, organisational design should focus on mechanisms for integrating individuals' specialised knowledge, recognising the challenges in transferring tacit knowledge.

## 2.3 Absorptive Capacity

Knowledge remains a key resource for generating value and maintaining competitive advantage in dynamic business environments (Teece et al., 1997). However, firms that rely solely on internal knowledge (i.e. knowledge from their own resource) may overlook opportunities to incorporate valuable external insights that support strategic innovation (Camisón & Forés, 2010). Therefore, it is vital for firms to explore and utilise external knowledge sources (i.e., knowledge that is not available within the company's resources) to remain competitive. (Lane et al., 2006). One way for an organisation to learn is through acquiring new members who possess knowledge that the company previously did not have (R. M. Grant, 1996a). The concept of absorptive capacity plays a central role in this process, as it enables firms to identify and apply external knowledge effectively to enhance performance.

Cohen and Levinthal (1990) provide the early definition of absorptive capacity that later is used by other scholars to expand or reconceptualise the theory. They define it as the ability of a firm to recognise and value new external knowledge, assimilate it, and apply it for commercial purposes. Kim (1998) states that high absorptive capacity is vital in effective organisational learning and that it consists of two major elements: prior knowledge base and effort of the organisation’s members. Building on Cohen and Levinthal’s definition, Lane et al. (2006) proposed that absorptive capacity

refers to a firm's ability to utilise external knowledge through three sequential processes: recognising and understanding new potential knowledge, assimilating valuable new knowledge, and applying the assimilated knowledge to generate new insights and achieve commercial returns. These processes are also known as exploratory learning, transformative learning, and exploitative learning, respectively.

In response to the dynamic nature of the business environment, Teece et al. (1997) emphasise the need for firms to develop dynamic capabilities. These capabilities are defined as a firm's ability to combine, construct, and restructure internal and external competencies to address changing conditions. They do not cause change to the strategic direction or the organisation, but assist firms in adjusting to strategic change (Sun & Anderson, 2008). Zahra and George (2002) reconceptualise absorptive capacity by incorporating the dynamic capabilities concept into its framework. They describe absorptive capacity as comprising organisational routines and strategic processes that enable firms to acquire, assimilate, transform, and apply knowledge for the development of dynamic capabilities. Sun and Anderson (2008) further elaborate that this view highlights the firms' systems, processes, routines and structures and should be regarded as a distinct form of organisational learning related to a firm's interaction with external knowledge. The absence of absorptive capacity may hinder firms from internalising external knowledge (Szulanski, 1996).

### 2.3.1 Absorptive Capacity Model

Aligned with their definition, Zahra and George (2002) present one of the most influential models to date, as illustrated in Figure 2-1. In this framework, Absorptive Capacity (ACAP) is divided into Potential Absorptive Capacity (PACAP/PAC) and Realised Absorptive Capacity (RACAP/RAC). PACAP includes the first two dimensions: acquisition and assimilation, while RACAP includes the latter two: transformation and exploitation. In addition to this core structure, the model also identifies key antecedents of ACAP, such as knowledge sources, complementarities, and experience, along with its outcomes, which include strategic flexibility, innovation, and firm performance. The relationships between these elements are shaped by moderators, namely activation triggers, social integration mechanisms, and regimes of appropriability.

However, this model received several critiques from Todorova and Dursin (2007). They argue that (1) recognising the value of knowledge is a distinct component prior to acquisition; (2) transformation is an alternative process connected to assimilation rather than necessarily a subsequent step; (3) the separation of PACAP and RACAP is unnecessary, as scholars choose to focus research on the four dimensions, not in groups; (4) social integration mechanisms likely affect all dimensions of absorptive capacity; (5) power relationships should be a factor influencing absorptive capacity; and (6) the inclusion of feedback loops in a dynamic model. Regardless, they mention that further research is needed to confirm their proposition above.

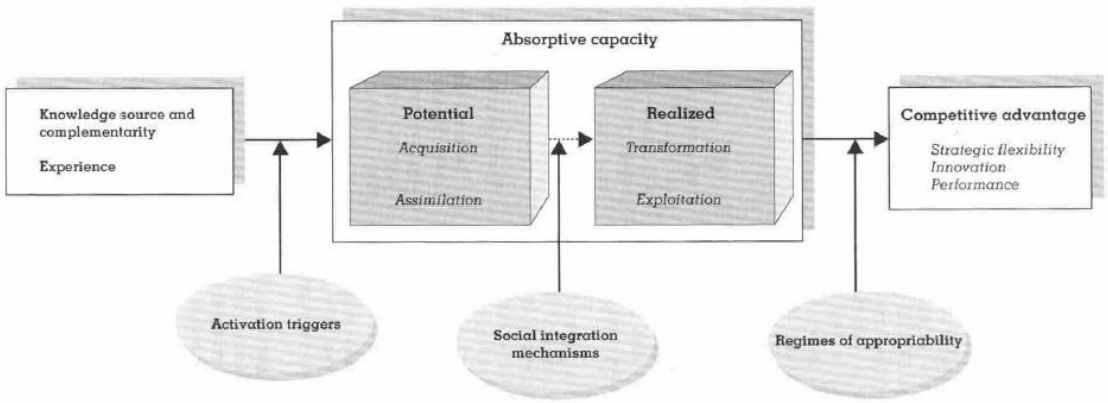


*Figure 2-1 Absorptive capacity model (Zahra & George, 2002)*

### 2.3.2 Dimension of Absorptive Capacity

PACAP captures the firm's effort in identifying and acquiring new external knowledge and assimilating it (Camisón & Forés, 2010; Zahra & George, 2002). RACAP represent the firm's ability to combine the newly assimilated knowledge with internal knowledge and incorporate it into operations and processes (Camisón & Forés, 2010; Zahra & George, 2002). Potential absorptive capacity contributes to competitive advantage by enhancing managerial flexibility and supporting the development of organisational resources and capabilities, whereas realised absorptive capacity does so by enabling the creation of new products and processes (Zahra & George, 2002).

#### Acquisition

Acquisition refers to a firm's capability to locate, identify, evaluate, and obtain externally available knowledge that is essential to its operations and processes (Lane & Lubatkin, 1998; Liao et al., 2003; Zahra & George, 2002). While some scholars, such as Todorova and Durisin, suggest that recognising the value of knowledge is a separate stage preceding acquisition, Camisón & Forés (2010) argue that valuing knowledge is embedded within the acquisition dimension since firms must value knowledge in order to acquire it. To facilitate the acquisition of new knowledge, firms must actively engage in networking efforts with customers, suppliers, or institutional partners (Albort-Morant et al., 2018; Tsai, 2001).

#### Assimilation

Assimilation refers to the organisational routines and processes through which newly acquired external knowledge is analysed, interpreted, internalised, and categorised (Szulanski, 1996; Zahra & George, 2002). It plays a vital role in embedding knowledge within existing cognitive frameworks and enabling its integration into broader organisational learning (Lane et al., 2006). The capacity to assimilate new knowledge is further strengthened by contextual factors. Prior knowledge forms a necessary cognitive foundation that enhances the interpretation of external insights (Kim, 1998). Additionally, language similarity between source and recipient contributes to interpretive alignment, and employee training programmes improve individual capabilities to process and comprehend new knowledge (Lane et al., 2001).

#### Transformation

Transformation refers to a firm's capacity to develop and refine internal routines that support the integration of newly acquired or assimilated knowledge with existing knowledge. This process may involve the addition or removal of knowledge, or the reinterpretation and recombination of existing knowledge to generate new and innovative insights (Kogut & Zander, 1992; Van Den Bosch et al., 1999), which is crucial for innovation. Sun and Anderson (2008) and Camisón & Forés (2010) stated that

transformation should be distinguished from assimilation, as it involves processes of a different nature that facilitate the integration of newly assimilated knowledge into existing knowledge.

### Exploitation

Exploitation or application refers to the organisational ability to embed acquired, assimilated, and transformed knowledge into operational routines in order to refine, expand, and leverage existing processes, capabilities, and competencies, as well as to develop new ones. This capacity enables firms not only to improve what they already do but also to innovate by generating new products, services, and organisational structures (Lane & Lubatkin, 1998; Zahra & George, 2002). Exploitation, together with transformation, plays a central role in supporting open innovation, as both are essential for translating knowledge into meaningful outcomes (Naqshbandi & Kamel, 2017). However, achieving an effective balance between acquisition and exploitation is critical. Volberda (2010) cautions that firms which overemphasise knowledge acquisition without adequate exploitation risk incurring high costs without capturing value, while excessive reliance on exploitation may result in competence traps that hinder long-term adaptability.

Table 2-4 summarises the indicators to measure the four dimensions of a firm's absorptive capacity provided by Camisón & Forés (2010).

*Table 2-4. Indicators to measure a firm's absorptive capacity (Camisón & Forés, 2010)*

| Dimension | Indicator |
|---|---|
| Acquisition | Knowledge of competition<br>Openness towards the environment<br>R&D cooperation<br>Internal development of technological competences |
| Assimilation | Assimilation of technology<br>Human resources<br>Industrial benchmarking<br>Involvement in spreading the knowledge<br>Attendance at training courses and professional events<br>Knowledge management |
| Transformation | Transmission of IT-based knowledge<br>Renewal capability<br>Adaptation capacity<br>Exchange of scientific and technological information<br>Integration of R&D |
| Exploitation | New knowledge exploitation<br>Application of experience<br>Development of patents<br>Technological proactiveness |

## 2.3.3 Antecedents

Antecedents of absorptive capacity refer to the preceding factors, conditions, or organisational characteristics that influence a firm's absorptive capacity. Cohen and Levinthal (1990) suggest that a firm's absorptive capacity depends on its Research & Development activities and levels of prior related knowledge. Zahra and George (2002), through its model, determine that antecedents only affect

potential absorptive capacity. These antecedents include a firm's exposure to diverse and complementary external sources of knowledge and experience. However, the findings by Vega-Jurado et al. (2008) show that organisational knowledge and R&D activities enhance the firm's ability to acquire and exploit external knowledge.

Jansen et al. (2005) argue that mere exposure to external knowledge is insufficient for firms to internalise new knowledge and contend that firms must develop organisational capabilities referred to as combinative capabilities to enhance their absorptive capacity. These capabilities enable firms to integrate and apply existing knowledge, both tacit and explicit, to create new technologies or replicate existing ones effectively (Kogut & Zander, 1992). Jansen et al. (2005) identify three types of combinative capabilities: coordination capabilities, system capabilities, and socialisation capabilities, each of which is supported by specific organisational mechanisms.

Coordination capabilities facilitate the flow of knowledge across organisational levels and disciplines. These capabilities are reflected in mechanisms such as cross-functional collaboration, participation in decision-making, and job rotation. Cross-functional teams, liaison roles, and task forces are commonly used to support this exchange. Involving employees in higher-level decision-making increases engagement and promotes knowledge sharing while rotating employees across roles enhance experiential learning. According to Jansen et al. (2005), these three mechanisms significantly influence both dimensions of potential absorptive capacity but have a positive effect only on the transformation dimension of realised absorptive capacity.

Systems capabilities are intended to pre-structure organisational behaviour and support the management of routine operations. These capabilities are often associated with formalisation and routinisation, which contribute to the development of consistent and predictable organisational responses. Formalisation refers to the degree to which procedures, rules, and communication are clearly documented, while routinisation involves the creation of task sequences that are repetitive, stable, and require limited cognitive effort. According to Jansen et al. (2005) routinisation negatively affects both dimensions of potential absorptive capacity and the transformation component of realised absorptive capacity. In contrast, formalisation has a positive impact on both dimensions of realised absorptive capacity.

Socialisation capabilities promote a shared understanding of acceptable behaviours within the organisation by shaping implicit norms and encouraging common communication codes and organisational values. These capabilities are generally reflected in two mechanisms: connectedness, which refers to the structural density of interpersonal relationships, and socialisation tactics, which guide individuals' interpretations and responses through shared social experiences. According to Jansen et al. (2005), connectedness significantly enhances the assimilation dimension of potential absorptive capacity, while both connectedness and socialisation tactics have a significant positive effect on both dimensions of realised absorptive capacity.

Distel (2019) adopts a different approach in identifying the antecedents that influence a firm's absorptive capacity. He argues that absorptive capacity is multilevel in nature, shaped by factors at both the organisational and individual levels. At the organisational level, Distel identifies two key antecedents: formal integration mechanisms and informal integration mechanisms.

Drawing on the concept of coordination capabilities as defined by Jansen et al. (2005), Distel describes formal integration mechanisms as structured methods for coordinating activities across organisational and functional units, such as liaison committees and interdepartmental task forces. Informal integration mechanisms, based on Jansen et al.'s socialisation capabilities, rely on open

communication and informal relationships within and across organisational units, often embedded in social networks. Both formal and informal integration mechanisms have a significant and positive impact on absorptive capacity at the organisational level (Distel, 2019).

At the individual level, he highlights knowledge workers' perspective taking and creative behaviour as relevant influencing factors. Perspective taking refers to the ability of knowledge workers to adopt the viewpoints of others to understand their needs and motives. This applies internally to colleagues, subordinates, and supervisors, and externally to customers and suppliers. Perspective taking is positively and significantly influenced by both types of integration mechanisms. In turn, it fosters creative behaviour, which is defined as the generation of novel and valuable ideas. Distel (2019) finds that creative behaviour has a significant and positive influence on absorptive capacity at the organisational level. Therefore, in addition to the direct influence that integration mechanisms have on absorptive capacity at the organisational level, they also affect absorptive capacity through the individual-level processes of perspective taking and creative behaviour (Distel, 2019).

Organisational culture dictates which mechanisms are primarily adopted within a company and affects their effectiveness in enhancing absorptive capacity. It refers to the shared values, beliefs, norms, and assumptions that shape how individuals behave within a firm (Teece et al., 1997). A company that values employee development and knowledge sharing tends to promote participation in decision-making and informal relationships among individuals, resulting in relatively high levels of transformation and exploitation. In contrast, companies with a hierarchical culture tend to emphasise formal processes and routines, which can hinder communication and the flow of ideas, thus acting as a barrier to integration (Naqshbandi & Kamel, 2017).

### 2.3.4 Outcomes

Zahra and George (2002) state that a firm's competitive advantage is an outcome of high absorptive capacity, which enhances strategic flexibility, innovation, and overall performance. Potential absorptive capacity provides firms with strategic flexibility by allowing them to continuously update and expand their knowledge base through the identification of new external knowledge. In contrast, realised absorptive capacity enables firms to transform new ideas into concrete innovations. Moreover, absorptive capacity contributes to both financial and non-financial performance (Camisón & Forés, 2010; Najafi Tavani et al., 2013) and strengthens a firm's ability to capitalise on available opportunities (Tsai, 2001).

### 2.3.5 Moderators

#### Activation triggers

Activation triggers is defined as events that force firms to respond to specific stimuli (Zahra & George, 2002). These triggers can emerge internally, such as organisational crises, or externally, such as technological shifts and radical innovations, that may impact the industry's future. These trigger types induce a firm's efforts to search for external knowledge.

#### Social integration mechanism

Zahra and George (2002) define social integration mechanisms as the processes and structures that facilitate knowledge sharing among organisational members. They emphasise its role as a moderator that enhances a firm's ability to transform and exploit assimilated knowledge. However, later scholars have proposed a broader role for social integration mechanisms. Todorova and Dursin (2007) argue that the dimensions of absorptive capacity consist of organisational routines and processes that involve social interactions, and are therefore likely to be influenced by social integration mechanisms. This proposition is supported by the findings of Vega-Jurado et al. (2008) and Upstill-Goddard et al.

(2016) who show that social integration mechanisms influence not only the transformation and exploitation of scientific knowledge, but also the acquisition and assimilation of new knowledge.

#### Regime of appropriability

The regime of appropriability refers to the industry dynamics that determine a firm's ability to protect its new products or processes, and it moderates the relationship between realised absorptive capacity and competitive advantage (Zahra & George, 2002). A strong regime exists when firms are consistently able to capture profits from their innovations, while a weak regime occurs when innovations spill over to competitors who can capitalise on them (Lane & Lubatkin, 1998). In industries with strong appropriability regimes, firms often rely on patents to safeguard their innovations, thereby gaining a considerable advantage over competitors (Delmas et al., 2011). However, patenting can also expose innovations to the public, and rapid technological advancement may enable competitors to design around existing patents (Sun & Anderson, 2008).

### 2.3.6 Green Absorptive Capacity Model

Sustainable transformation is seen as a way to achieve business competitive advantage. Firms implement sustainability standards and practices to access new business opportunities (Upstill-Goddard et al., 2016). Consumers have begun to consider the environmental impact of products and prefer brands that are environmentally friendly (Jaiswal & Singh, 2018). Firms that switch to sustainable manufacturing from conventional methods have profited more than their competitors while also enhancing the brand image (Begum et al., 2023). In the construction industry, transformation towards sustainability relies on firms' ability to innovate products, services, and practices (Keast & Hampson, 2007).

