

When Lean Startup Meets Complex Societal Problems: Challenges in Startup Early-Stage Experimentation

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Abstract: In today's rapidly evolving entrepreneurial landscape, addressing complex societal challenges, or has emerged as a crucial area of focus for startups. On the other hand, startups are often encouraged to adopt experimental lean approaches, which emphasize focusing on a customer problem and developing hypotheses to envision a viable value proposition and business model. However, while lean methodologies prioritize quick iterations and scalability, they may fall short when tackling complex issues that require long-term commitment, collaboration across diverse stakeholders, and careful consideration of societal impact. The study's research question is centred on understanding how lean startup approaches can be applied to engage with stakeholders, pivot, and iterate their business models based on feedback received from various actors. To explore this, we select the mobility industry in Italy as the empirical setting for this study. Italy's urban mobility landscape presents a unique and complex context, characterized by a growing need for sustainable transport solutions, the presence of public and private sector collaboration, and the active role of diverse actors working to address these challenges. We employ an exploratory multiple-case study approach, examining five startups addressing mobility-oriented problems. A total of 13 in-depth interviews were conducted in two waves. Data was triangulated with secondary sources, such as podcasts, whitepapers, and press releases, to understand the stakeholder dynamics involved in the experimentation phase. Our findings suggest that: (i) startups typically begin with broad, ambitious goals, only to pivot toward more narrowly focused problems, thereby reducing the scope of their initial ambitions; (ii) startups addressing more complex problems tend to find support from public entities, while those focused on less wicked problems prioritize direct engagement with end-users and industry experts, as the lean startup approach suggests. Moreover, by adopting as an analytic device the three main categories derived from the lean Impact startup framework (value search, value creation, and value distribution), we identify specific challenges faced by entrepreneurs in the first two stages of the process. The study concludes by offering practical insights into how entrepreneurs can better navigate the complexities of stakeholder engagement when tackling wicked problems.

Keywords: Lean Startup; Societal Challenges; Wicked Problems; Experimentation

1. Introduction

In the contemporary landscape of innovation and entrepreneurship, addressing complex societal challenges has become a focal point for researchers and practitioners alike (George et al., 2011). These problems are also known as "wicked problems," i.e. difficult to define, have no clear solution, and are deeply interconnected with other problems. Wicked problems, a term first coined by Rittel and Webber (1973), require innovative approaches and frameworks that go beyond traditional problem-solving methods.

On the other side, startups have emerged not only as engines of economic growth and technological advancement but also as potential vehicles for addressing these intricate societal challenges, as they make them particularly suited to exploring new solutions where established organizations may struggle to act (George, Schillecxbeck and Marril, 2021; Filippelli, Troise, Bigliardi, & Corvello, 2025).

The rapid evolution of the business landscape, characterized by technological advancements and ever-changing market dynamics, has necessitated the adoption of innovative methodologies by entrepreneurs and organizations (Ghezzi, 2019). The Lean Startup Approach (LSA), developed by Eric Ries and Steve Blank, is one such approach that has drawn a lot of interest (Ries, 2011; Blank, 2023). To validate value propositions and business models, LSA places a strong emphasis on iterative experimentation and customer-centricity as a learning strategy to reduce uncertainty (Cavallo & Ghezzi, 2020).

However, a critical gap remains in our understanding of how LSA can be applied to contexts defined by wicked problems and societal grand challenges. While LSA has proven effective in many contexts, extending its principles to address wicked problems presents unique challenges and opportunities. Wicked problems necessitate an understanding of unintended consequences, interconnected sub-problems, and the perspectives of diverse stakeholders (Alford & Head, 2017).

By adopting an exploratory multiple case study design (Eisenhardt & Graebner, 2007; Yin, 2003), this research investigates how startups in the mobility industry implement the Lean Startup Approach (LSA) in response to stakeholder feedback. The mobility sector offers a particularly fertile ground for this exploration, as it embodies many of the characteristics associated with challenges that are interdependent, context-specific, and involve a multiplicity of actors with conflicting interests, rendering conventional solutions insufficient or even counterproductive.

