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Walzer, Alexander N.; Tan, Tan; Graser, Konrad; Hall, Daniel M.

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Exploring the Dynamics of Entrepreneurship, Innovation and Investing in Construction Robotics

Alexander N. Walzer¹, Tan Tan², Konrad Graser³, Daniel M. Hall²

¹ Institute of Construction and Infrastructure Management, ETHZ, Switzerland

² Department of Management in the Built Environment, TU Delft, Netherlands

³ Centre for Building Technologies and Processes, ZHAW, Switzerland

Corresponding author email address: awalzer@ethz.ch

Introduction

To scale, startups often seek external funding like venture capital (VC), where investors get an equity stake. The goal is to transition from their initial market via mergers, acquisitions, IPOs, SPACs, or buyouts. However, startups come with the potential for both immense success and failure. This high-risk environment is typical of the startup ecosystem. Recently, the construction industry has seen an emergence of technology startups, e.g. in SaaS. Construction robotics firms face challenges due to the need for physical, custom products amidst demand volatility and long development times, unlike software-only firms. These deep tech ventures often seek funding from venture capital (VC) for not only financial support, but also industry connections and insight. The VC model has the principal-agent issue, where motivating an entrepreneur (agent) to act in the VC's (principal) best interest is difficult due to information asymmetry. VCs mitigate this by using high-powered incentives, controlling rights, and staged investments to align interests. Academic research on VC impacts on hardware startups in AEC is limited, hence this research aims to address this gap.

Methods

We conducted 127 semi-structured and open-ended interviews with 95 individuals in 2022 and 2023 in Europe and North America, as well as in other regions, resulting in transcribed interviews and field notes, spanning more than 92 hours. The study incorporates stakeholder groups such as startup founders, investors, clients, partners and others (Table 1). Subsequently, we employ abductive thematic analysis as theorising with empirical data is the core of abductive research (Thompson 2022, Fig. 2). In total, we have categorized 2998 data segments from the raw data (such as phrases and paragraphs) into nine overarching categories, encapsulated within three overarching themes (Fig. 3).

Results

Our research identifies five primary dimensions (Fig. 4) of venture capital's influence on construction robotics startups, which are interconnected and dynamically interact. We identify misalignments and present them in a coherent way. This research is currently being prepared for a journal publication, a preprint may be available from the authors upon request. Further, a parallel study is conducted using a data-centric, quantitative research approach to enrich the findings presented here.

Are you into entrepreneurship? Let's connect!

- *VC funding facilitates startups' growth and scalability, including expanding markets, hiring talent, and increasing production. Startups can overcome hurdles, manage risk, and execute growth strategies with venture capital.*

- *VC funding spurs innovation by allowing startups to experiment with new technologies, processes, and business models, such as integrating robotics, AI, and sustainable practices.*

- *VC investments often indicate industry trends and opportunities, with particular interest in robotics, automation, and Property Technology (PropTech), suggesting promising areas for innovation.*