Gluch et al. (2009) developed the green absorptive capacity model to achieve competitive advantage through sustainability transformation, as illustrated in Figure 2-2. They developed this model based on Zahra and George's framework, which they argue provides a comprehensive explanation at the time. Based on their research findings, they made several adjustments to the general absorptive capacity model. First, they discovered that activation triggers have a direct influence on acquisition rather than merely a moderating effect. Second, the antecedents are divided, indicating that different factors affect acquisition in distinct ways. Third, social integration mechanisms significantly influence exploitation with a minimal impact on transformation. Fourth, competitive advantage is shaped by transformation, exploitation, and regimes of appropriability. Therefore, the model proposed by Gluch et al. diminishes the moderating role, as the components have a direct influence on others.

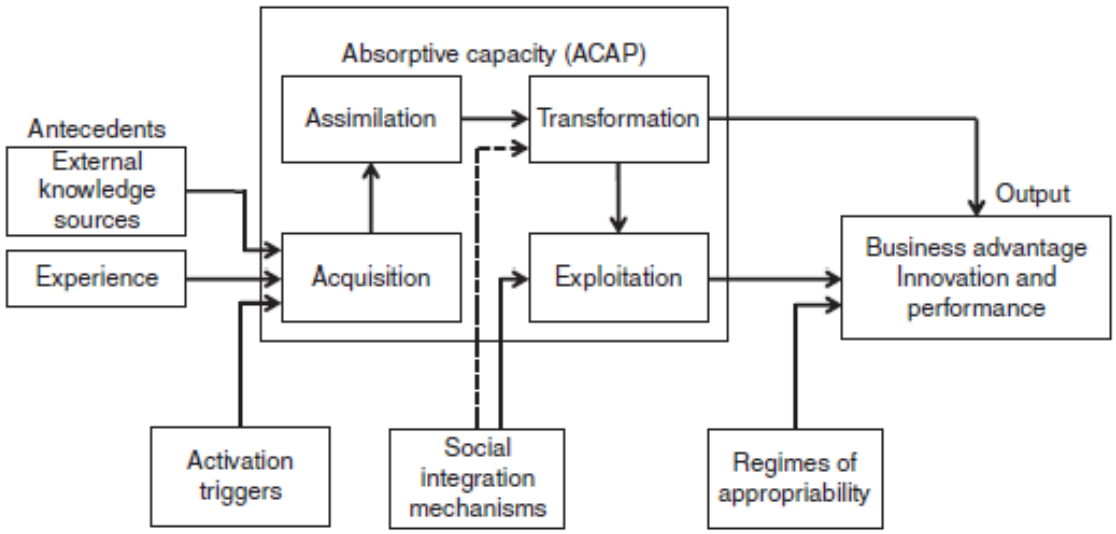


*Figure 2-2. Green absorptive capacity model (Gluch et al., 2009)*

### Stakeholders' role

Gluch et al. (2009) found that activation triggers have the strongest influence on a firm's acquisition capability compared to other antecedents. They observed that internal stakeholders, such as employees and managers, exert nearly the same level of influence as key external actors, including customers and tenants. Consumers and users place significant pressure on firms to pursue green innovation (Gluch et al., 2009; Pacheco et al., 2018; Upstill-Goddard et al., 2016) while also providing incentives that support sustainability initiatives (Zhang et al., 2020). Other notable sources of influence include formal institutions, through regulatory enforcement, and informal institutions, such as NGOs, which promote adherence to environmental norms (Zhang et al., 2020; Zhou et al., 2021). Incentive-based policies are more likely to stimulate innovation compared to command-and-control regulations, which drive compliance (Zhang et al., 2020).

Green absorptive capacity enables firms to respond to these pressures by converting them into drivers of sustainable innovation (Pacheco et al., 2018; Zhang et al., 2020; Zhou et al., 2021). It supports sustainability-oriented transformation by embedding environmental thinking into daily operations and helping firms turn regulatory obligations into competitive advantage (Martinez et al., 2023). However, Upstill-Goddard et al. (2016) observe that firms with limited resources may not engage in sustainability-related knowledge absorption unless clear incentives are present. Therefore, they argue that policy should focus on making sustainability profitable to promote knowledge acquisition. Even larger firms, despite having more resources, may still face challenges in implementing green innovation without sufficient green absorptive capacity (Zhou et al., 2021).

Beyond exerting pressure or offering incentives, stakeholders also act as important sources of sustainability-related knowledge that support environmental innovation. Collaboration and relationship learning with external stakeholders enhance green absorptive capacity by improving a firm's ability to acquire and apply sustainability insights (Albort-Morant et al., 2018; Marrucci et al., 2022). In particular, involving customers in green value co-creation activities strengthens a firm's capacity to internalise and utilise environmental knowledge (Yousaf, 2021). These practices contribute to meeting stakeholder expectations, which is essential for achieving sustainable and successful organisational performance (Gluch et al., 2009).

### Organisational integration mechanisms

The effectiveness of internal integration mechanisms in supporting absorptive capacity is dependent on the organisational context. In a quantitative study of the construction sector, Gluch et al. (2009) found that social integration mechanisms (i.e. top management support and communication) were positively associated with exploitation activities but did not significantly influence the transformation dimension of absorptive capacity. In contrast, Upstill-Goddard et al. (2016), applying Gluch's model in qualitative case studies of small and medium-sized enterprises (SMEs), observed that the same mechanisms supported all four dimensions of absorptive capacity, suggesting greater influence in smaller and more flexible organisational environments. Focusing on SMEs as well, Marrucci et al. (2022) emphasise that proactive learning, ongoing training, and cross-functional collaboration are essential for internalising and applying knowledge related to the circular economy. These practices are more likely to thrive in organisational structures that promote open communication and adaptability.

In a broader context, research emphasises the significance of internal knowledge processes. Adu-Yeboah et al. (2023) found that firms investing in internal learning and knowledge diffusion mechanisms are better positioned to integrate sustainability into their innovation strategies. Similarly, Begum (2023) stresses the need for systems that support continual learning and knowledge application across the organisation. In addition, top management's ability to balance internal and external focus is identified as a key factor that positively influences absorptive capacity (Stelmaszczyk et al., 2023).

#### Green absorptive capacity for sustainability

Many multinational corporations often face challenges in applying the knowledge they acquire despite their strong potential absorptive capacity, leading to passive knowledge storage and limited realised absorptive capacity (Riikkinen et al., 2017). Firms must go beyond the acquisition and assimilation of knowledge and focus on its practical exploitation and integration into organisational operations to fully realise the benefits of sustainability initiatives. Green absorptive capacity plays a key role in this transition by enabling firms to assimilate external environmental knowledge and align it strategically with internal functions such as marketing and service delivery (Ismail et al., 2023).

Firms that successfully internalise and apply green knowledge are better positioned to respond to market complexity while maintaining alignment with sustainability principles (Martinez et al., 2023). Higher levels of absorptive capacity also improve a firm's ability to transform sustainability efforts into innovative services, embedding sustainability into value creation strategies (Adu-Yeboah et al., 2023). This capability allows organisations to convert employee-generated environmental knowledge into strategic advantage, making sustainability a source of competitive differentiation (Begum et al., 2023). In addition, green absorptive capacity supports the realisation of entrepreneurial visions by transforming environmental insights into tangible sustainability outcomes (Marzouk & El Ebrashi, 2024).

### 2.3.7 Barriers in Absorptive Capacity

While a firm's absorptive capacity is critical to achieving competitive advantage, several barriers may hinder its full development. Matthyssens et al. (2005) established the link between such barriers and the development of absorptive capacity through case study research. Building on these findings, Cuervo-Cazurra and Rui (2017) refined the concept by categorising barriers according to their origin, distinguishing between internal and external sources. In addition, Leal-Rodríguez et al. (2014) highlight the role of cultural barriers in shaping absorptive capacity processes and influencing innovation outcomes. Understanding and addressing these barriers is essential for firms to minimise negative impacts and effectively absorb external knowledge in pursuit of sustained competitive advantage (Cuervo-Cazurra & Rui, 2017).

### Internal barriers

Managerial cognition and attitude can pose significant barriers to the development of absorptive capacity. Managers may exhibit biases against external knowledge, often associated with the 'not-invented-here' syndrome, past experiences, adherence to dominant industry norms, or personal career interests that distort their perception of value or lead to suboptimal partner selection (Cuervo-Cazurra & Rui, 2017; Matthyssens et al., 2005). Such biases can obstruct knowledge acquisition or, if knowledge is acquired, hinder its assimilation (Cuervo-Cazurra & Rui, 2017). Organisational inertia and complacency, where past successes result in resistance to change or a tendency to ignore external developments, may further impede the development of absorptive capacity (Matthyssens et al., 2005). At the individual level, negative responses such as lack of motivation, resistance to change, absenteeism, or the turnover of key personnel can weaken the firm's knowledge base and undermine the collective motivation required for effective knowledge absorption (Junni & Sarala, 2013).

Weak internal structures and processes pose significant challenges to the development of absorptive capacity, even when individual-level conditions are favourable. A lack of coordination between units or functions, ineffective communication channels, and the absence of systematic knowledge management practices can prevent acquired knowledge from being properly assimilated and transformed (Cuervo-Cazurra & Rui, 2017; Junni & Sarala, 2013). Moreover, an unsupportive organisational culture, characterised by limited collaboration, aversion to failure, and a lack of incentives for learning and knowledge sharing, can further demotivate employees (Cuervo-Cazurra & Rui, 2017). Cultural barriers have been shown to negatively moderate the relationship between absorptive capacity and innovation outcomes (Leal-Rodríguez et al., 2014). Organisational design also plays a critical role; excessive hierarchical rigidity can restrict flexibility and communication (Naqshbandi & Kamel, 2017), while insufficient formalisation of routines may hinder the systematic capture and use of knowledge (Vega-Jurado et al., 2008). Ultimately, the presence of prior related knowledge is essential. Without an adequate foundation of skills and understanding, individuals are unlikely to successfully absorb and apply new external knowledge (Cuervo-Cazurra & Rui, 2017; Junni & Sarala, 2013; Vega-Jurado et al., 2008).

### External barriers

Muted activation triggers from the external environment, such as low competitive intensity or substantial government support, can reduce a firm's perceived urgency to seek out and integrate external knowledge (Cuervo-Cazurra & Rui, 2017). In addition, conflicting relationships with external knowledge sources, resulting from misaligned objectives, lack of trust, or poor communication, may limit access to critical knowledge and hinder its effective exploitation (Cuervo-Cazurra & Rui, 2017; Matthyssens et al., 2005). Weak appropriability regimes, where intellectual property protection is insufficient, may also discourage external partners from sharing valuable knowledge due to concerns over imitation (Cuervo-Cazurra & Rui, 2017). Furthermore, firms may struggle to capture value from innovations developed using external knowledge if competitors can easily replicate the outcomes. In some cases, poor contract enforcement can make it difficult to resolve disputes, further increasing reluctance to engage in knowledge sharing (Cuervo-Cazurra & Rui, 2017).

Table 2-5 provides the summary of barriers and their proposed solution in absorptive capacity.

*Table 2-5. Barriers and proposed solution in absorptive capacity*

| Source | Barriers | Solution | Reference |
|---|---|---|---|
| **Internal** | **Managerial Biases & Attitudes**<br><br>Biases ('not-invented-here' syndrome), personal interests, | **Proactive & Principle-Based Leadership**<br>• Establish clear principles that prioritise partnership success. | (Cuervo-Cazurra & Rui, 2017) |

| | | | |
|---|---|---|---|
| | inertia, and complacency that devalue external knowledge. | • Use strategic communication to frame external partners positively and counter the 'not-invented-here' bias.<br>• Align managerial incentives with long-term knowledge integration goals, not just short-term operational targets. | |
| | **Negative Individual Responses**<br><br>Lack of motivation, resistance to change, absenteeism, and turnover of key personnel. | **Implement Supportive HR & Communication Systems**<br>• Ensure transparent and honest communication about strategic goals and changes to reduce uncertainty and build trust.<br>• Design supportive HR systems (e.g., team-based rewards, dual-channel promotion tracks for technical and managerial staff) to motivate and retain talent.<br>• Actively manage integration processes to create social ties between units, fostering a sense of shared purpose. | (Junni & Sarala, 2013; Cuervo-Cazurra & Rui, 2017) |
| | **Weak Internal Structures & Processes**<br><br>Poor coordination, rigid hierarchy, unsupportive culture, and lack of systematic knowledge management. | **Design for Knowledge Flow & Integration**<br>• Implement systematic social integration mechanisms like cross-functional teams and job rotation to break down silos.<br>• Develop a "knowledge-processing system" that combines a flexible, non-bureaucratic structure with a supportive, fault-tolerant culture.<br>• Invest in formal processes for capturing, storing (e.g., shared databases), and disseminating knowledge. | (Cuervo-Cazurra & Rui, 2017; Junni & Sarala, 2013); Naqshbandi & Kamel, 2017) |
| | **Lack of Prior Related Knowledge**<br><br>Insufficient foundation of skills, experience, and R&D to understand and apply new external knowledge. | **Strategic Investment in Human & Technological Capital**<br>• Invest continuously in employee training and education to build foundational skills and a common language.<br>• Maintain consistent internal R&D efforts, not just as a source of innovation, but as a mechanism for building the capacity to understand and evaluate external technology. | (Vega-Jurado et al., 2008; Junni & Sarala, 2013; Cuervo-Cazurra & Rui, 2017) |
| **External** | **Muted Activation Triggers**<br><br>Low competitive intensity or high government support reduces the perceived urgency to seek external knowledge. | **Increase Managerial Exposure & Foster Proactive Scanning**<br>• Actively expose managers to competitive pressures by entering more dynamic markets, participating in global industry events, and analysing disruptive competitors.<br>• Develop a proactive culture of environmental scanning to recognise market shifts and technological changes early, creating an internal sense of urgency rather than waiting for external shocks. | (Cuervo-Cazurra & Rui, 2017) |
| | **Conflicting Source Relationships**<br><br>Misaligned objectives, lack of trust, or poor communication with external partners. | **Proactive Relationship Management & Governance:**<br>• Invest in building relational trust through consistent, transparent communication and demonstrating a commitment to mutual goals.<br>• Establish clear governance structures (e.g., joint steering committees) to align objectives and provide forums for resolving disagreements. | (Cuervo-Cazurra & Rui, 2017; Matthyssens et al., 2005) |

| | | | |
|---|---|---|---|
| | | • Circumvent obstacles by collaborating on less sensitive, non-core technologies first to build a track record of success. | |
| | **Weak Appropriability Regimes & Contract Enforcement**<br><br>Poor IP protection and unreliable contracts make partners reluctant to share knowledge and make innovations easy to copy. | • **Adopt a Multi-Pronged Strategic Response**<br>• Adapt the Learning Strategy: Focus on acquiring less sensitive, non-core technologies that partners are more willing to share.<br>• Build Relational Trust as a Substitute: Develop strong, trust-based relationships that can serve as an informal governance mechanism where formal contracts are weak.<br>• Use Strategic Acquisitions: Bypass reluctant partners by acquiring firms in countries with strong IP protection to directly obtain core technologies and IPR. | (Cuervo-Cazurra & Rui, 2017) |

## 2.4 Synthesising the Theories

As the Netherlands pursues its ambitious national goals for a circular economy by 2050, the building renovation industry has become a focal point for sustainable transformation. For companies in this sector, the ability to innovate and adopt circular practices is no longer just a compliance issue but a key determinant of competitive advantage. The literature review has established that such innovation is heavily dependent on a firm's ability to identify and integrate valuable knowledge from external sources. This imperative places the theory of Absorptive Capacity at the heart of this research, as it provides a robust framework for understanding how companies can effectively harness external knowledge to drive sustainable transformation.

The conceptual framework for this research, illustrated in Figure 2-3, is therefore built upon the foundational absorptive capacity model proposed by Zahra and George (2002). However, to tailor this model to the specific context of this study, several critical modifications were made. First, to align the framework with the theme of sustainability, the work of Gluch et al. (2009) and Upstill-Goddard et al. (2016) was integrated, as they have adapted the model specifically for green innovation in the construction industry. Second, to provide a more granular understanding of how absorptive capacity functions within an organisation, the organisational capabilities identified by Jansen et al. (2005) are incorporated. While Jansen et al. originally termed these "antecedents," this research repositions them as the critical "organisational integration mechanisms," as they represent the specific levers (e.g., culture, communication, formalisation) that enable the absorptive capacity processes to work effectively. Finally, the framework deliberately disregards the "regime of appropriability" aspect, as the focus here is on harnessing the tacit and non-proprietary knowledge of migrant workers, not on protecting formal intellectual property.

