

# No One Size Fits All: Multiple Pathways to Success for Clean- and Hardtech Startups

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<https://youtu.be/PjJ0MvOx6dl>



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## Research Highlights

7 Relevant Causal  
Conditions Identified

In-depth, semi-  
structured interviews  
conducted with  
11 firms

3 Categories of Cases  
and 4 Recipes  
(Consistency: 0.908;  
Coverage: 0.670)

## Motivation

To curb climate change, we need breakthrough innovation in **physical products and processes that reduce our environmental impact** (i.e., clean-, hardtech). Lawmakers tried boosting investment in cleantech with loans, subsidies, and tax breaks; but venture capitalists have been steadily pulling funds since 2009. Early-stage hardtech firms, more capital-intensive than softtech counterparts, were hit the hardest by this investment “valley of death.” But some clean-, hardtech startups did exit successfully between 2005 and 2016. This study therefore dives into these outlying successes with a **case comparative method** to identify **combinations of causal conditions** for their successful exit.



## Research Question(s)

For U.S. clean- and hardtech firms that achieved outlying, successful exits from 2005-2016, what combinations of causal conditions set them apart from unsuccessful cases?

Among the successful cases, were there causal conditions that set them apart from *each other*? That is, are there multiple pathways to success or just one? What are they?

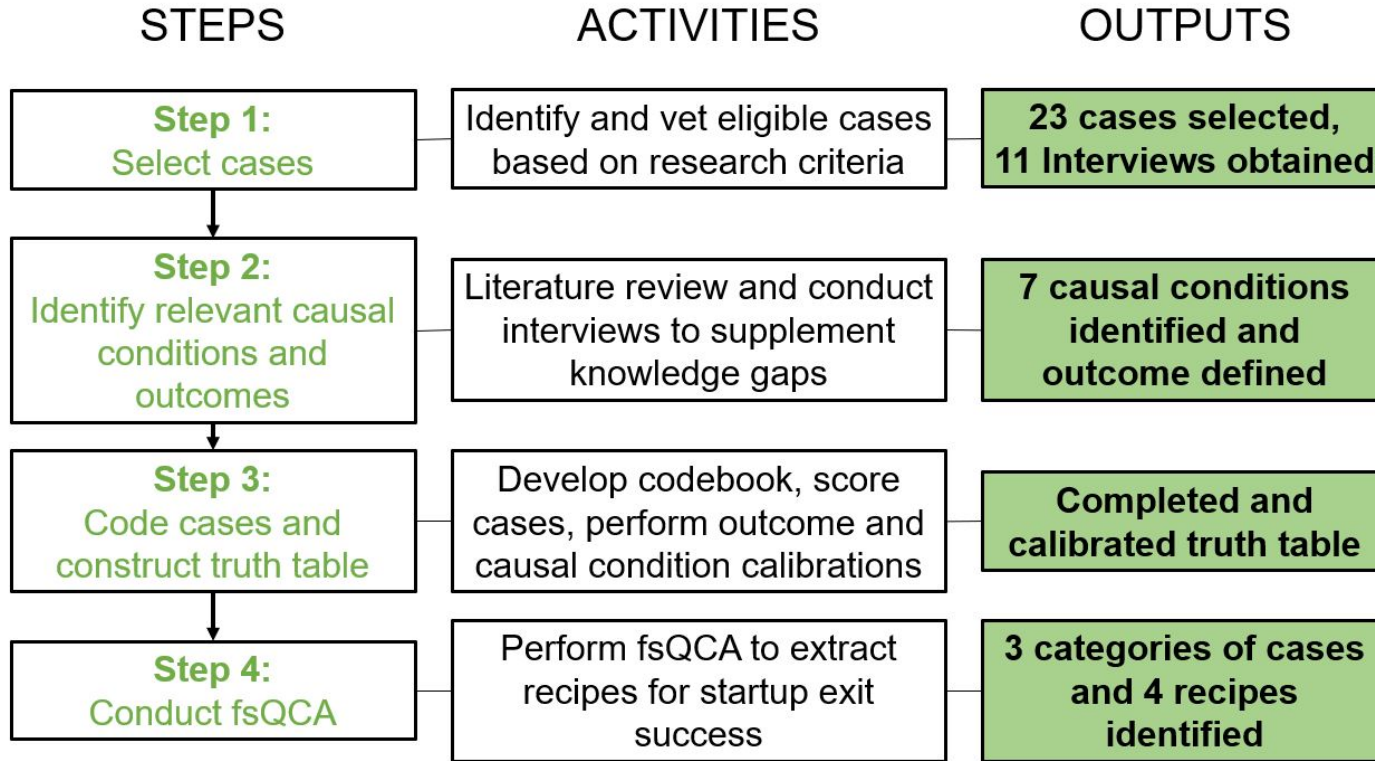
## Analytical Approach

We used a **case comparative approach** based on boolean algebraic principles called **fuzzy-set qualitative comparative analysis (fsQCA)**. FsQCA was chosen to answer this study's research question for three reasons:

- 1) fsQCA and other case comparative approaches can identify configurational solutions to an outcome (**conjunctural causation**);
- 2) fsQCA can identify multiple causal pathways that lead to the outcome of interest (**equifinality**);
- 3) There are currently a **dearth** of successful cleantech hardware startups, making statistical methods an inappropriate approach.