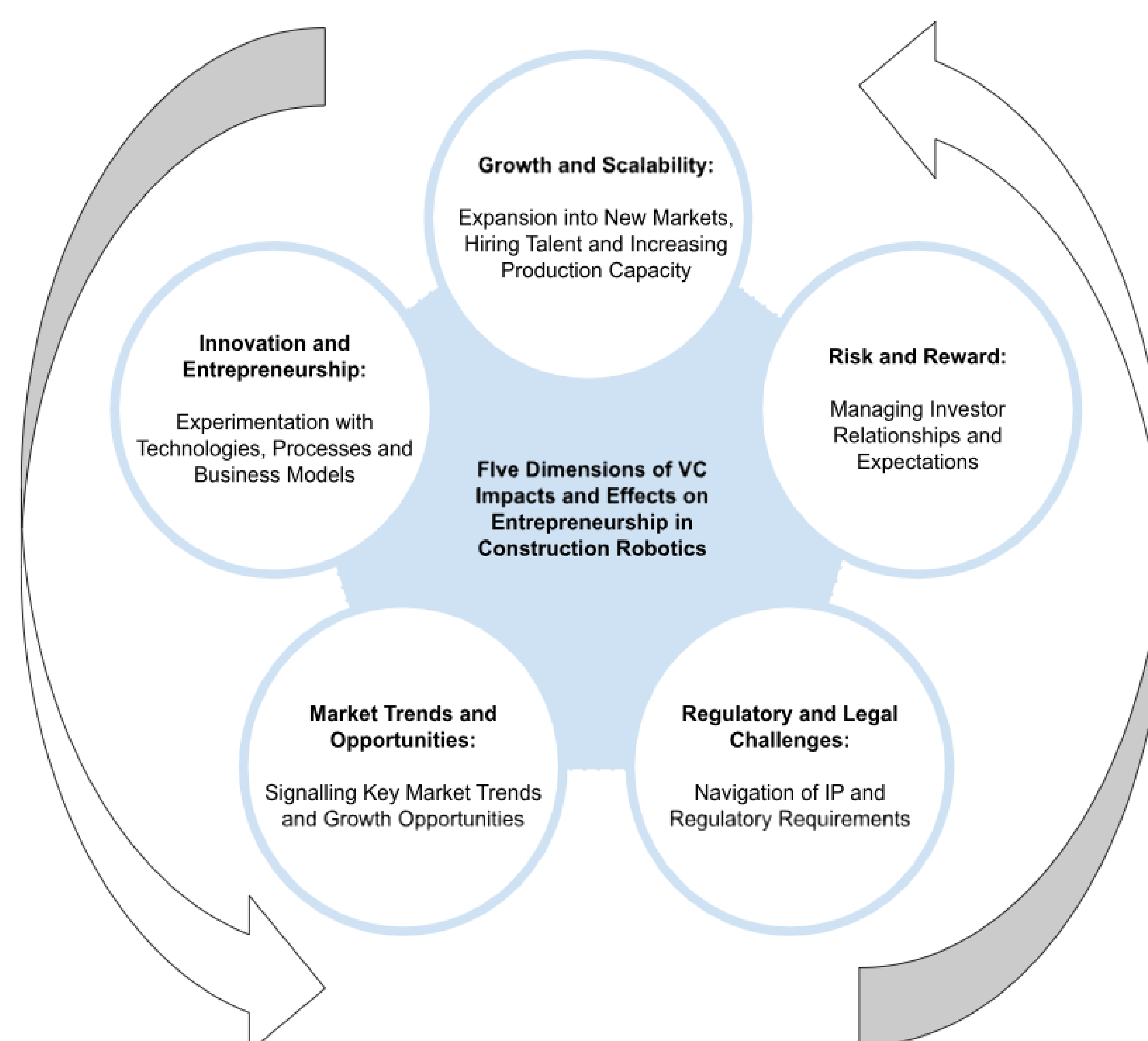


Fig. 4: Flywheel potential dimensions of misalignments

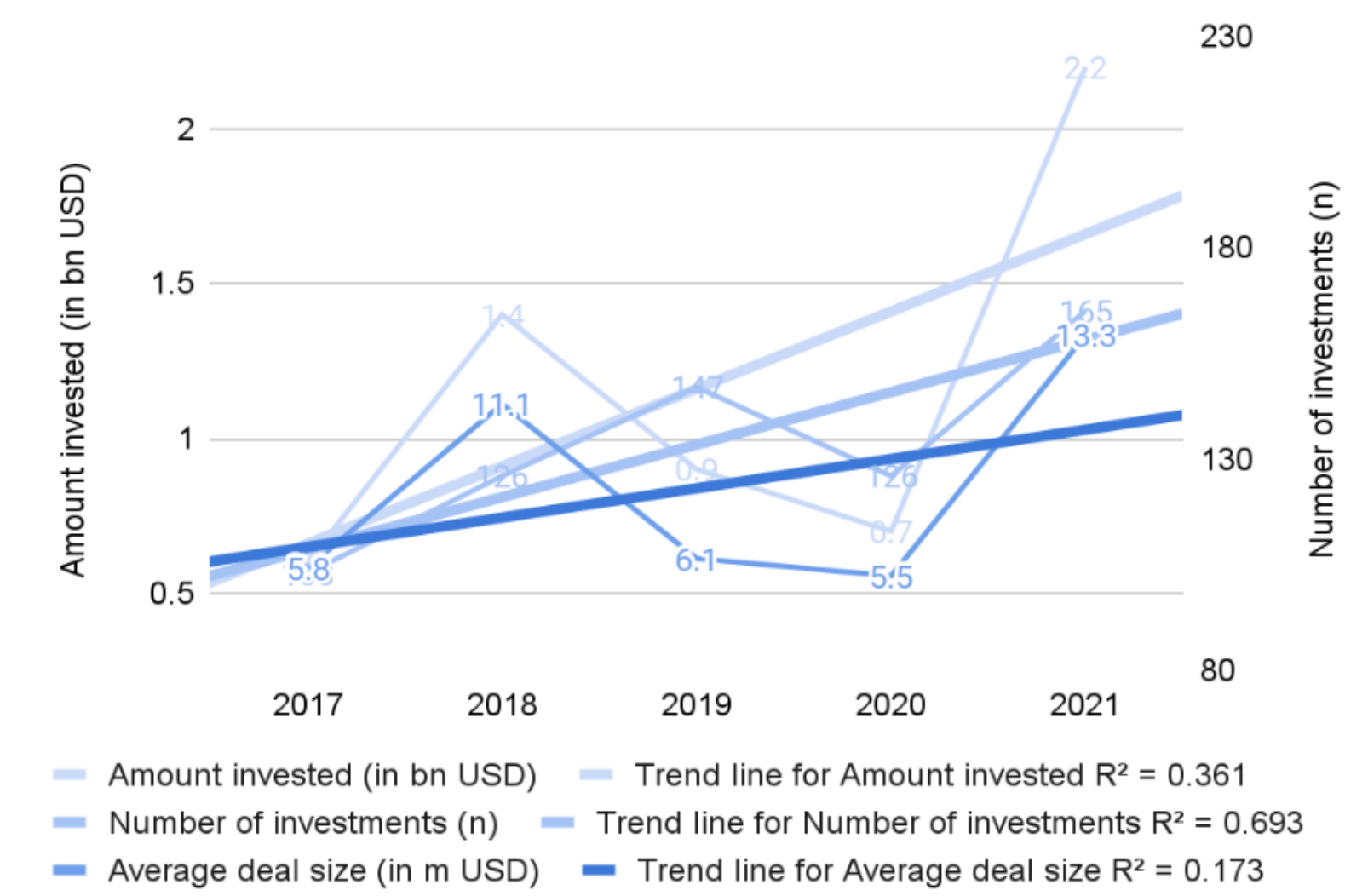


Fig. 1: US Construction Technology Investments 2017-2021 (Source: SVB)

| Interviewee Role(s) | No. | Focus Area | No. | Status | No. |
|---------------------|-----|--------------------------|-----|-------------------------|-----|
| (Co-)Founder | 51 | Robotics / Automation | 48 | Operational | 84 |
| Executive | 39 | Offsite / Prefabrication | 43 | Stealth | 10 |
| Advisor | 25 | Software / Firmware | 41 | Defunct | 2 |
| Investor | 16 | On-Site Construction | 33 | Exited | 2 |
| Other | 14 | Internet of Things (IoT) | 24 | | |
| Client | 13 | Climate / Energy | 23 | | |
| | | | | Region | No. |
| | | | | Continental Europe | 54 |
| | | | | North America | 46 |
| | | | | Multinational | 16 |
| | | | | Asia-Pacific | 7 |
| | | | | South America | 2 |
| | | | | Population | No. |
| | | | | Interviews (n) | 127 |
| | | | | Interviewees (N) | 95 |
| | | | | Data Collection | No. |
| | | | | Total duration (h) | 92 |
| | | | | Online (Verbatim) | 58 |
| | | | | In-person (Field Notes) | 43 |
| | | | | Online (Non-verbatim) | 10 |

Table 1: Participants' demographics (N=95)