This synthesised framework conceptualises a dynamic process. It begins with external Triggers (e.g., government policy, client demands) that prompt a company to seek new knowledge. The firm then scans various External Knowledge Sources, with a particular focus on the often-overlooked expertise of migrant workers. A company's ability to even recognise the value of this knowledge is determined by its existing Knowledge Base (e.g., prior experience, employee education). Once knowledge is identified, it is processed through the four dimensions of absorptive capacity: Acquisition, Assimilation, Transformation, and Exploitation, which provide a structured pathway from initial learning to practical application. The success and efficiency of this entire process are profoundly influenced by the firm's Organisational Integration Mechanisms, which act as the enablers or barriers to effective knowledge flow.

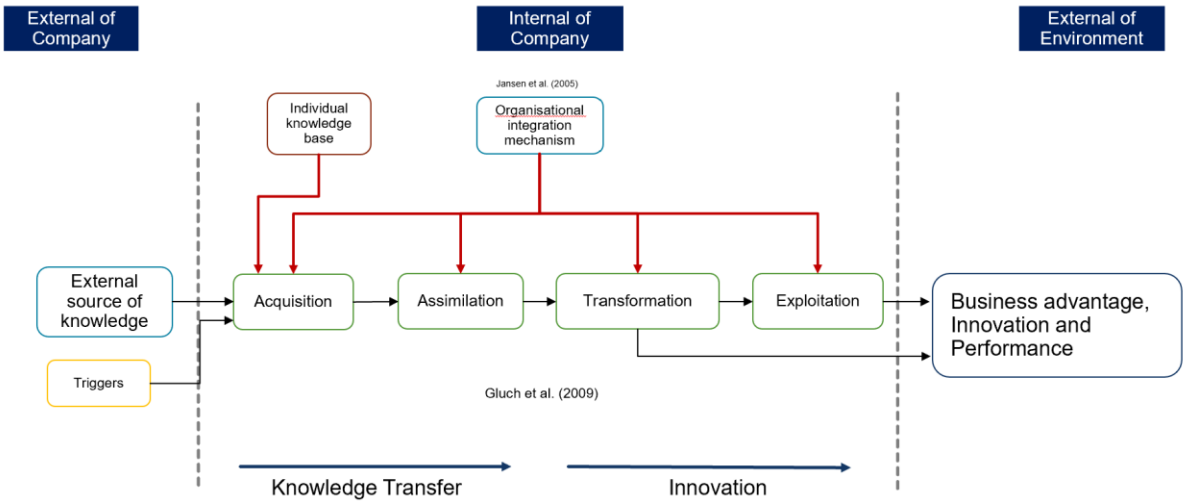


*Figure 2-3. Conceptual framework of absorptive capacity (adapted from Gluch et al. (2009), based on Zahra and George (2002))*

# 3 Methodology

This chapter outlines the steps of the approach used in this research. The study employed a qualitative method with a case study, involving semi-structured interviews as the primary data collection technique and qualitative analysis to understand the phenomena examined. This approach will address the second, third, and fourth sub-research questions by exploring the knowledge contribution of migrant workers, the variation of knowledge integration practices in different company scales, and the organisational barriers faced when integrating this knowledge, based on the insights from the literature review. The workflow for this qualitative approach is illustrated in Figure 1-3.

## 3.1 Data Collection

### 3.1.1 Literature Review

A comprehensive literature review was conducted to establish the theoretical and practical foundations of this research.

This review has three purposes. Firstly, it established the background and problem context by identifying the current state of migrant employment in the Netherlands and worldwide, while also assessing the status of circular economy practices and barriers in the building renovation industry. Second, it aimed to guide the subsequent empirical research by developing a robust conceptual framework for analysing the data. Finally, the theoretical constructs identified in this framework would later inform the coding process during the qualitative data analysis phase.

The review was executed through a systematic, two-phase process using academic databases such as Scopus, Web of Science, Google Scholar, and the TU Delft Repository.

1. Phase One: Contextual Framing.

The initial phase focused on understanding the context of the research problem. A broad search was conducted to identify the current conditions, common practices, and known barriers related to circularity in the construction sector. This search was guided by keywords such as *"circular economy construction"* and *"circular practice renovation"*. The findings from this phase were essential for shaping the problem statement and research relevance.

2. Phase Two: Theoretical Framework Development.

The second phase aimed to identify a suitable theoretical lens for understanding external knowledge integration within firms. An initial exploratory search was performed using broad keywords like *"company external knowledge recognition"* and *"external knowledge integration"*. This search identified the 'Absorptive Capacity' framework as the most relevant and comprehensive theory for the research objectives. Following this, a more focused and in-depth literature search was conducted using the specific keywords *"absorptive capacity"* and *"absorptive capacity construction"* to build a detailed understanding of the model, its dimensions, and its application in a comparable industry context.

The synthesis of these two phases resulted in the conceptual framework presented in Section 2.4, which provided the theoretical foundation for the semi-structured interviews and the subsequent data analysis.

### 3.1.2 Semi-structured Interview

This research employs semi-structured interviews to gain insights into the role of migrant workers in the building renovation industry, particularly regarding the integration of their knowledge into companies' sustainable transformation. Using a mix of open-ended and follow-up questions, the interviews explore the reasons behind employing migrant workers, including perceptions of their circular knowledge and contributions. They also examine the current practices of circular knowledge integration within companies and identify barriers that hinder the effective use of migrant workers' knowledge. This interview format enables respondents to share their experiences and perspectives, which allows a deeper understanding of the phenomenon in the Netherlands' building renovation industry.

### 3.1.3 Respondents

The selection of respondents was guided by a purposive sampling strategy. This non-random approach was chosen to deliberately include individuals with specific knowledge and experience relevant to the research questions, ensuring a rich and multi-faceted understanding of the phenomenon. The goal was not statistical representation but rather to capture a comprehensive range of perspectives on the integration of migrant workers' knowledge in the building renovation industry.

#### Criteria for Respondent Selection

To ensure the relevance and depth of the data, all potential participants were required to meet one of the following criteria while also being willing to share their insights and experiences within the scope of the research and the informed consent agreement.

1. Respondents must have professional experience with projects in the building construction and renovation industry within The Hague and its surrounding area that employ migrant workers.
2. Respondents must have an understanding of the dynamics in migrant workers' employment in the building construction and renovation industry within The Hague.
3. Respondents own a project in the building construction and renovation industry within The Hague and its surrounding area that employs migrant workers.

Based on the criteria outlined above, 10 respondents from four different stakeholder groups were chosen. Including these four distinct stakeholder groups was crucial for triangulating the findings and examining the issue from multiple perspectives. The list of respondents is shown in Table 3-1. The definition of each group and their specific contributions to the research are detailed below.:

#### Contractors

As the central unit of analysis, contractors provide the most direct insights into the research questions. Their perspective is essential for understanding day-to-day hiring practices, on-site knowledge sharing routines (or lack thereof), the direct barriers they face, and how their absorptive capacity functions in practice.

#### Clients

Their perspective is crucial for understanding the demand-side pressures that influence contractor behaviour. They provide insights into project requirements, how circularity is valued during contractor selection, and their perceptions of the skills and value that migrant workers bring to a project.

#### Labour Unions

They offer a macro-level perspective on the workforce. Their input is vital for understanding the systemic issues that shape the employment of migrant workers, such as the prevalence of temporary

contracts, the "labour-focused" employment model, and the broader social and economic factors at play.

Non-Governmental Organisations (NGOs)

Similar to labour unions, NGOs provide a critical third-party perspective that sits outside the direct commercial relationship between clients and contractors. They offer a broader societal context on the role of migration in The Hague and the social challenges faced by migrant workers.

*Table 3-1. List of respondents*

| No | Role | Category | Interview Date | Code |
|---|---|---|---|---|
| 1 | Project Director | Contractor | 28 May 2025 | CON01 |
| 2 | Owner and manager | Contractor | 8 June 2025 | CON02 |
| 3 | Sustainability transition leader | Client | 10 June 2025 | CLI01 |
| 4 | Property owner | Client | 16 June 2025 | CLI02 |
| 5 | Region coordinator | Non-governmental organisation | 23 June 2025 | NGO01 |
| 6 | Federation vice president | Labour union | 24 June 2025 | LUN01 |
| 7 | Policy advisor | Labour union | 24 June 2025 | LUN02 |
| 8 | Property owner | Client | 25 June 2025 | CLI02 |
| 9 | Negotiator | Labour union | 27 June 2025 | *LUN03* |
| 10 | Site supervisor | Contractor | 1 July 2025 | CON03 |

### 3.1.4 Interview Protocol

A standardised protocol was followed for all interviews to ensure consistency in the data collection process while maintaining the flexibility inherent in a semi-structured approach. The protocol consisted of four key stages: initial contact, informed consent, the interview session, and post-interview data handling.

1. Initial Contact and Scheduling

Potential participants, identified through the purposive sampling strategy, were initially contacted via email or professional networking platforms. The introductory message provided a brief overview of the research topic, its academic purpose, and an invitation to participate in an interview. Upon their expression of interest, a suitable time was scheduled based on the participant's availability.

2. Informed Consent Process

Ethical considerations were crucial throughout the research process. Prior to the scheduled interview, each participant was provided with the official Informed Consent Form (see Appendix B). This document detailed the purpose of the study, the voluntary nature of their participation, their right to withdraw at any time, and the procedures for ensuring confidentiality and anonymity. At the beginning of each interview session, these points were verbally reiterated, and participants were given a final opportunity to ask questions before providing their explicit consent to proceed and be audio-recorded.

3. Interview Session and Structure

The interviews were conducted as semi-structured conversations, lasting approximately 40-60 minutes each, and were held either in person or via Microsoft Teams. The semi-structured format allowed for a consistent line of inquiry guided by the research questions, while also providing the flexibility to probe deeper into emergent themes and individual experiences.

While the overarching themes remained consistent, the specific questions were tailored to the expertise and perspective of each stakeholder group to ensure relevance. The distinct sets of interview questions developed for each group are provided in the appendices:

- Appendix C: Interview Questions for Contractors
- Appendix D: Interview Questions for Clients
- Appendix E: Interview Questions for Labour Union and NGO Representatives

Each interview followed a general structure:

- Introduction: A brief introduction to the researcher and a restatement of the research goals.
- Background Questions: Initial questions about the respondent's role and experience to establish context.
- Thematic Questions: A series of open-ended questions aligned with the core research themes (knowledge types, integration practices, barriers).
- Closing: A final opportunity for the respondent to add any further thoughts or ask questions.

4. Data Recording and Transcription

With participants' permission, all interviews were audio-recorded. The recordings were then transcribed verbatim to create a complete and accurate written record of the conversations. To ensure accuracy, the transcripts were carefully reviewed against the original audio files. Participants were also offered the opportunity to review their own transcripts to verify their statements and suggest any necessary clarifications.

## 3.2 Methodology of Analysis

In this research, a qualitative analysis is performed using a thematic analysis approach. Thematic analysis is a method for analysing qualitative data that involves systematically identifying, organising, and interpreting patterns of meaning across datasets (Braun & Clarke, 2006). This method facilitates a nuanced and detailed interpretation that helps to understand social phenomena, rather than simply summarising the data. It is suitable for this research as it allows for an in-depth exploration of respondents' experiences and perspectives regarding the perception of migrant workers' knowledge and the barriers faced in recognising and utilising the knowledge. This method will employ a hybrid approach where both deductive and inductive processes will be used to analyse the data (Fereday & Muir-Cochrane, 2006). It allows the theoretical framework developed during the literature review phase to guide the analysis while also enabling the discovery of emerging themes directly from the narratives of the respondents.

The analysis will follow the process illustrated in Figure 3-1.

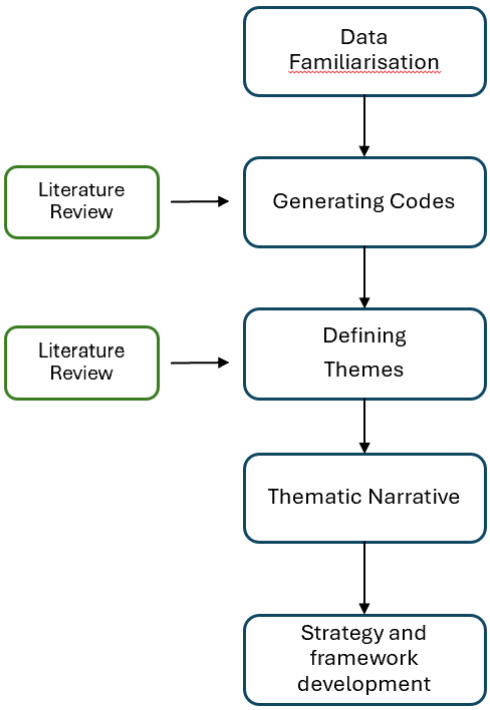


*Figure 3-1. Flow of data analysis*

1. Data familiarisation

The first step involves deep immersion in the data. All interview recordings will be transcribed verbatim to create a comprehensive written record of the discussions. The transcripts will then be read and re-read multiple times, alongside listening to the original audio recordings, to ensure accuracy and to develop a holistic understanding of the participants' perspectives, tones, and the overall context of their responses.

2. Generating initial codes

This phase will begin with the deductive application of a preliminary coding frame based on the key theoretical constructs from the literature review. Transcripts are uploaded to Atlas.ti, which then will be coded. The list of circular practices in the building renovation industry will serve as guiding concepts for sub-research question 2, while the conceptual framework of absorptive capacity, as illustrated in Figure 2-4, will serve as a guiding concept for sub-research questions 3 and 4. These concepts will guide the initial coding of data segments that relate to stakeholders' perception of migrant workers' knowledge and the integration of that knowledge for the company's sustainable performance.

Concurrently, an inductive coding process will be employed. The data will be reviewed line-by-line to identify relevant information and concepts that may not fit within the initial theoretical frame. New codes will be generated "from the data" to capture unexpected insights, specific contextual factors, and unique participant experiences. This dual approach ensures that the analysis is both theoretically relevant and empirically grounded.

3. Defining themes

Following the initial coding, an iterative process of theme development will be undertaken. This process involves searching for, reviewing, defining, and naming the final themes. Initially, the comprehensive list of codes will be collated and analysed to identify significant, broader patterns of meaning that form potential themes. These initial themes will then be rigorously reviewed against

both the coded data extracts and the entire dataset to ensure they are coherent, distinct, and accurately representative of the data. This iterative process may involve merging overlapping themes, splitting complex themes into sub-themes, or re-evaluating the underlying codes until a robust thematic map is established. For each finalised theme, a clear definition and a concise name will be developed, alongside an analytical narrative that captures its essence in relation to the research questions.

4. Thematic narrative

This phase involves interpreting the findings and analysis chapters of this thesis. The analysis will present the thematic narrative logically and compellingly, weaving together the analytical descriptions of each theme with illustrative data extracts.

5. Strategy and framework development

In the final phase of the analysis, the thematic narrative developed in the previous step was synthesised with the conceptual framework of Absorptive Capacity. The purpose of this synthesis was to interpret the findings through a theoretical lens and to develop both a practical strategic framework and a refined theoretical model. This process involved systematically mapping the identified barriers and practices from the interviews onto the four dimensions of Absorptive Capacity. By connecting the practical challenges to the specific theoretical dimensions they impact, a set of actionable solutions was formulated. Concurrently, this process allowed for a critical re-evaluation of the initial conceptual framework.

# 4 Findings

This chapter presents the empirical findings from the semi-structured interviews conducted with key stakeholders in The Hague's building renovation industry. The chapter is structured according to the conceptual framework outlined in Figure 2-4, with the data organised to reflect its main components. The findings are presented thematically, focusing on the triggers driving circularity, the nature of firms' internal knowledge bases, the external sources of knowledge, and the practices and mechanisms used to share and integrate knowledge within firms. In addition, the chapter explores the role of migrant workers, examining both the dynamics of their employment and the knowledge they contribute to the sector.

## 4.1 Triggers for Circularity

The interviews highlight several triggers for contractors to start adopting circular goals and seek out the necessary knowledge to achieve them. The earliest and most significant driver was the Netherlands government's circular and sustainability policy framework, which laid out a roadmap for transitioning to a circular construction industry. Before these policies were introduced, circularity was not a priority in most companies' business strategy. However, the new regulations have pushed firms to incorporate circular goals into their strategic planning, leading them to adjust daily operations to align with circular design principles and practices.

*"Our construction companies, they start running once there is legislation in place. So, before we had any legislation, there was not a little focus on circularity." – LUN01*

Additionally, clients and shareholders, who provide financial stability, have become significant drivers of circularity adoption. Clients who understand the importance of sustainability and circularity have started to demand and incorporate circular specifications into their buildings, prompting companies to integrate circularity into their construction designs and working methods. Furthermore, companies' status as public companies requires them to maintain shareholder value by prioritising circular projects in accordance with the sustainable reporting directives. These triggers compel contractors to integrate circularity into their business strategies.