# Methods: Steps in Fuzzy-set Qualitative Comparative Analysis (fsQCA)



## Methods: Step 1. Select Cases (Clean-, Hardtech Firms)

### Selection Procedure:

1800 companies headquartered in the US in timeframe of interest (2005-2016)



195 companies identified as hardtech



30 eligible clean- *and* hardtech companies

All companies were contacted at least three times over a six-month period



11 companies consented to participate in research study; Semi-structured interviews conducted with founders or early employees for each firm. 7 provided sufficient information for further analysis using fsQCA

## Methods: Step 2. Identify Relevant Causal Conditions and Outcomes

### Causal Conditions

- 1) Favorable Industry - Contextual factors outside of startup control are amenable and advantageous to the type of innovation being developed.
- 2) Commercial Readiness - The startup's technology has been developed to reach a maturity level such that introduction to market is possible.
- 3) Visibility to Potential Investors - The firm is positioned such that successful contact between potential investors and the firm is possible.
- 4) Interaction with Actual Investors - The nature and frequency of dialogue between the firm and its investors and the degree to which both parties' goals aligned.
- 5) Management Experience - Firm leaders have previous experience on building and scaling a startup or relevant industry experience.
- 6) Non-financial Support - The firm is affiliated with or uses resources from an outside program or institution.
- 7) Straightforward Development Path - The firm has reached exit with minimal pivot activity.

### Outcome Condition

- 1) Successful Exit - A cleantech hardware startup was considered a positive investment decision by its investors.



## Methods: Step 3. Code Cases and Construct Truth Table

A **hybrid process** of deductive and inductive thematic analysis was used to interpret the interview data, where a **theory-driven codebook** was first developed a priori and **supplemented with data-driven methods** as interview data was compiled.

**To the right:** *Example of the indicators and scoring system for one of the causal conditions (Management Experience). A similar process was employed for all causal and outcome conditions.*

### Management Experience

#### Indicators:

1. Founding member/CEO's level of experience with previous startup building or scaling
2. Founding member/CEO's level of experience with hardtech startups
3. Founding member/CEO's level of experience with cleantech
4. Founding member/CEO's level of experience in core technology's industry

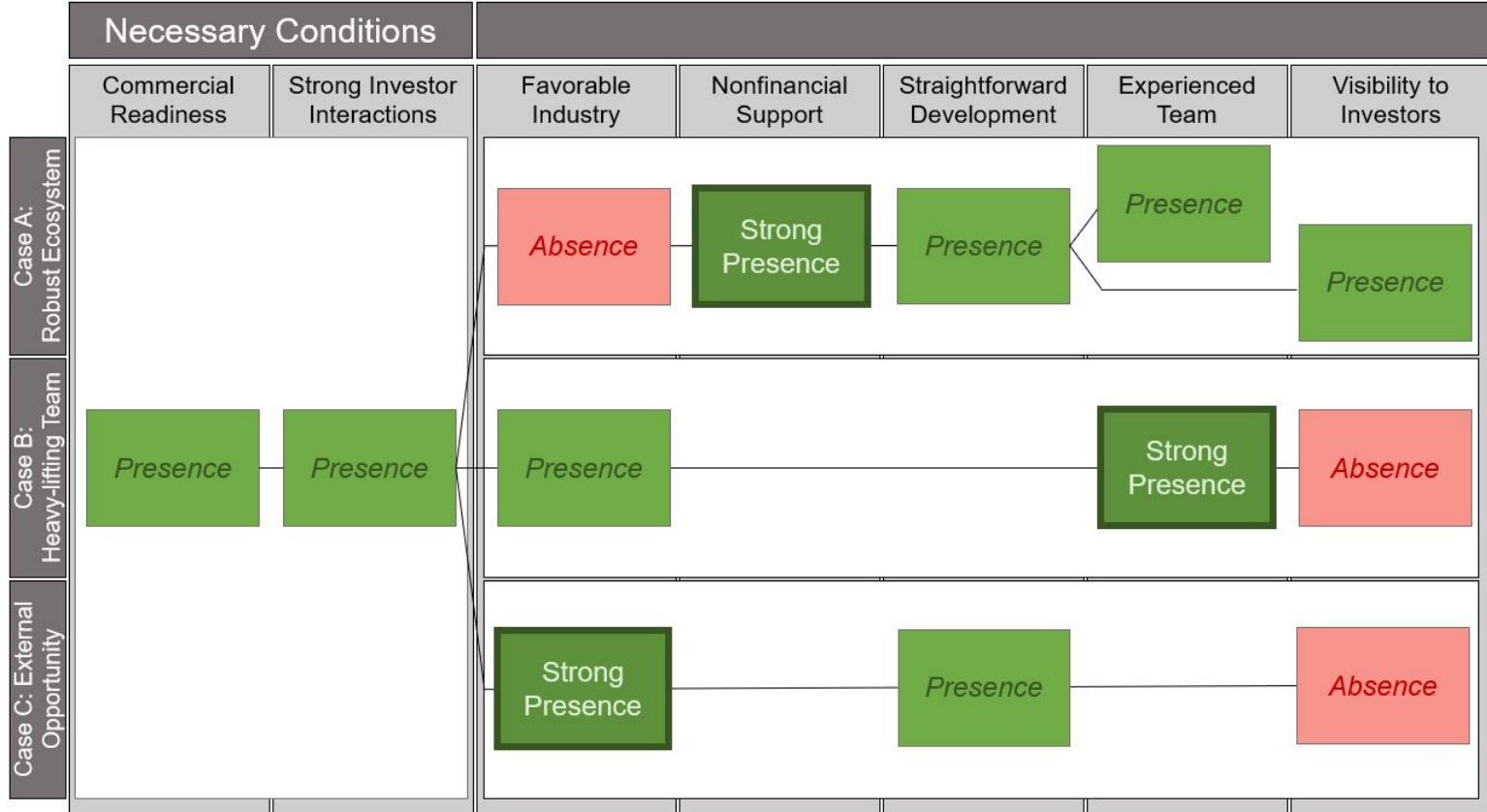
#### Scoring system:

Index score out of 8:

- Previous startup experience (3 points possible: 0 for none, 1-3 for low-high)
- Industry experience (3 points possible: 0 for none, 1-3 for low-high)
- Hardtech experience (1 point possible)
- Cleantech experience (1 point possible)



# Methods: Step 4. Conduct fsQCA



**Consistency: 0.908; Coverage: 0.670**



## Results: Category A. Robust Ecosystem

Case A: Robust Ecosystem						
Favorable Industry	Commercial Readiness	Nonfinancial Support	Strong Investor Interactions	Straightforward Development	Experienced Team	Visibility to Investors
Absence	Presence	Presence	Presence	Presence	Presence	
						Presence

### Key Quotes:

“[The incubator] offered a menu of human resources, recruiting, H.R., finance, accounting, any of the patent attorney and commercial attorney facilities and IT... I think it is a huge benefit versus having to do it yourself. As an entrepreneur, [the operational aspect] is very distracting and not what you want to do first.”

## Results: Category B. Heavy-lifting Team

Case B: Heavy-Lifting Team						
Favorable Industry	Commercial Readiness	Nonfinancial Support	Strong Investor Interactions	Straightforward Development	Experienced Team	Visibility to Investors
Presence	Presence		Presence		Presence	Absence

### Key Quotes:

One founder described having one hundred and seven investors, of whom “probably a hundred of them were friends of the family, and the other seven were Wall Street public company investors that invested in bulletin board companies. ... I knew almost all of them personally, and I made sure that they were prioritized and knew what was going on. We didn't sugar coat shit. We told them exactly what was what. And so I had a high degree of credibility and trust with them, and a lot of them invested two or three times in the course of the company's history.”

## Results: Category C. External Opportunity

Case C: External Opportunity						
Favorable Industry	Commercial Readiness	Nonfinancial Support	Strong Investor Interactions	Straightforward Development	Experienced Team	Visibility to Investors
Presence	Presence		Presence	Presence		Absence

Further research is required to investigate if favorable market conditions can cause an artificially high exit valuation for a company due to flocking of investors, and whether these companies have continued to succeed after supportive policies have reached their sunset dates.

## Takeaways

**There are multiple pathways for clean- and hardtech startups to achieve success. Achieving well in all seven causal conditions will likely lead to a successful exit, but this study allows entrepreneurs, incubators/ accelerators, and policymakers to prioritize limited time and capital for cleantech development.**

## Value

Our paper's contribution to the existing literature on clean- and hard-tech entrepreneurship is threefold. First, through literature review and inductive thematic analysis, we identify seven key causal conditions that contributed to successful exit cases. Next, we conduct semi-structured interviews with founders and early employees to build in-depth case knowledge of eleven early-stage clean- and hard-tech companies in our relevant timeframe. These eleven cases provide empirical examples that refine and support our understanding of the seven causal factors. Lastly, we conduct a fuzzy-set qualitative comparative analysis (fsQCA) to identify distinct "recipes," or pathways, that distinguished successful cases from unsuccessful cases in our study.



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# Questions?

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