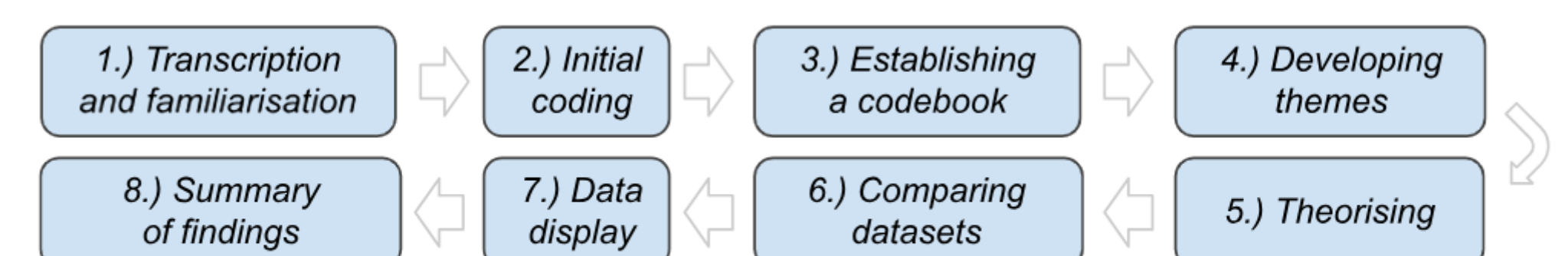


Fig. 2: Abductive thematic analysis

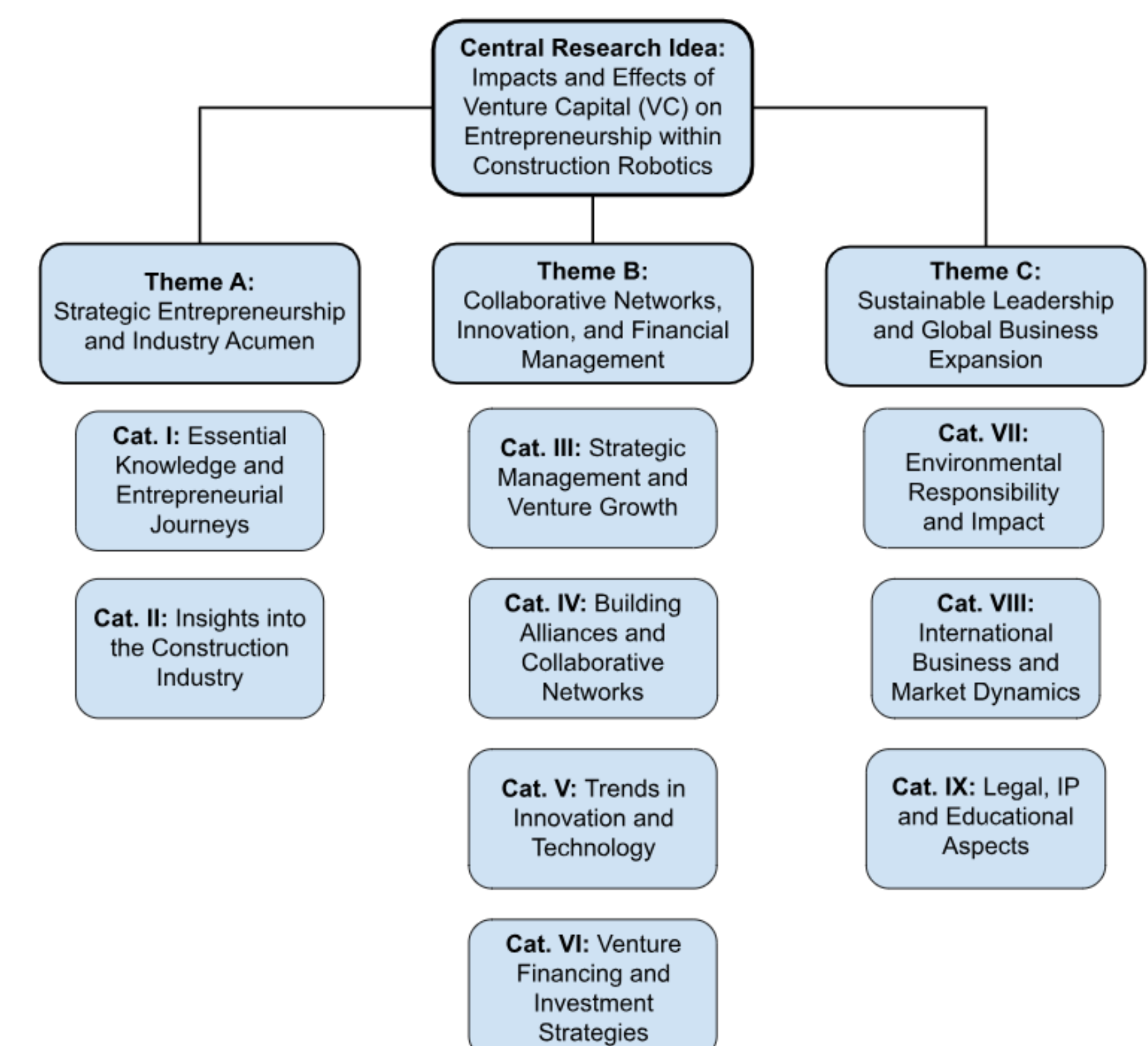


Fig. 3: Thematic Network Analysis

- *VC funding brings challenges. Entrepreneurs need to manage investor relationships and expectations, balancing the acquisition of funds with maintaining control. There might be pressure to focus on short-term financial goals over long-term strategies.*

- *VC involvement emphasizes careful navigation of regulatory and IP challenges. Startups must meet legal requirements and protect IP to retain investor confidence and secure further funding. With the aid of VC, construction robotics startups can expand their operations, recruit skilled personnel, and boost their production capabilities.*