*"First, the client. They ask or demand certain sustainability standards. Second, as we are a public company, we have our goals to achieve…In the end, our goal is to maintain shareholder value" –* CON01

However, the interview with the owners and clients of small building renovation contractors reveals different dynamics between these triggers and contractors' circular adoption. Clients are the most significant and direct triggers for circular adoption, as they provide designs and requirements for the projects. Policy frameworks are not sufficient to trigger contractors to engage in circular practice; they need detailed standards, regulations, and enforcement from the government.

*The regulations come from the Dutch government. I don't know which part of it, but they're part of the government program. And each one has its own controls. The government will come and check on all of this at some point. – CON03*

The absence of shareholders in a company's ownership means that decisions around implementing circular practices are based largely on what the owner considers necessary and practical, rather than on concerns about public image or sustainability branding. As the interviews revealed, contractors tend to adopt only those circular measures that are straightforward, low-cost, and do not disrupt

project timelines. Any practice that involves extra processing, specialised materials, or risks delaying the work is usually avoided. In reality, circularity is followed only when it fits with operational efficiency and short-term cost savings.

*“We try to reuse ceramic remainders… (for recycling) we don’t do it in the projects because it is time consuming” – CON3*

These instances suggest that firms’ proximity to the triggers influences their receptivity to them. The lack of pressure from the client—whether because circularity is not their focus or due to society's general preference for new materials over reused or recycled ones, as observed from one of the clients of the smaller renovation firm—and the government's circular implementation creates a barrier for contractors to pursue circularity.

*“Circularity not that much. That's not on my top priority basically.” – CLI03*

## 4.2 The Company’s Knowledge Base for Circularity

The interviews reveal variation between the factors contributing to the company’s circular knowledge base and the content of the circular knowledge itself.

Larger contractors tend to have a broader and more diverse knowledge base, built from the education and experience of their employees. These factors also influence recruitment decisions, as firms seek individuals who can bring valuable skills and knowledge to the business. This potential of human capital is further enhanced by knowledge gained from the company’s past projects. Additionally, many of these contractors have dedicated research and development teams or internal consultancy units responsible for developing new working methods for testing by the construction team on-site. This enables the firm to deepen its knowledge through a learning-by-doing approach. It demonstrates that larger firms have more resources at their disposal and are better equipped to keep pace with developments in circular construction.

*"We have a lot of smart people working in our company, so it mainly comes from ourselves and experience; it is a learning curve. It is a combination of theory and then put into practice. The theory can be from formal education, university, or the consulting business unit within the company." – CON01*

On the other hand, smaller contractors largely rely on the knowledge of the owner or supervisors, either from their experience or vocational training, as their base knowledge. They typically work with a small core team, bringing in project-based workers to keep costs down. Therefore, once a project ends, the tacit knowledge held by these temporary workers leaves with them, making it difficult for the contractor to retain knowledge and develop a long-term understanding of circular practices.

*"So, for new knowledge regarding environmentally friendly materials or reused materials, it is from me, based on my experience.” – CON02*

The instances above suggest that a firm's resource and hiring policy is crucial in developing its base knowledge.

## 4.3 External Source of Circularity Knowledge

While larger contractors mainly rely on internal resources to develop circular practices, they remain open to external knowledge. The most formal and structured of these sources comes through high-level forums involving key industry stakeholders. Initiated by the government, these contractors

engage in discussions with ministries and research organisations, where circularity is explored at a strategic level, helping to shape the long-term direction of the industry.

*"This thing around circularity and all these changes taking place is very much an issue for the larger companies, and they have in the Netherlands this tripartite (Company-University-Ministry). They have talks. There are the ministry involved, the tech universities, I think the Tech University of Delft is involved, and the major companies involved. So that's a 'tripartite' talk." – LUN01*

Despite working in a fragmented sector, interview findings suggest that circular knowledge is rarely shared between clients, contractors, and subcontractors. Their collaboration typically extends only to the translation of circular requirements, ensuring each party plays its part in achieving overall circular goals. There is little unsolicited knowledge flow from the supply chain back to the main contractor; instead, subcontractors mostly respond to the project-specific requirements passed down to them.

*"...our client will have the highest overall demand. This will be our start, then we will translate the client's demands to concrete, sustainable, circular goals within specifics aspects of the building/project... by using our experience and our skill and then put into specific questions to the subcontractors." – CON01*

By contrast, smaller contractors tend to take a more passive approach to external knowledge regarding circularity. They usually wait for new standards or updates to shape their practices, such as government regulations or guidance from research bodies. When they do actively seek out information, they rely on informal and readily accessible channels. Platforms like YouTube offer step-by-step guidance, while advice from experienced peers or friends is trusted for its practical, hands-on value.

*"We still adhere to regulations and recommendations from research institutions and the government. We simply adhere to existing standards and practice guidelines." – CON02*

The findings above suggest that access to external knowledge and its relevance determine the source from which external knowledge is obtained.

## 4.4 Migrant Workers' as External Source of Knowledge

### 4.4.1 Reasons for Hiring Migrant Workers

The interview reveals that different stakeholders offer varied perspectives on why migrant workers are employed in the construction and renovation sector. Across these perspectives, the value placed on migrant workers is generally tied to economic and logistical needs, rather than to their potential knowledge or expertise.

From the viewpoint of labour unions, clients, and small contractors, the employment of migrant workers is mostly viewed as a practical response to labour shortages and financial pressures. Labour unions argue that this reliance is the result of the sector's low wages and project-based contracts, which make construction work unattractive to the local workforce.

*"It's because it's cheaper, because it's a lot more flexible, and because it allows them to organise away responsibility for their workload... That's the reason why migrant workers are used." – LUN02*

Clients share this sentiment, citing a simple lack of available domestic workers, particularly among the younger generation. For smaller contractors, the reasoning is also financial and logistical: migrant workers offer a cost-efficient and flexible labour that can be scaled up or down to meet the demands of each project, a crucial factor for managing tight budgets and timelines.

*"I don't have permanent employees in this company, I only hire workers on an hourly basis...Because this company is still new, I am reluctant to have permanent employees."* - CON02

However, their hiring decisions are uniquely influenced by social and cultural factors. These smaller contractors often employ migrants based on a shared background, relying on community connections, a common language, or the same nationality to build their teams. This reliance on personal referrals and community ties not only simplifies recruitment but also fosters a sense of trust and effective communication on-site.

*"But the majority of people on my projects are Indonesian, perhaps because they know I'm Indonesian, they prefer to work on my projects. Culture can influence the compatibility of workers and projects." – CON02*

In contrast, large contractors present a different perspective, viewing the recruitment of migrant workers not merely as a staffing solution, but as a strategic acquisition in specialised expertise. Their focus is on hiring 'knowledge migrants', individuals with specific high-level skills that are hard to source locally.

*"The migrant workers who have been hired are mainly because of their specialties or expertise... the local employees have limited knowledge of." – CON01*

Despite these different perspectives, they point to a common theme: outside of specialist roles in large contractors, migrant workers are rarely viewed as a source of valuable or innovative knowledge, especially in newer areas such as circular construction. Their value is largely framed in terms of availability, flexibility, and cost-efficiency. This mindset presents a barrier, making it difficult for firms to recognise or incorporate the tacit and explicit knowledge migrant workers may bring from their own backgrounds.

*"I think I'm pretty sure there's a lot of migrant workers that possess a lot of actual knowledge or useful knowledge, but the way a lot of these migrant workers are recruited…They're not really looking for a certain kind of skills or expertise…" – LUN02*

### 4.4.2 Migrant Workers' Knowledge

Although the primary reasons for hiring migrant workers are often cited as availability, flexibility, and cost-efficiency, a closer examination of the interviews reveals that these workers possess a wide variety of knowledge, valuable for the contractor's operation. An analysis of the skills and practices mentioned shows that their knowledge spans procedural skills in general construction, deep know-how that leads to work efficiency, and extends to regulatory and environmental awareness, such as waste disposal and the use of environmentally friendly materials. Within each of these types of knowledge, several practices of circularity are identified.

#### Circular knowledge on material reuse

One of the most practical forms of circular knowledge observed relates to the reuse of materials like paint and ceramics. This expertise is aimed at minimising construction waste and reducing the consumption of new materials, which also offers tangible cost savings. One building renovation owner mentioned that he learned this skill through an experienced peer and then applied it in his projects so that other workers are aware of this practice and can adopt the same method. This suggests that this knowledge is not formally taught but rather gained through direct, hands-on experience. For a migrant worker to develop this skill, they must have been involved in projects where such practices were encouraged or required. It is a form of "learning by doing" that transforms a cost-saving measure into an embedded, practical skill.

*"We also implement material reuse. For example, paint. Paint can be filtered to be purified again, and there is a tool to do it..." – CON02*

*"For example, pieces of pipe or ceramic, actually they can still be used…there are still workers who use the ceramic pieces." – CON03*

### Circular knowledge on long-lasting materials

A more technical form of circular knowledge involves the substitution of traditional materials with more durable, long-lasting alternatives. The use of plastic to replace wooden door and window frames is a prime example. This material substitution aims to increase the lifespan of building components while minimising the extraction of natural raw materials like wood. This type of knowledge is typically disseminated through official channels, such as regulations or standards set by government bodies or research institutions. For a migrant worker to possess this knowledge, they must be made aware of it as a standard practice. This awareness is most effectively cultivated through formal education or vocational training that explicitly references these established standards.

*"For example, the use of plastic-based frames to replace wooden frames. That's because there is a recommendation from the government to reduce logging and so that it lasts longer, and to reduce the use of biochemical paint as a coating." – CON02*

### Circular knowledge on insulation materials

Another form of circular knowledge involves the use of high-performance insulation materials, such as triple or quadruple-glazed windows, to improve a building's energy efficiency. This practice offers a significant advantage by providing superior thermal insulation, which conserves heat, minimises energy consumption, and reduces the need for active heating systems. Like the knowledge of long-lasting materials, awareness of these material alternatives is usually driven by official standards and recommendations. A migrant worker acquires this knowledge by being educated on these standards, such as through formal training, where these materials are specified as the required materials for building construction and renovation.

*"The use of triple-quadruple glaze windows for better thermal performance... The above will be applied to all projects except in areas where there are other regulations from the government or protected historic buildings." – CON02*

The findings strongly suggest that circular knowledge, being a part of know-how knowledge and regulatory, is not an inherent trait of migrant workers. Instead, it must be acquired through experience or education. Similarly, it also applies to most of the other types of knowledge. Table 4-1 lists all the knowledge a migrant worker might possess, along with the relevant profile, indicating whether they require experience or education to acquire the knowledge. The knowledge numbered one to fourteen is more common among workers in smaller building renovation firms, while knowledge fifteen and sixteen is considered to be of a higher level, requiring a university degree. Workers with these types of knowledge are often known as knowledge migrants and are typically recruited by larger companies.

Furthermore, the interview also reveals that context is a challenge for contractors to fully utilise migrant workers' knowledge, not only knowledge related to circularity. This is evident in the significant differences in materials, standards, and regulations between a worker's home country and the Dutch context. One contractor detailed this challenge, explaining that even experienced painters from abroad must be retrained on the specific multi-step Dutch process of sanding, priming, and finishing, as their home-country methods are incompatible.

*"A worker from his home country who did painting... when he applied the same method here for this project, it didn't fit..."– CON02*

An important exception to this is found among migrant workers from other European countries. Due to the harmonisation of standards across the EU, these workers may arrive with a base level of circular knowledge that is directly applicable. This familiarity with shared European standards gives them an advantage in understanding and implementing circular practices without extensive retraining.

*"Generally, besides Indonesian people, migrant workers from Europe know all of this, because it is a standard from European countries, not just the Netherlands, it's a regulation for all of Europe." – CON03*

This distinction highlights that, arguably, the primary barrier to leveraging migrant workers' knowledge is often not a lack of skill, but the misalignment between their home country and the Dutch-specific context of the construction industry.

*Table 4-1. List of migrant workers' knowledge*

| No | Knowledge Findings (Code) | Knowledge Type | Worker Profile |
|---|---|---|---|
| 1 | Basic tasks in construction and renovation, including working methods and materials | Procedural | Migrant workers in general |
| 2 | Adjusted knowledge of working methods to match Dutch context | | Educated migrant workers |
| 3 | Precise workmanship to achieve outstanding quality | | Experienced migrant workers |
| 4 | Knowledge on a more effective and efficient ways of work | Know-How | Experienced migrant workers |
| 5 | Knowledge of different qualities of materials | | Experienced migrant workers |
| 6 | Circular knowledge on material reuse | | Experienced or educated migrant workers |
| 7 | Basic knowledge of regulations and standards | Regulatory | Experienced or educated migrant workers |
| 8 | Knowledge of risk assessments, procedural safety, dangerous substances, environmental compliance, and emergency planning | | Educated migrant workers |
| 9 | Circular knowledge on insulation materials for energy efficiency | | Educated migrant workers |
| 10 | Circular knowledge on long-lasting building materials | | Educated migrant workers |
| 11 | Knowledge of sorting waste types and disposal | Environmental | Educated migrant workers |
| 12 | Knowledge of environmentally friendly practices of materials | | Educated migrant workers |
| 13 | Knowledge of where to look for labour supply | Networks | Experienced migrant workers |
| 14 | In very few cases, migrant workers can bring a client | | Experienced migrant workers |
| 15 | Knowledge of solving engineering problems or specific installations | Engineering | Educated migrant workers |
| 16 | Knowledge about project management and project development | Management | Educated and experienced migrant workers |

## 4.5 Circular Knowledge Sharing Practice in the Company

The interview reveals that knowledge flows differently across both scales of contractors. The routines and processes they implement vary in response to their resource and organisational structures.

For larger companies, the creation of circular knowledge is primarily in-house, driven by dedicated R&D departments and the systematic analysis of lessons learned from past projects. They supplement this internal generation with external knowledge acquired through a mix of formal and informal routines. They participate in high-level joint forums with government ministries and research organisations, and host technical lunches with external speakers to stay relevant to current issues. Informally, employees are free to seek out new knowledge, which is then shared within the company's digital ecosystem.

*"Or have a college, (similar) with the Co-pilot AI, to share knowledge. Maybe also some technical lunches which are given…" – CON01*

Once knowledge enters the company, it is disseminated through multiple formal channels. An online forum allows individuals with specific expertise to document their knowledge and engage in discussions with peers, while a digital library makes this information accessible to all employees. Newly developed knowledge is then strategically applied on-site, and learning is recorded through project interphase feedback. Individuals possessing knowledge beneficial to a project are identified and integrated into the project team, ensuring that new insights are effectively tested and utilised.

*"The designers experienced for themselves what happened with their design in the next phase, because they were consulted on the next steps in the phase, so they got feedback from us, and sometimes asked questions." – CON01*

However, a potential barrier within this specialised and departmental structure is that employees are pressured to stick strictly to their specific job descriptions, which may result in little motivation to independently acquire, share, or be involved in creation of new knowledge beyond their designated roles, potentially hindering bottom-up innovation.

*"The supervisors on-site only focus on delivering what is asked from them. So, everything is prepared, and they only need to implement supervision and build what is on the drawings. Circular ambitions and the steps needed to make the buildings most sustainable are already prepared; it's within the plan. They only need to execute." – CON01*

In smaller companies, knowledge flow is characterised by passivity and informality. Lacking specific routines to keep up with circular trends, they tend to be reactive, mainly relying on notifications of updated standards from the government or research institutions to guide their practices. When they do seek knowledge, it is through informal means like YouTube tutorials or peer discussions. This passivity also extends to their indifference towards the knowledge background of migrant workers; recruitment is not driven by a search for specific skills but rather for their work output. Consequently, owners and leaders rarely ask for inputs proactively because the working methods follow a standard practice. However, workers have the freedom to provide suggestions during work.

*"Workers have the initiative to express their own opinions. While the materials are good and standard here, when it comes to work methods, workers will often say, "This is how it used to be with us..."" – CON02*

Knowledge sharing within these firms is predominantly verbal, occurring during daily routines such as toolbox meetings or coffee breaks. Using break times for sharing knowledge is crucial because workers

are typically busy with their tasks during working hours, and forcing suggestions during intense work may lead to miscommunication or even increased friction among workers. However, training for new workers is done through on-the-job learning, where senior workers will supervise and guide the new workers.

*“When we're working, we don't usually do it. Let each person do their own work. When we're taking a break, chatting, or having coffee, we usually share (knowledge)…If we give advice during work, it's not only not accepted but can potentially lead to arguments.” – CON03*

Formal means like office meetings and written documentation are avoided, as they are considered inefficient and time-consuming. Without written documentation, the company lacks standard operating procedures; it mainly relies on procedures provided by the material supplier. As a result, knowledge is retained in the owner’s mind, who also ensures that standard methods are applied across various projects. Moreover, changes to procedures rarely happen, solely in response to supplier updates. Without documented procedures and limited resources, they are confined to adopting simple, circular practices that do not require extensive resources or additional processes.

*“No (written procedure). I discuss everything. Because I think if it has to be written down and then discussed every time someone wants a job, that kind of work system is slow. Usually, I just tell them, "The materials are this, this, this. Do you understand?"” – CON02*

A barrier that could hinder knowledge sharing is workers' pride. This pride may cause workers to be reluctant to share their knowledge, viewing it as a source of power. It also leads to workers hesitating to implement new knowledge suggested by others, considering it inferior. This worsens the condition in which some workers are notably reluctant to make extra effort for circular practices, such as reusing remainder material.

*“They think if you don’t want to give away power or your achievement, it’s bad to share knowledge.” – CON01*

## 4.6 Influencing Mechanism

Larger contractor and small contractor have their own routines and processes to acquire and integrate knowledge. The effectiveness and continuity of these routines and processes are determined by specific mechanisms used in the organisation.

The larger contractor uses a matrix organisation to better capture knowledge across different disciplines and project phases. This organisational structure positions employees within a department based on their specialities while also involving them in a project. By assigning employees to specific departments and projects, the structure increases the frequency and likelihood of knowledge transfer between various projects, phases, and business units. Furthermore, a high level of formalisation within the organisation also enhances the effectiveness of knowledge-sharing activities. The policy of putting practical knowledge into text amplifies the effectiveness of knowledge forums and knowledge banks.

*"The design (business unit) managers, they know what the designers are working with, how their knowledge is being shared and because we are oriented on this level (same business unit) not only on a project level to keep the project under control, it is very important to share knowledge to know what the specific problem are, from the design, engineering, or tendering phase. So this is a way to secure our knowledge and keep our projects under control at the end. So basically, the designers share their knowledge with the other designers and also with the project team." – CON01*

In contrast, smaller contractors' reliance on informal methods of knowledge sharing has worked because the nature of the knowledge used in projects is often simple, standardised, and repetitive, aligning with the nature of the project. A single, standard work method is usually employed across all projects until technological or equipment updates prompt a change, removing the incentive for workers and firms to innovate new circular practices.

*“(working methods) It's the same. Because the work standards and methods are the same…this company has maintained the same working methods. Unless technological advancements occur, work that was previously manual becomes mechanised.” – CON02*

However, the interviews reveal that regardless of the formality of the mechanism, its effectiveness hinges on a shared, underlying principle: the presence of an open and trusting culture. Across the board, it was emphasised that for knowledge sharing and development to truly flourish, a culture must be fostered where employees are encouraged to speak up, contribute ideas, and learn from mistakes without fear of punishment. This supportive environment is essential to allow both formal matrix structures and informal daily briefings to function as effective channels for knowledge integration.

*"The best thing you can do is to facilitate circumstances that will affect the internal motivation of a person. Simply said, give them room to learn, to make mistakes, to experience or explore some area. That is the most important thing." – CON01*

The findings above suggest that the mechanism a company chooses to facilitate the flow of knowledge depends on its size, the structure of the firm, and the complexity of the knowledge. Formalised and structured mechanisms enhance the impact of complex knowledge transfer in large firms with rigid hierarchy, while verbal and informal means are sufficient in small firms, which predominantly adopt routine and straightforward procedures. These mechanisms promote communication within a firm, which is essential in ensuring knowledge is extensively and effectively shared.

The most significant barrier to the transfer of knowledge across all routines and processes is the difference in language and culture. This is the second reason, after work coordination, that larger companies implement a policy allowing employees to speak Dutch. Similarly, this is the reason smaller building renovation firms seek workers with a similar nationality or language background. When they comprise workers from different nationalities, they will converse in Dutch, albeit with limited proficiency.

*“If all the workers were Indonesian, we would speak Indonesian, it would be easier. (Otherwise) We communicate in basic, daily conversation, Dutch, although it's not perfect.” – CON02*

# 5 Discussion

This chapter interprets the findings presented in Chapter 4, connecting the empirical data to the theoretical framework of Absorptive Capacity established in the literature review. The findings reveal a fundamental issue in the Dutch building renovation industry: while migrant workers possess a certain extent of circular knowledge, their potential is often overlooked because they are predominantly hired through a labour-focused, rather than a knowledge-focused, employment model. Crucially, this research uncovers that this underutilisation is not uniform. Instead, it manifests in two distinct ways, dictated by company scale. On one hand, large contractors demonstrate higher potential absorptive capacity through formalised systems and strategic hiring, but may face institutional rigidity. On the other hand, smaller contractors are caught in a 'cycle trap' of low innovation, where resource constraints and a reliance on temporary, project-based contracts severely limit their ability to acquire, assimilate, and exploit new knowledge. This discussion will first explore the broader implications of these findings for the implementation of circularity, then delve into a detailed analysis through the lens of absorptive capacity, before culminating in a strategic framework to address these challenges.

## 5.1 Discussion on Implementation of Circularity

The Netherlands government has established two main environmental goals: achieving net-zero carbon emissions and creating a fully circular economy by 2050 (Climate Act, 2019; The Ministry of Infrastructure and the Environment & The Ministry of Economic Affairs, 2016). Several studies and policy frameworks related to circular economy principles have been issued and enforced by the government and research organisations within the construction and building renovation sectors to meet these goals, such as the National Climate Agreement (2019) and the National Circular Economy Programme (2023-2030). However, the adoption of circular practices in the industry remains fragmented, with efforts and integration into company strategic objectives primarily limited to larger contractors. Smaller building renovation firms' involvement in reaching the nation’s circularity targets is still restricted due to their limited connection to government initiatives and the majority of clients' lack of awareness of circular practices.

Considering the employment patterns of migrant workers in the construction and building renovation sector, where larger contractors tend to hire knowledge migrants, the overall contribution of migrant workers to circularity is greater through small firms, as this is where they are most likely to be employed. However, the lack of pressure for circularity from both the government and clients on smaller renovation firms limits the utilisation of migrant workers’ knowledge potential. According to Cuervo-Cazurra and Rui (2017), this is what is understood as muted activation triggers. It reduces the need and value of external knowledge. Thus, migrant workers are employed using a ‘temporary contract’ scheme where they are valued for their labour instead of the knowledge they bring. This contract also disincentivised the transfer of knowledge in a company. Employers engaging in this kind of contract are more concerned with the migrant workers' productivity to ensure their money's worth.

Figure 5-1 illustrates the stages a worker experiences in a linear employment arrangement where they are employed under a temporary contract. In this scheme, workers are recruited after the contractor secures a project. Once the project is completed, the workers are discharged. This type of employment maximises the company’s financial efficiency in exchange for its growth in knowledge base. The potential time for knowledge transfer is only during the project execution phase, but it is still unlikely to occur if the employer fails to value the worker's knowledge.

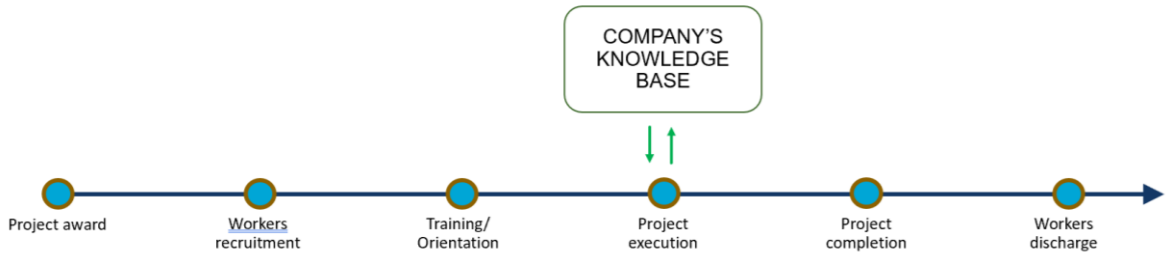


*Figure 5-1. Stages of a worker in a linear employment (author's own illustration)*

Temporary contracts lead to a high staff turnover, with employees leaving the organisation. Junni and Sarala (2013) explain that this negatively affects the company's absorptive capacity, or its ability to innovate and adopt circular practices. This occurs because knowledge resides primarily in individuals, especially in smaller firms where written procedures are rarely implemented. When someone leaves the company, their knowledge, analytical skills, and experience leave with them. This problem is exacerbated by the lack of formalisation in documenting knowledge.

For better adoption and innovation of circular practices, firms should transition to employ workers in more sustainable employment. Figure 5-2 shows the stages a worker experiences in a permanent contract. In this scheme, once a project reaches its completion, workers are retained in the company for upcoming projects. This allows workers' knowledge to be integrated into the company's knowledge base and utilised to innovate new ways of working and circular practices. Even after project completion, knowledge is still being shared within the company.

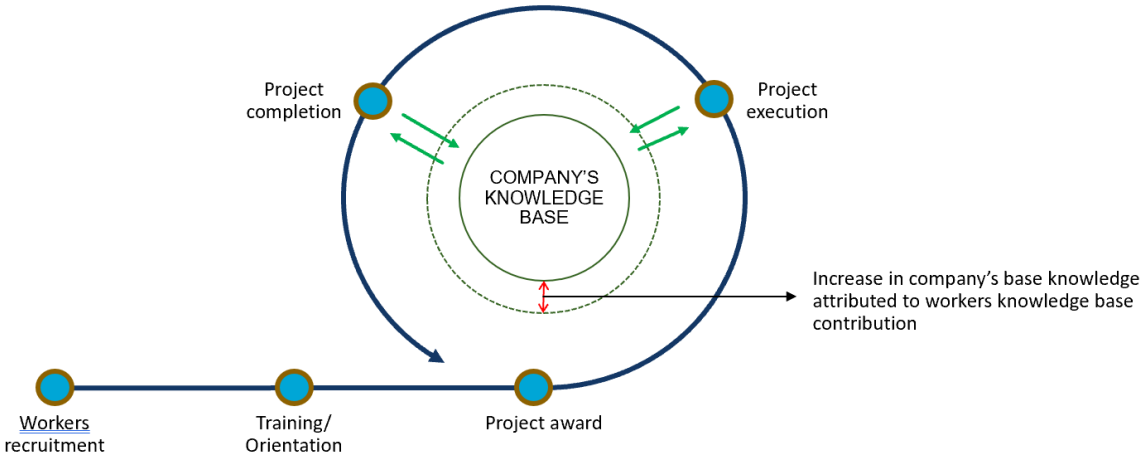


*Figure 5-2. Stages of a worker in sustainable employment (author's own illustration)*

However, the condition and nature of these smaller contractors eliminate the need for employers to employ workers with permanent contracts. Figure 5-3 illustrates the cycle these smaller contractors are trapped in, which compels them to use temporary contracts and disregard the importance of knowledge acquisition. Unlike the larger contractors, these smaller contractors have limited financial resources, which restrict them to only undertaking simple and straightforward projects. These kinds of projects do not entail complex work and only require minimal basic knowledge to complete. The work is standard and repetitive. Therefore, employers do not seek a particular type of knowledge when recruiting and utilise temporary contracts to minimise spending. However, this type of contract causes low knowledge retention and subsequently produces minimal innovation. Due to low innovation, they are unable to expand their target market and are limited to one type of project, which does not yield substantial profits. This cycle aligns with the findings from Jansen et al. (2005), which imply that the

routinisation of activities in a project hinders innovation. Simple and routine renovation projects do not encourage small contractor owners to engage in circular practice innovation.

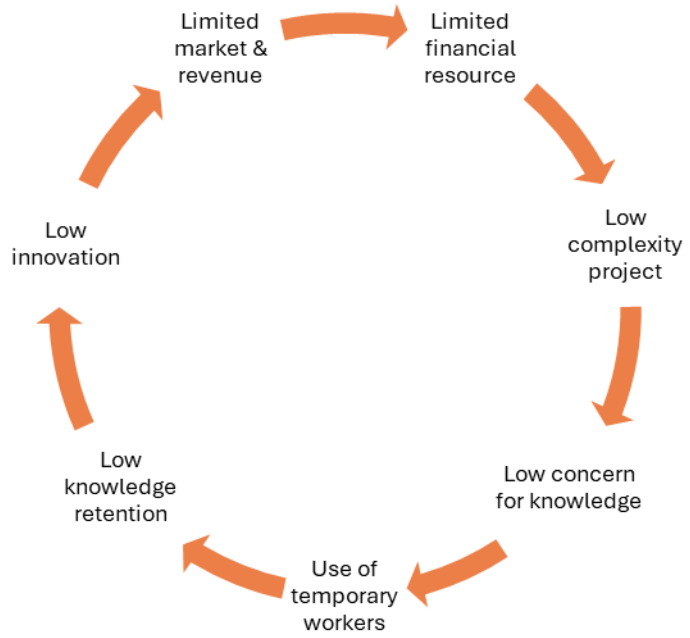


*Figure 5-3. Cycle trap of a small contractor (author's own illustration)*

Therefore, it is argued that to help companies break free from this cycle and start valuing migrant workers, significant triggers are needed to encourage them to adopt a certain level of circularity in their projects. Cuervo-Cazurra and Rui (2017) suggest that increasing managers' exposure to competitive pressures, market changes, or technological shifts can help activate these triggers. The project complexity in the cycle above should be increased. This can be achieved through government policy, and its subsequent enforcement, which necessitates and requires circular practices and design in building renovation projects (Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022). Such regulations would pressure not only small contractors but also clients, who would then demand that the contractors adhere to and implement circular principles. The participation of clients and the market is crucial, as mentioned by Zhang et al. (2019), because government policy will only enforce compliance, while clients can foster innovation in circular design and practices.

However, Upstill-Goddard et al. (2015) stated that implementation is only likely when these smaller contractors perceive immediate financial benefits, as they have limited resources. Therefore, the policy should prioritise making the circularity financially appealing in the short term to encourage contractors to invest in knowledge acquisition. This can be achieved by implementing financial support mechanisms, which may include grants, subsidies, and tax incentives for CE projects (Fernandes & Ferrão, 2023b). Additionally, as these smaller firms have limited resources early on, Yousaf (2021) and Giorgi et al. (2022) suggest that green value co-creation through collaboration with customers, suppliers, and communities to create environmental value jointly could be a solution. In summary, external push from stakeholders in the building renovation industry is imperative for smaller contractors to adopt circular principles in their projects.

## 5.2 Discussion on Absorptive Capacity

### 5.2.1 Triggers

Zahra and George (2002) suggest that triggers for knowledge absorption can be either internal or external. In this study, however, all observed triggers are external, mainly taking the form of the Netherlands' circular policy framework and client demands. This aligns with the findings of Upstill-Goddard et al. (2016), who argue that triggers for sustainability in construction typically stem from stakeholder pressure. These external forces directly push contractors to seek out relevant knowledge, supporting the view of Gluch et al. (2009) and Upstill-Goddard et al. (2016) that triggers have a direct impact on knowledge acquisition.

This challenges Zahra and George's (2002) original model, which framed triggers as moderating influences, rather than as direct drivers. The findings in this research indicate that a firm's response to triggers depends on its proximity to them. In particular, larger contractors, due to their closer ties to government bodies and policy networks, are more likely to respond to policy triggers and embed circular goals into their strategic planning.

### 5.2.2 Company's Knowledge Base

The large contractor's personnel, with diverse experience and educational backgrounds, along with its research and development department, constitute its high level of knowledge base, according to Junni and Sarala (2013) and Zahra and George (2002). Conversely, the smaller contractors' lack of permanent workers causes the firm's knowledge base to rely solely on the experience and educational background of the owner or team leaders. This suggests that a company's hiring policy and resource determine their degree of knowledge base. As mentioned in section 5.1, to increase their knowledge base, the company should shift from labour-focused hiring to knowledge-focused hiring. It is crucial for a company to expand its circular knowledge base because it facilitates learning new information and enhances innovation capabilities (Marrucci et al., 2021).

### 5.2.3 External source of knowledge

Aligned with the findings by Albort-Morant et al. (2018) and Marucci et al. (2021) on relationship learning, the larger contractors are actively involved in relationship learning with the government and research institutions. This provides complementary knowledge about circular principles, which guides and informs the contractor of the nation's long-term direction. However, the flow of knowledge in their supply chain remains minimal due to limited application. On the other hand, smaller contractors rely on their suppliers for knowledge, although they are still limited to working methods and material handling. In relation to circular knowledge, smaller contractors tend to wait for knowledge issued by the government or research institutions, such as regulations or practical guides.

These findings align with Vega-Jurado et al. (2008), who state that firms seek knowledge sources based on the accessibility and applicability of the knowledge they are searching for. However, the phenomena observed in smaller contractors further contrast the findings by George and Zahra (2002), who mentioned that firms proactively scan the environment for new knowledge, whereas it is suggested that firms seek knowledge mainly when they are under pressure.

Additionally, the findings suggest that small contractor owners do not perceive migrant workers as a source of circularity knowledge, despite the fact that these workers possess a certain level of circularity knowledge gained from their experience or vocational training. This oversight of knowledge source and subsequent underutilisation is attributed to several barriers in each of the absorptive capacity dimensions.

### 5.2.4 Acquisition

Acquisition, the first stage of absorptive capacity, covers how a construction firm identifies and obtains external knowledge. The findings show that large contractors acquire knowledge by attending industry forums, bringing in external experts for specialist talks, and through individual research. While small contractor mainly rely on updated standards and guidance. When they do seek knowledge, it is through informal means like YouTube tutorials or peer discussions

A key difference was observed in how firms acquire knowledge from migrant workers. Large contractors can do this formally through their recruitment process. Smaller contractors, however, as they do not see migrant workers as a knowledge source, do not care about knowledge when recruiting workers. They rely on informal methods during the project, such as on-the-job discussions where a worker might suggest a practical solution. The challenge with this informal approach is that valuable knowledge can be lost if workers remain silent and are not encouraged to share it. Therefore, employers and leaders need to have a dialogue with migrant workers proactively to build trust and foster a sense of shared purpose (Junni & Sarala, 2013; Cuervo-Cazurra & Rui, 2017).

The employers' bias, where they view migrant workers as a labour source instead of a knowledge source, poses a barrier. It results in employers passively waiting for workers' suggestions. Furthermore, there is a doubt about how employers in small contractors can objectively value the knowledge a migrant worker holds. Cuervo-Cazurra and Rui (2017) stated that it is important for employers to be aware of their bias and deliberately design strategies to overcome bias. As explained above in section 5.1, it is important for employers to view migrant workers as a source of circular knowledge and employ an objective method to value knowledge. Additionally, the labour union suggest a skill passport for migrant workers which contains their history of training and certification.

Another observed barrier is workers' reluctance to share knowledge, as they perceive it as relinquishing power. Sun and Anderson (2008) suggest implementing reward and recognition to sustain new behaviours related to knowledge sharing.

### 5.2.5 Assimilation

The assimilation dimension consists of organisational routines and processes through which newly acquired external knowledge is analysed, interpreted, internalised, and categorised. The process identified in the findings is a knowledge-sharing session in the form of a toolbox meeting or an online group, and the use of a digital knowledge bank in a large contractor. However, the routines and processes implemented correspond with the company's resources.

The barriers related to this dimension include the use of temporary contracts, which discourage knowledge transfer among workers as they are contracted to perform manual labour, limited time slots for knowledge sharing, and a lack of documentation for knowledge sharing. To overcome this, companies should consider transitioning from temporary to permanent contracts. Additionally, scheduling a knowledge-sharing session during break time or utilising a platform for knowledge sharing can help, as it eliminates the need for in-person meetings. These routines need to be supported with a culture of documenting knowledge.

### 5.2.6 Transformation

The transformation dimension firm’s capacity to develop and refine internal routines that support the integration of newly acquired or assimilated knowledge with existing knowledge. These routines are more apparent in the larger contractors that possess a research and development department and are capable of producing designs for their projects through their design or engineering department. They

are capable of adjusting the design or working method based on feedback from the construction team. The smaller contractors are very limited in this dimension as their works only revolve around standard and repetitive method. Even when they receive input or guidance on certain circular practices, they will do it as per the instructions with minimal adjustment.

A significant barrier in this dimension is the migrant workers' context mismatch, where their knowledge is not utilised due to differences in regulations and standards in the Netherlands. Additionally, the firm's lack of a written operational procedure hinders transformation. However, Todorova and Dursin (2007) argued that the transformation dimension of absorptive capacity provides the capabilities for companies to adjust this knowledge to match the local context. In line with Todorova and Dursin (2007), Junni and Sarala (2013) stated that when contextual mismatch occurs and is managed effectively, it can provide opportunities for deeper learning and adaptation. Therefore, it is important for the company to build on their transformation capabilities.

### 5.2.7 Exploitation

An organisation's ability to embed new knowledge into its daily operations is key to refining existing procedures and developing new skills. As with the transformation stage, smaller contractors often lack the capacity to do this effectively. For example, when instructed to implement circular practices, they can face resistance from the workforce. This reluctance often stems from the extra effort required, or sometimes from an operative's belief that their traditional methods are better. As suggested previously, a rewards and recognition scheme can help incentivise staff to adopt these new working practices.

The larger contractor, on the other hand, effectively exploits their newly developed knowledge through implementation in new or pilot projects. Additionally, they identify the knowledge holder to include them in the team to oversee the project.

### 5.2.8 Organisational Integration Mechanism

#### Openness culture

Openness culture is a significant mechanism expressed by the respondent to promote innovation. Even though the smaller contractor lacks transformation and exploitation capabilities, this culture remains important to encourage workers to voice their suggestions proactively; otherwise, the absorptive capacity of the smaller contractor will decrease further. In the large contractor, this open culture is equally vital. It creates an environment where employees are not afraid to experiment, allowing mistakes to be treated as valuable learning opportunities that drive knowledge creation and innovation. Therefore, it is suggested that an open culture positively impacts the three dimensions: acquisition, assimilation, and transformation.

#### Utilisation of Information Technology

In relation to migrant workers' knowledge, small contractors rarely gain a direct advantage from information technology, especially when compared to larger firms that use it to identify and recruit knowledge migrants. However, on a broader level, both small and large contractors make use of information technology, though in different ways and to varying degrees.

For small contractors, the main benefit lies in the acquisition dimension of knowledge. Platforms like YouTube and social media make it easier for them to access external knowledge and pick up practical tips or methods they might not otherwise encounter.

On the other hand, large contractors benefit extensively from information technology, through digitalisation, as it is integrated into every stage of the project and used across departments. It

supports the acquisition dimension by helping them recruit knowledge migrants and invite external experts. It also plays a role in the assimilation of knowledge through the use of internal knowledge banks and online forums that support knowledge-sharing within the company. Furthermore, it enhances the transformation dimension by facilitating feedback exchanges between engineering and construction teams, improving the way knowledge is applied in practice.

These findings suggest a refinement of the proposition made by Camison and Forés (2010), who described information technology as an indicator of the transformation dimension. Based on this research, information technology acts as a mechanism that positively influences the three dimensions: acquisition, assimilation, and transformation

### Selection of common language

Both types of contractors use a common language to communicate and share knowledge. Language in this research refers mainly to the language used in daily conversation to express and address opinions. This shows that language is a mechanism that impacts the routines in each of the absorptive capacity dimensions. When a single language known to all is selected, it enhances all dimensions of absorptive capacity. In contrast, selecting a language unfamiliar to the worker can negatively impact the knowledge flow process.

### Connectedness

The two types of contractors employ different kinds of organisational structures. The larger contractor uses a matrix organisation structure to create broad connectedness, which it loses due to its size and departmentalisation. Conversely, due to the lean team they employ, the smaller contractor does not use any particular organisational structure. Both structures provide connectedness among employees and with their employer, and they facilitate assimilation of knowledge in the company, confirming the proposition by Jansen et al. (2005) that connectedness enhances assimilation. The level of transformation and exploitation of the larger contractor further confirms the proposition that it also enhances those two dimensions. The low level of transformation and exploitation in smaller contractors suggests that, even in high-connectedness, failing to equip oneself with the necessary routines can still trap a firm in low realised absorptive capacity.

### Formalisation

Larger contractors use formalisation as a key mechanism to disseminate, transform, and apply knowledge across the organisation. While Jansen et al. (2005) argue that formalisation primarily supports transformation and exploitation, with little effect on assimilation, the findings of this study suggest otherwise. In practice, formalisation appears to enhance assimilation, particularly through the use of knowledge banks, where information is documented and made accessible to all employees. This structured approach helps employees understand, share, and apply knowledge more effectively. It is also worth noting that Jansen's framework may not have accounted for the role of information technology, which in modern settings plays a significant role in how formalisation contributes to a company's absorptive capacity.

### Routinisation

Smaller contractors tend to follow routinised work processes, as their projects are generally standardised and repetitive in nature. As a result, they seldom introduce new practices, particularly in relation to circularity. This pattern is supported by Jansen et al. (2005), who argue that routinisation can hinder innovation by negatively affecting the acquisition, assimilation, and transformation dimensions. However, while this approach limits innovation, it proves effective for the transfer of tacit knowledge. In situations where language barriers exist, routinisation also helps create a more efficient and consistent way of working on site.

Cross-functional team

The large contractor utilises a cross-functional team within their project team. In an integrated project, the design and construction teams collaborate to acquire comprehensive project knowledge, capturing interdisciplinary insights and refining them for future projects. While this mechanism is apparent in larger contractors, it is inapplicable in smaller ones, where team members perform similar functions, carrying out general tasks. These findings support the findings by Jansen et al. (2005) that cross-functional teams enhance the acquisition, assimilation, and transformation of knowledge.

## 5.3 Strategy Development

The preceding discussion has identified a series of complex, interrelated barriers that prevent building renovation firms, particularly smaller ones, from harnessing the valuable circular knowledge of migrant workers. These firms are often caught in a "cycle trap" of low innovation, driven by a lack of external pressure and insufficient internal absorptive capacity. To address these challenges, this section synthesises the findings into a coherent, actionable strategic framework, as illustrated in Figure 5-4. This framework guides contractors, clients, and government bodies to initiate a fundamental shift from a labour-focused to a knowledge-focused employment model, thereby unlocking a vital source of innovation for sustainable transformation.

### 5.3.1 External Barriers

The discussion in Section 5.1 revealed that external triggers for circularity are often "muted" for smaller firms due to their limited proximity to policy circles and less stringent client demands. This lack of pressure creates a significant barrier by lowering the perceived need to invest in acquiring new knowledge. To overcome this, the triggers must be strengthened through pressure from both the government and clients. Table 5-1 summarises these barriers and outlines specific, actionable solutions, noting their origin from academic literature.

*Table 5-1. Summary of identified external barriers*

| Barrier | Proposed Strategic Solution | Solution Reference |
|---|---|---|
| **Muted Activation Triggers**<br><br>Lack of external pressure on smaller firms from government and clients. | • **Strengthen Government & Client Triggers:** Mandate circular practices in regulations and contracts.<br>• **Shift Procurement:** Value circular performance over lowest cost. | (Giorgi et al., 2022; Hossain et al., 2020; Wuni, 2022) |
| **Lack of Financial Viability**<br><br>High perceived costs and unclear business case for circularity in smaller firms. | • **Provide Financial Incentives:** Offer tax reductions and subsidies.<br>• **Facilitate Co-creation:** Support forums connecting firms with suppliers, communities, and customers | (Fernandes & Ferrão, 2023b; Giorgi et al., 2022; Yousaf, 2021) |

### 5.3.2 Variations in Organisational Practice

The findings reveal a stark divide between the knowledge integration practices of large and small contractors across all components of the absorptive capacity model. These variations, derived directly from the interview data in Chapter 4, are crucial for understanding how different practices resulted in different levels of circularity performance. Table 5-2 provides a comparative summary.

*Table 5-2. Variation in knowledge integration practices based on contractor scale*

| Component | | Large Contractor Practices | Small Contractor Practices |
|---|---|---|---|
| **External Knowledge Sources** | | Formal, strategic engagement (forums, ministries.<br><br>Proactive scanning for innovation. | Informal, reactive learning (YouTube, peers).<br><br>Mainly wait for standard updates. |
| **Company Knowledge Base** | | Diverse and deep (R&D capacity and varied employee education and expertise). | Concentrated and narrow (owner's experience). |
| **Absorptive Capacity Routines** | Acquisition | Forums, external expert talks, internal research units, proactive searches, and employee recruitment | Wait and rely on informal suggestions (e.g., migrant workers' verbal inputs) when necessary, look through informal sources (e.g. peers and YouTube) |
| | Assimilation | Digital platforms (knowledge banks), training, and shared documents | Mainly through verbal sharing during breaks, peer teaching (on-the-job), |
| | Transformation | Feedback loops between design & construction, cross-functional learning | minimal transformation; follow standard methods |
| | Exploitation | Apply in pilot projects, involve knowledge holders in project teams | Rarely implement new knowledge |
| **Organisational Mechanisms** | Selection of common language | Selection of Dutch as a language for communication | Selection of a common language based on the majority of workers. When workers are diverse, Dutch is selected. |
| | Oppeness culture | Employees are free to learn and are involved in knowledge creation | Workers are free to voice their opinions |
| | Use of Information Technology | Information technology is used extensively | Information technology is used mainly to look for knowledge |
| | Connectedness | Broad connectedness through organisational structure to overcome departmentalisation | High connectedness due to the lean team |
| | Formalisation | High use of formalisation | |
| | Routinisation | | High use of routinisation |
| | Cross-functional team | Implement a cross-functional team in integrated projects | |

### 5.3.3 Absorptive Capacity Barriers

The analysis identified critical internal barriers at each stage of the absorptive capacity process that prevent firms from effectively integrating knowledge. Table 5-3 summarises these barriers and outlines

specific, actionable solutions, noting their origin from academic literature or the empirical findings of this study.

*Table 5-3. Summary of identified absorptive capacity barriers*

| ACAP Dimension | Identified Barrier | Proposed Strategic Solution | Solution Reference |
|---|---|---|---|
| **Acquisition** | **Employer Bias:** Viewing migrants as a labour source not a knowledge source<br><br>**Passive Acquisition:** Passively waiting for suggestions.<br><br>**Subjective Valuation:** Lacking objective methods to assess knowledge.<br><br>**Worker Reluctance to Share:** Fear or pride prevents sharing. | Shift from labour-focused to knowledge-focused hiring.<br><br>Implement proactive dialogue<br><br>Adopt objective evaluation tools, such as a "skills passport."<br><br>Implement a reward/recognition system for sharing. | Author's Synthesis<br><br>(Junni & Sarala, 2013; Cuervo-Cazurra & Rui, 2017).<br><br>Interview finding<br><br>Sun & Anderson (2008) |
| **Assimilation** | **Temporary contract:** temporary contract disincentivised knowledge sharing<br><br>**Lack of Documentation:** Reliance on verbal-only knowledge sharing.<br><br>**Time Constraints:** No dedicated time for communal sharing. | Shift to sustainable employment contracts.<br><br>Formalise knowledge capture with simple digital tools.<br><br>Schedule dedicated, regular sharing sessions.<br><br>Strengthen team connectedness | (Junni & Sarala., 2013)<br><br>(Jansen et al., 2005)<br><br>Interview findings<br><br>(Jansen et al., 2005) |
| **Transformation** | **Contextual Mismatch:** Incompatibility of home-country knowledge.<br><br>**Lack of Formal Procedures:** No routines to adapt new ideas.<br><br>**Low Project Complexity:** Repetitive projects create no need for new knowledge.<br><br>**Departmental silos (in large firms):** knowledge may only be kept in a deprtment | Treat mismatches as learning opportunities via adaptation teams.<br><br>Establish a simple feedback loop for R&D.<br><br>Create visual standard operating procedures (SOPs)<br><br>Leverage cross-functional teams to ensure knowledge is shared across departments<br><br>Increase project complexity via client/gov triggers. | Todorova & Dursin (2007)<br><br>Interview findings<br><br>Author's Synthesis & (Jansen et al., 2005)<br><br>Author's Synthesis & (Jansen et al., 2005) |
| **Exploitation** | **Workforce Resistance:** Reluctance to adopt new methods due to extra effort or pride.<br><br>**Lack of Application Process:** No clear pathway for implementation. | Link rewards directly to the implementation of ideas.<br><br>Empower knowledge holders as mentors<br><br>Systematically break inefficient routines to | Sun & Anderson (2008)<br><br>Author's Synthesis<br><br>Author's Synthesis & (Jansen et al., 2005) |

| | | | |
|---|---|---|---|
| | | facilitate the implementation of new methods<br><br>Designate pilot projects and empower knowledge holders as mentors. | Interview findings |

### 5.3.4 Synthesising the Strategic Framework

The solutions developed to address the external triggers, the internal absorptive capacity barriers, and the existing organisational practices are not isolated interventions. They form an interconnected and comprehensive strategy for systemic change. By combining stronger external triggers with the enhanced internal absorptive capacity, companies can build the capability to harness migrant workers' knowledge systematically. This integrated approach is visually synthesised in Figure 5-4: Strategies for harnessing migrant workers' circular knowledge. This framework provides a practical roadmap for firms to move from a reactive, labour-focused model to a proactive, knowledge-focused one, thereby unlocking a critical source of sustainable innovation.

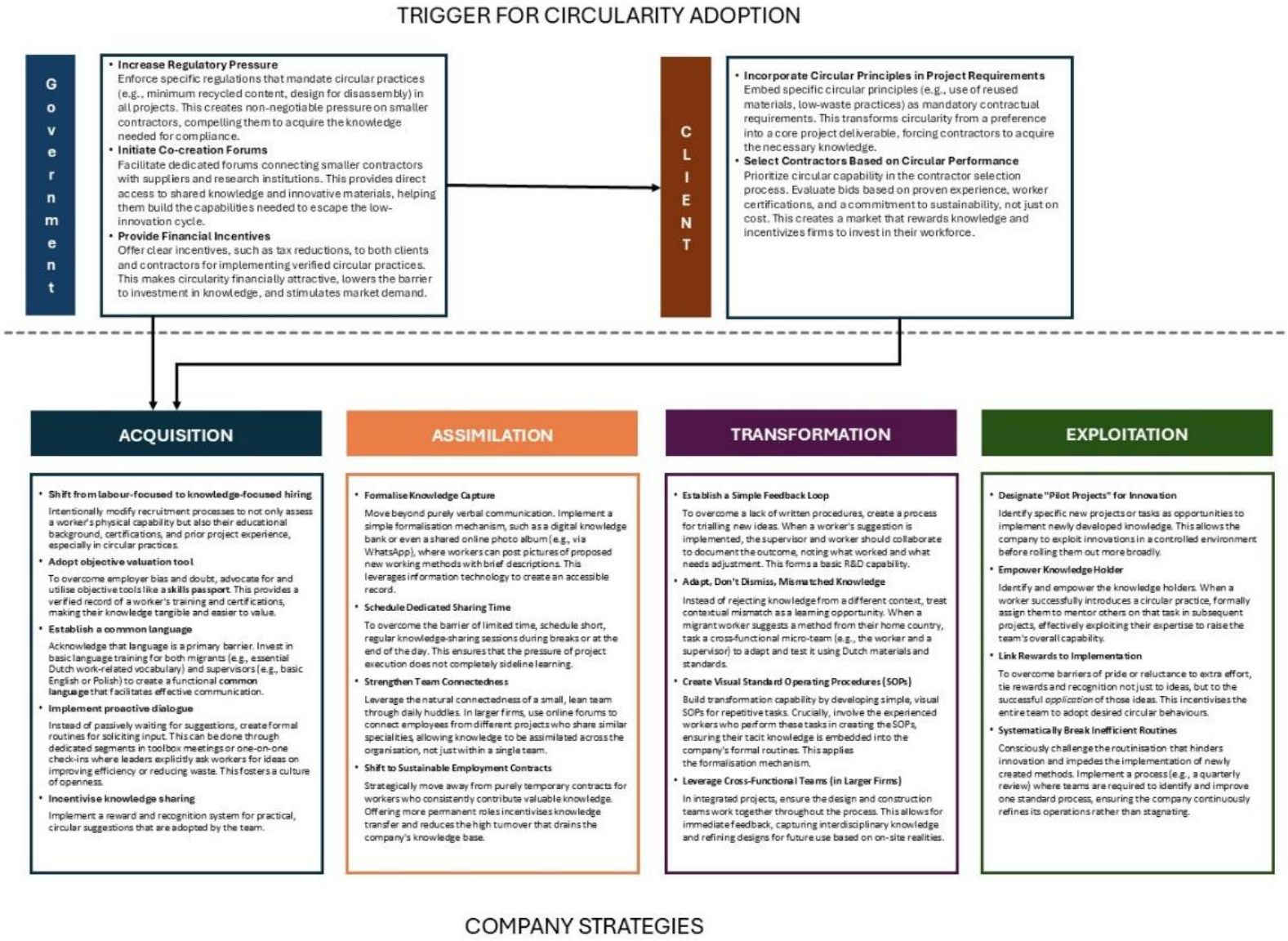


*Figure 5-4. Strategies for harnessing migrant workers' circular knowledge (author's own illustration)*

## 5.4 Circular Absorptive Capacity Framework Development

Based on the discussion in sections 5.1 and 5.2, this section consolidates the findings into a revised theoretical framework for harnessing migrant workers' circular knowledge, as illustrated in Figure 5-5. This framework is an empirically grounded enhancement of the conceptual model introduced in Section 2.4, modifying the Green Absorptive Capacity model to the current advancement and dynamics of circularity in the building renovation industry. The model visualises the dynamic process of knowledge integration, detailing the interplay between its core components and a refined set of organisational integration mechanisms. The following subsections explain each component of the framework and formalise the key theoretical contributions through a series of propositions.

### The Core Absorptive Capacity Process

The findings confirm that all four dimensions of absorptive capacity are essential for achieving circular innovation and performance. As shown in the centre of Figure 5-5, external knowledge flows through the sequential stages of acquisition, assimilation, transformation, and exploitation. A key enhancement to the model is the explicit feedback loop (shown in red), which illustrates that successfully processed knowledge not only reward the company with circular innovation and performance enriches the firm's internal knowledge base, increasing its capacity for future learning. Acquisition itself for enriching company's base knowledge is not enough; assimilation is necessary as it provides company with the understanding of the knowledge. When company manage to progress beyond assimilation then the nature of the knowledge shift from conceptual knowledge to practical knowledge.

### Triggers for Circularity

The framework begins on the left with external triggers, which the findings identify as government policy and client demands. However, the findings suggest that the influence of these triggers is not uniform across all firms. Instead, a firm's reaction is determined by its position within the industry ecosystem.

**Proposition 1:** A firm's organisational proximity to an external trigger is a primary determinant of its responsiveness to that trigger. The closer a firm's organisational ties are to the source of a trigger (e.g., government or a key client), the more directly and urgently it will respond, leading to a stronger motivation to acquire the relevant knowledge.

### External Sources of Knowledge

The findings identified a range of external knowledge sources, including forums, regulations, and the supply chain, with new workers representing a critical yet underutilised source of knowledge. The framework positions these sources as inputs to the acquisition process, with the selection being a highly pragmatic decision.

**Proposition 2:** The perceived accessibility and applicability of external knowledge are the primary drivers influencing a firm's source selection behaviour. A firm is more likely to engage with knowledge sources that align with its immediate operational needs and existing capabilities, shaping a distinct acquisition pathway for different company scales.

### Company Knowledge Base

The findings identify a company's R&D capacity and the collective experience of its employees as key components of its knowledge base. They also confirm that knowledge resides within individuals, meaning that a firm's knowledge base is closely linked to the quality and depth of its human capital. This internal knowledge base serves as the initial filter through which the value of external knowledge is assessed, and it plays a crucial role in shaping the firm's capacity to acquire new knowledge.

## Organisational Integration Mechanisms

These mechanisms serve as critical enablers, shaping the effectiveness of the entire absorptive capacity process. The lines connecting each mechanism to the four dimensions indicate their specific points of influence, with solid lines representing positive effects and dotted lines indicating negative ones. The findings confirm the presence of four mechanisms identified by Jansen et al. (2005): connectedness, routinisation, formalisation, and cross-functional teams. In addition, this research proposes three new mechanisms that emerged from the data: selection of a common language, the development of an openness culture, and the use of information technology.

Selection of Common Language**:** The findings revealed that a shared language understood by all employees is a prerequisite for any form of knowledge transfer, affecting all interactions within the absorptive capacity process.

**Proposition 3:** The establishment of a common language acts as a foundational mechanism by reducing communication barriers, thereby enhancing the process and routines across all four dimensions of absorptive capacity.

Openness Culture**:** The findings highlighted that an open culture is vital for encouraging workers to share ideas and to learn from experimentation, primarily impacting the acquisition, assimilation and transformation stages.

**Proposition 4:** Fostering a culture of openness encourages proactive knowledge sharing and creation by establishing a secure environment for experimentation and learning from failure. Therefore, it enhances the process and routines within the acquisition, assimilation and transformation dimension.

Use of Information Technology: The findings showed that IT is used differently by large and small firms but consistently impacts the first three dimensions by facilitating the locating of new knowledge, providing knowledge storage and extensive dissemination, and giving and receiving feedback across departments and project phases.

**Proposition 5:** The utilisation of information technology facilitates targeted knowledge search (acquisition), translating knowledge into accessible formats (assimilation), and creating project feedback loops (transformation). It positively influences the acquisition, assimilation and transformation dimensions.

Connectedness**:** The findings confirmed Jansen et al.'s (2005) view that connectedness aids assimilation, transformation and exploitation, but also revealed that high connectedness alone cannot overcome a lack of formal routines.

**Proposition 6:** High internal connectedness in a firm enhances knowledge assimilation by facilitating informal communication but is insufficient to develop realised absorptive capacity without complementary formal routines. Therefore, it is trapped in a state of low innovation.

Routinisation**:** The findings suggest a dual role for routinisation. While it limits innovation as Jansen et al. (2005) argued, it also serves a positive function in transferring tacit knowledge in specific contexts.

**Proposition 7:** The use of highly routinised work processes hinders innovation by disregarding the acquisition, assimilation, and transformation of new knowledge. However, it enables the assimilation of tacit knowledge by providing a structured, repeatable context for learning-by-doing where language barriers exist.

Formalisation**:** The research expands on Jansen et al.'s (2005) model by showing that formalisation, particularly through knowledge banks, also plays a crucial role in the assimilation phase.

**Proposition 8:** The use of formalisation mechanisms enhances knowledge assimilation, in addition to transformation and exploitation, by codifying and disseminating information across the organisation.

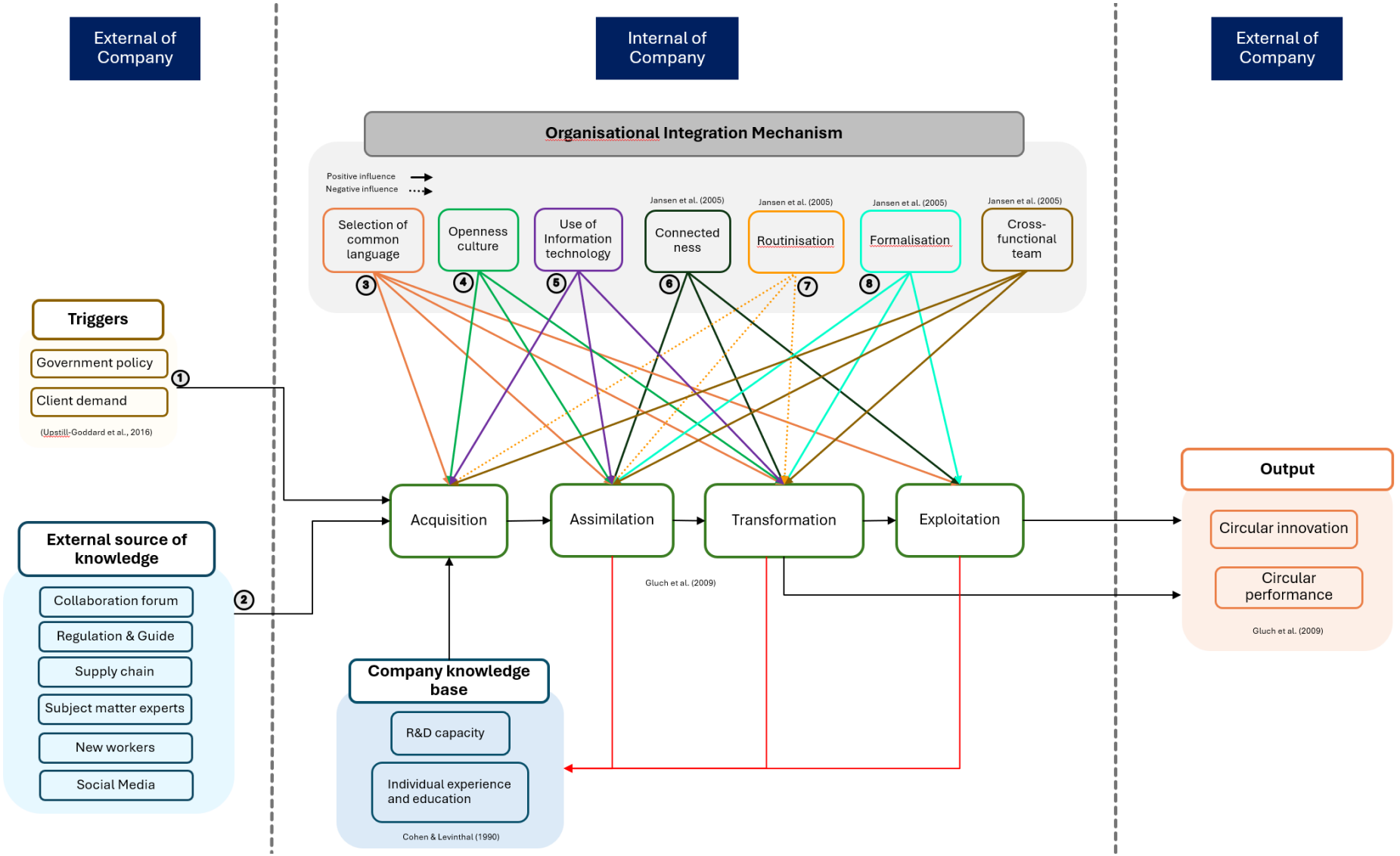


*Figure 5-5. Improvement for Absorptive Capacity for circularity (author's own illustration)*

# 6 Conclusion

## 6.1 Sub-Research Question 1

*"What conceptual frameworks explain the role of migrant workers' knowledge in a company's sustainable transformation?"*

The Absorptive Capacity model suggests that migrant workers' knowledge acts as valuable external knowledge, in the form of circular practices, unknown to the company. This knowledge is valuable, and with the appropriate processes, from acquisition to exploitation, a company can leverage this knowledge to achieve a competitive advantage through sustainable transformation. Additionally, once the migrant knowledge has been integrated into the company's resources, it can expand the company's base knowledge, which will subsequently increase the company's absorptive capacity so it can recognise and value other new knowledge.

## 6.2 Sub-Research Question 2

*"What knowledge do migrant workers bring to the company?"*

Although often hired for their labour, migrant workers bring a diverse range of knowledge spanning multiple categories. This includes fundamental procedural knowledge for general construction tasks and deep, experience-based know-how that contributes to efficiency and outstanding workmanship.

Crucially, the findings suggest that specific circular knowledge is not an inherent trait but is acquired through two primary pathways. Firstly, practical knowledge related to material reuse (e.g., paint and ceramics) is typically gained through hands-on experience in projects where such practices are implemented. Secondly, more technical knowledge concerning insulation materials (e.g., triple-glazed windows) and long-lasting materials (e.g., plastic substitution for wood) is usually acquired through formal education or vocational training, as it is driven by an awareness of official regulations and standards.

## 6.3 Sub-Research Question 3

*"How do migrant knowledge integration practices vary in different company scales?"*

Smaller Contractors (The "Reactive and Informal" Model): These firms are characterized by passivity and informality. Knowledge acquisition is reactive (waiting for suggestions), sharing is verbal and unstructured (e.g., during coffee breaks), and there are no formal processes for documentation or transformation. While internal connectedness is high within the small team, the entire organisation is isolated from the broader knowledge ecosystem, trapping it in the "cycle trap" of low innovation.

Larger Contractors (The "Proactive but Rigid" Model): These firms operate with formal and systematic practices. They have R&D capacity, use digital knowledge banks, and strategically hire specialists. However, this structure can create departmental silos, which hinder the flow of tacit, bottom-up knowledge from on-site workers to the design and engineering departments, creating a different kind of integration challenge. Therefore, they need to overcome these disadvantages through selecting appropriate integration mechanisms which allow knowledge transfer across departments, such as a cross-functional team.

## 6.4 Sub-Research Question 4

*"What are the barriers companies face in integrating migrant workers' knowledge?"*

Companies face several significant barriers in integrating migrant workers' knowledge. The most fundamental barriers identified are:

Temporary Contracts and Linear Employment
The prevalent use of temporary, project-based contracts results in high staff turnover. This creates a "linear employment" cycle where tacit knowledge, residing within individuals, leaves the company upon project completion. This severely hinders a firm's ability to retain knowledge and build its long-term absorptive capacity, trapping smaller firms in a low-innovation, low-revenue cycle.

Contextual Mismatch
There is often a significant misalignment between the knowledge and experience gained in a worker's home country and the specific materials, regulations, and standards of the Dutch context. This mismatch can render prior expertise incompatible without substantial retraining, acting as a major barrier to the transformation and exploitation of their knowledge.

Employer Bias
Many employers, particularly in smaller firms, view migrant workers primarily as a source of labour rather than knowledge. This mindset precludes proactive efforts to acquire or value the expertise they may hold, creating a critical barrier in the acquisition dimension.

Organisational and Social Barriers
These include a lack of formalisation and documentation in smaller firms, which prevents knowledge from being institutionalised. Furthermore, language and cultural differences impede effective communication, whilst workers' pride or reluctance to share knowledge can obstruct informal knowledge transfer.

## 6.5 Main Research Question

*"How can companies in the building renovation industry harness migrant workers' circular knowledge in sustainable transformation?"*

Companies in the building renovation industry can harness migrant workers' circular knowledge for sustainable transformation by undertaking a fundamental strategic shift from a labour-focused to a knowledge-focused employment model. This transformation is catalysed by powerful external triggers from government (through regulations and incentives) and clients (through project requirements), which create the necessary impetus for change.

The process requires companies to first overcome significant barriers, primarily the prevalent use of temporary contracts that lead to high staff turnover and knowledge loss, and the contextual mismatch between a worker's home-country experience and Dutch standards. To do this, companies must develop their absorptive capacity across four key dimensions. This involves:

1. Acquiring knowledge by proactively identifying and valuing migrant workers' skills through objective tools like skills passports and fostering direct dialogue.
2. Assimilating this knowledge by implementing formalised capture mechanisms, such as digital knowledge banks, and offering sustainable contracts that encourage knowledge transfer.
3. Transforming their own routines by establishing feedback loops to adapt and integrate new, context-specific knowledge.

4. Exploiting this enhanced knowledge base by implementing innovations in pilot projects and empowering knowledge-holding workers to mentor their peers.

Underpinning this entire process is the crucial role of organisational integration mechanisms, especially the cultivation of an open and trusting culture where communication is encouraged and learning from mistakes is permitted. This enables the effective flow and application of knowledge, allowing a company to fully leverage the expertise of its entire workforce, including its migrant workers, for a genuine, sustainable transformation.

# 7 Recommendations and Limitations

## 7.1 Contributions

This research provides a different point of view on absorptive capacity. Wherein prior research emphasises the different dimensions of absorptive capacity and how they impact the company's success in harnessing external knowledge to achieve competitive advantage, this research shows how external knowledge in the form of migrant knowledge can be better utilised through processes and routines in the company's absorptive capacity.

### 7.1.1 Practical Contributions

The primary practical contribution of this research is the strategic framework developed in Figure 5-4, which offers tangible guidance for harnessing migrant workers' circular knowledge. It provides actionable strategies for contractors, clients, and government bodies, aimed at transforming the prevailing labour-focused employment model into a more sustainable, knowledge-based one. For contractors, particularly smaller firms, the framework outlines specific routines and mechanisms to enhance their absorptive capacity, enabling them to break free from the "cycle trap" of low innovation and low knowledge retention. By detailing concrete steps in acquisition, assimilation, transformation, and exploitation, this research operationalises the process of turning migrant workers from a perceived source of labour into a recognised source of valuable knowledge.

### 7.1.2 Theoretical Contributions

Theoretically, this research contributes to the literature on absorptive capacity by developing a contextualised framework, Figure 5-5, that addresses the specific dynamics of the building renovation industry. While much of the existing research focuses on measuring the impact of the absorptive capacity dimensions on competitive advantage, this study shifts the focus towards the strategic utilisation of external knowledge. It demonstrates how a specific, and often overlooked, form of external knowledge, that held by migrant workers, can be systematically integrated. By synthesising the absorptive capacity model with the realities of a fragmented, project-based industry, this research offers a nuanced perspective on how organisational integration mechanisms and a firm's resource base directly shape its ability to learn and innovate.

## 7.2 Limitations

This research, like any study, is subject to certain limitations that should be considered when interpreting its findings.

Firstly, this research did not include the migrant workers' perspective, even though it aims to explore the knowledge they possess. This was a deliberate choice due to ethical concerns and practical constraints in accessing a vulnerable population for research purposes. Consequently, the findings are based on the perceptions of employers, clients, and labour representatives, and may not fully capture the lived experiences or the complete scope of knowledge held by the workers themselves.

Secondly, the number of building renovation firms involved in this study is limited, and they are primarily located within The Hague and its surrounding area. As a case study, this approach provides depth but limits the generalisability of the findings. The dynamics and barriers observed may be specific to the contractor being interviewed. Caution should be exercised when applying the conclusions to the broader construction industry across the Netherlands or internationally.

## 7.3 Recommendations

The findings and limitations of this study suggest several avenues for future research to build upon this work.

Firstly, this research scope stops at proposing recommended actions and strategies for harnessing migrant knowledge. Further validation is needed to see and measure the impact of these strategies. Future research could employ longitudinal case studies to closely monitor the implementation of the proposed strategies and measure the resulting output on a company's absorptive capacity and circular innovation performance.

Secondly, to address the issue of generalisability, further research should be conducted to confirm these findings by incorporating a greater number of contractors of different sizes and from various regions. A larger-scale comparative study could provide a more comprehensive understanding of how firm size and geographical context influence the integration of migrant workers' knowledge.

Thirdly, this research implies that a firm's resources determine the extent of its knowledge base and the routines adopted that constitute its absorptive capacity. Dedicated empirical research is needed to clarify this relationship. A quantitative study could be designed to test the correlation between a firm's financial resources, its hiring policies, and its performance across the four dimensions of absorptive capacity.

Fourthly, future research could significantly enhance the findings' validity by incorporating direct, on-site observational methods. Adding a site observation component would provide a powerful method for triangulating the interview data, bridging the potential gap between what stakeholders report and what occurs in practice. A researcher present on-site could independently verify the project scope and, more importantly, identify tangible opportunities for implementing circular practices, such as material reuse or waste reduction, that may not be fully captured in interviews. This approach would be particularly valuable for observing tacit knowledge in action, revealing practical, informal circular innovations that employers may be unaware of and that workers themselves might not articulate. This would yield a more grounded and nuanced understanding of the operational realities of sustainable transformation.

Finally, a further area of research could investigate the specific impact of information technology on the absorptive capacity of construction firms. The findings indicated a stark difference in IT adoption between large and small contractors, and future studies could explore how digital tools specifically influence the acquisition, assimilation, transformation, and exploitation of knowledge in this sector.

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# A. Human Research Ethics Approval

Date 22-May-2025
Correspondence hrec@tudelft.nl

Human Research Ethics
Committee TU Delft
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The Netherlands

*Ethics Approval Application: Harnessing Migrant Workers' Circular Knowledge for Sustainable Transformation: Building Maintenance and Renovations in The Hague*
*Applicant: Onesmus Hopijayanto Salokang, Onesmus*

Dear Onesmus Onesmus Hopijayanto Salokang,

It is a pleasure to inform you that your application mentioned above has been approved.

Thank you very much for your submission to the HREC. Your submission has been approved.

1. Specify the timeline during which participants can opt out of the study explicitly, i.e., before anonymisation and or aggregation.

In addition to any specific conditions or notes, the HREC provides the following standard advice to all applicants:
• In light of recent tax changes, we advise you to confirm any proposed remuneration of research subjects with your faculty contract manager before proceeding.
• Please make sure when you carry out your research that you confirm contemporary COVID protocols with your faculty HSE advisor and that ongoing COVID risks and precautions are flagged in the informed consent, with particular attention to this where there are physically vulnerable (e.g., elderly or with underlying conditions) participants involved.
• Our default advice is not to publish transcripts or transcript summaries but to retain these privately for specific purposes/checking, and if they are to be made public, then only if fully anonymised and the transcript/summary itself approved by participants for a specific purpose.
• Where there are collaborating (including funding) partners, appropriate formal agreements, including clarity on responsibilities, including data ownership, responsibilities and access, should be in place, and relevant aspects of such agreements (such as access to raw or other data) are clear in the Informed Consent. Please update the ICF to communicate to the participants that transcripts will be shared for review.

Good luck with your research!

Sincerely,

Dr. C. Shelley-Egan
Chair HREC
Faculty of Technology, Policy and Management

# B. Informed Consent

## Informed Consent Form

You are being invited to participate in a research study titled Harnessing Migrant Workers' Circular Knowledge for Sustainable Transformation. This study is being done by Onesmus Hopijayanto Salokang from the TU Delft.

The purpose of this research study is to investigate how companies can effectively utilize and harness the knowledge of migrant workers, and will take you approximately 50 minutes to complete. The data will be used for a Master Thesis. We will be asking you to provide information regarding how the company values the knowledge of migrant workers and the challenges that emerge when integrating that knowledge into the company resources.

As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by minimizing the collection of your personal information, keeping your responses anonymous, and ensuring the strict protection of the data mentioned above. Personal information that will be collected are name, email, company, and job position. These data will solely be used for thesis purposes, such as correspondence exchange and providing background context for the interview. The interview will be recorded via Microsoft Team, audio only, and will be transcribed automatically by the application. A transcription of the interview will then be made and agreed upon before it is processed for the Thesis. The original transcripts and recordings will only be available for the researcher and will not be published. Direct quotations from segments of the interview included in the published thesis will be made anonymously. All collected data will be stored in Tu Delft's OneDrive and will be deleted once the project is over.

Your participation in this study is entirely voluntary, and you may withdraw at any time prior to data aggregation and anonymisation. You are also free to omit any questions.

On the next page, you can find the informed consent form of the research. Please read each point carefully, tick the appropriate box, and sign the form to indicate your consent.

Corresponding researcher
Onesmus Hopijayanto Salokang

Responsible researcher
Johan Ninan

| PLEASE TICK THE APPROPRIATE BOXES | Yes | No |
|---|---|---|
| **A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICPANT TASKS AND VOLUNTARY PARTICIPATION** | | |
| 1. I have read and understood the study information dated [_ _/_ _/_ _ _ _], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction. | ☐ | ☐ |
| 2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason. | ☐ | ☐ |
| 3. I understand that taking part in the study involves:<br>• The interview will be semi-structured interview with open-ended question<br>• The interview will collect personal information limited to name, email, company, and job position<br>• An interview will be conducted online via Microsoft Teams or In-person meeting<br>• The interview will be transcribed automatically via Microsoft Teams, applicable also for In-person interview, and the researcher will provide written transcription to be agreed upon prior to data processing.<br>• The interview recording and transcription will be stored in the researcher's OneDrive TU Delft storage and will be destroyed once the project is completed | ☐ | ☐ |
| 4. I understand that I will not be compensated for my participation | ☐ | ☐ |
| 5. I understand that the study will end by September 2025 | ☐ | ☐ |
| **B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)** | | |
| 6. I understand that taking part in the study involves the following risks and will be mitigated through the following:<br>• The risk of leaked information<br>• The risk of identification<br>• The risk of reputation damage form leaked information and identification<br>To mitigate the above risk, all personal information and interview data will be stored securely and will not be published. Only aggregated data (e.g.codebook and analysis of the interview) will be published in the Thesis, and direct quotations will be made anonymously. Furthermore, I have the option to concur with the interview result, deny to answer any questions, end the interview at any time and withdraw from this research any time prior to data aggregation and anonymisation. | ☐ | ☐ |
| 7. I understand that taking part in the study also involves collecting specific personally identifiable information (PII) (name, email, company) and associated personally identifiable research data (PIRD) (job position and job description) with the potential risk of my identity being revealed and the risk of being identified. | ☐ | ☐ |

| PLEASE TICK THE APPROPRIATE BOXES | Yes | No |
|---|---|---|
| 8. I understand that some of this PIRD is considered as sensitive data within GDPR legislation, specifically<br>• Job position<br>• Political, economic, social, technological, or environmental view | ☐ | ☐ |
| 9. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach:<br><br>The interview will be conducted anonymously. Personal information of the interviewees will not be published to anyone who is not involved in the research. After the research is completed, the personal data will be deleted. | ☐ | ☐ |
| 10. I understand that personal information collected about me that can identify me, such as name and email will not be shared beyond the study team. | ☐ | ☐ |
| 11. I understand that the (identifiable) personal data I provide will be destroyed after the research is completed | ☐ | ☐ |
| **C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION** | | |
| 12.I understand that after the research study, the de-identified information I provide will be used as a published Masters Thesis in the TU Delft repository | ☐ | ☐ |
| 13. I agree that my responses, views or other input can be quoted anonymously in research outputs | ☐ | ☐ |
| **D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE** | | |
| 14. I give permission for the de-identified interviews that I provide to be archived in TU Delft repository (https://repository.tudelft.nl) so it can be used for future research and learning. | ☐ | ☐ |

**Signatures**

| _____ | _____ | _____ |
|---|---|---|
| Name | Signature | Date |

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

| _____ | _____ | _____ |
|---|---|---|
| Researcher's Name | Signature | Date |

Study contact details for further information: Onesmus H. Salokang

# C. Interview Questions for Contractor

Q1: Could you please explain your role in the company and the related responsibilities?

Q2: Does your company implement circularity goals or practices, and why?

Q3: How did you search for the knowledge to achieve this goal?

**RQ2: What knowledge do migrant workers bring to the company**

Q4: Why do companies hire migrant workers, and what do they bring to the project?

Q5: How is it different from the local counterparts? Why can't it be fulfilled by the local labour?

Q6: What do you look for when hiring workers?

Q7: What is the scheme used in the employment of workers?

Q8: Do you notice specific skills or ways of working that they possess based on their previous experience or country of origin?

**RQ3: How do migrant knowledge integration practices vary in different company scales?**

Q9: How does your company try to find out or be aware about migrant worker's circular knowledge, practice or idea?

Q10: How do you disseminate or spread this knowledge and then ensure that it is understood by personnel from different teams?

Q11: How does your company try to combine or integrate the new knowledge into the existing circular procedure or practice?

Q12: When a new procedure is created, will it be applied only to the respective project, or will it be applied across multiple projects the company has?

Q13: What do you think is important that a company has to possess to ensure that the previous activities, from recognition to application across multiple projects are implemented?

**RQ4: What are the barriers companies face in integrating migrant workers' knowledge?**

Q14: What are the barriers to recognising and eventually utilising migrant workers knowledge?

# D. Interview Questions for Client

Q1: Could you please explain your role in the company and the related responsibilities? or

Q1: Could you please explain your background

Q2: Do you emphasise circularity goals when you are renovating either through design or certain practices, and why?

Q3: How did you search for the knowledge to achieve this goal or validate the design of the contractor?

Q4: How do you select your contractor?

**RQ2: What knowledge do migrant workers bring to the company**

Q5: Why do companies hire migrant workers, and what do they bring to the project?

Q6: How is it different from the local counterparts? Why can't it be fulfilled by the local labour?

Q7: Do you have a preference on whether a contractor uses migrant workers or not?

Q8: Do you notice specific skills or ways of working that they possess based on their previous experience or country of origin?

Q9: Do you think they possess certain skills or knowledge based on their previous experience or country of origin?

**RQ3: What are the barriers companies face in integrating migrant workers' knowledge?**

*This section is done to receive suggestions from clients*

Q10: How do you think a company can find out or be aware of migrant workers' circular knowledge, practice or idea?

Q11: How do you think a company can disseminate or spread this knowledge and then ensure that it is understood by personnel from different teams?

Q12: How does your company try to combine or integrate the new knowledge into the existing circular procedure or practice?

Q13: Do you think it is better that when a new procedure is created, it is only applied to the respective project, or across multiple projects the company has? Why?

Q14: What do you think is important that a company has to possess to ensure that the previous activities are implemented? Mechanism?

**RQ4: What are the barriers companies face in integrating migrant workers' knowledge?**

Q15: What are the barriers to recognising and eventually utilising migrant workers knowledge?

# E. Interview Questions for Labor Union and NGO

Q1: Could you please explain your role in the organisation and the related responsibilities?

Q2: How significant and important are circularity and sustainable goals in the building renovation and construction industry?

Q3: What makes a company adopt circular and sustainable practices?

Q4: What role do you see for migrant workers in achieving these goals?

Q5: How do you think companies usually obtain knowledge for circularity and sustainability?

**RQ2: What knowledge do migrant workers bring to the company**

Q6: Why do companies, especially in building renovation and construction, hire migrant workers? What do they bring to the project?

Q7: What is the scheme used in the employment of workers?

Q8: Do you think they possess certain skills or knowledge based on their previous experience or country of origin?

**RQ3: What are the barriers companies face in integrating migrant workers' knowledge?**

*This section is done to receive suggestions from unions and NGO*

Q9: How do you think a company can find out or be aware of migrant workers' circular knowledge, practice or idea?

Q10: How do you think a company can disseminate or spread this knowledge and then ensure that it is understood by personnel from different teams?

Q11: How does your company try to combine or integrate the new knowledge into the existing circular procedure or practice?

Q12: Do you think it is better that when a new procedure is created, it is only applied to the respective project, or across multiple projects the company has? Why?

Q13: What do you think is important that a company has to possess to ensure that the previous activities are implemented? Mechanism?

**RQ4: What are the barriers companies face in integrating migrant workers' knowledge?**

Q14: What are the barriers to recognising and eventually utilising migrant workers' knowledge?

Q15: How do you think the issue of migrant workers being equal to cheap labour can be resolved?