By adopting the social LSA framework as analytical device (Bacq & Wang, 2024), this study contributes to the literature in three ways: (i) it examines how entrepreneurs in the mobility sector identify and shape new business opportunities with an explicit environmental or social mission (i.e., value search); (ii) it investigates how startup strategies evolve in response to stakeholder engagement and the feedback derived from interactions with users, partners, institutions, and communities (i.e., value creation); (iii) it investigates how measurable or perceived improvements in relation to the wicked problems at stake (i.e., value distribution).

We aim to enrich the understanding of how the Lean Startup Approach (LSA) is applied in wicked contexts, where the problems entrepreneurs seek to address are deeply intertwined with complex societal challenges. Ultimately, we seek to inform both theory and practice on how experimentation and feedback loops can be mobilized not only to build viable businesses, but also to generate broader societal value.

2. Theoretical Background

2.1 Wicked Problems

The concept of *wicked problems* emerged in the late 1960s to describe complex societal challenges that resist traditional problem-solving approaches (Rittel & Webber, 1973; Skaburskis, 2008). Introduced by Rittel and Webber in their seminal work *Dilemmas in a General Theory of Planning*, wicked problems are characterized by features: wicked problems lack a definitive formulation; understanding the problem is itself part of the problem-solving process. They have no stopping rule, meaning that one never knows when a solution is "good enough," and no objective test of solution validity – solutions are judged subjectively as better or worse depending on stakeholders' values and perspectives. Importantly, each attempted solution is a "one-shot operation" with often irreversible consequences. Moreover, wicked problems are inherently unique, context-specific, and often symptoms of other problems, forming a network of interdependent issues (Rittel & Weber, 1973; Alford & Head, 2017).

In this context, entrepreneurship is increasingly recognized as a key vehicle for engaging with wicked problems. Entrepreneurs operate in uncertain, dynamic environments and are often able to craft novel value propositions that address social and environmental challenges. Recent work calls for equipping individuals with the mindset and capabilities of "wicked scientists" – those trained to tackle the ambiguity, complexity, and interdependence of modern grand challenges (Moritz & Kawa, 2022).

One promising entrepreneurial response involves the development of context-specific strategy tools. Burke and Wolf (2020) show how the process of *toolmaking* – i.e., crafting ad hoc strategic frameworks – can help managers and entrepreneurs navigate wicked problems. These tools, rather than providing fixed solutions, facilitate sensemaking, experimentation, and continuous adaptation to shifting stakeholder environments.

2.2 Lean Startup Approaches

The Lean Startup methodology has become a cornerstone in the study and practice of entrepreneurship because it offers a disciplined, experiment-driven path through high uncertainty (Shepherd & Gruber, 2020). Rooted in Ries's Lean Startup and Blank's Customer Development, the approach revolves around five tightly linked routines: (1) articulating falsifiable hypotheses about the venture's core assumptions and ordering them by risk; (2) embedding these hypotheses in a provisional business model design that specifies how the venture might create, deliver, and capture value; (3) building a *minimum viable product* (MVP) that is just elaborate enough to test the riskiest assumptions; (4) engaging "earlyvangelists" to generate rapid, qualitative and quantitative feedback; and (5) iterating through a disciplined *persevere–pivot–perish* decision loop. Recent scholarship extends this logic beyond purely commercial goals. Bacq and Wang (2024) propose a *Lean Impact Startup* framework that marries Lean experimentation with contemporary stakeholder theory, positioning iterative learning as a means to surface and negotiate social and environmental value claims. This

suggests that entrepreneurial mindsets, digital tools, and collaborative stakeholder engagement can be mobilised to tackle wicked problems in agile and scalable ways.

Our study asks: “How do lean impact entrepreneurs approach stakeholder engagement during different stages of the experimentation process?” By focusing on this question, we aim to deepen scholarly understanding of how LSA principles are reinterpreted in contexts where stakeholder feedback is not just a means for validating value propositions and business models, but a critical input for achieving lasting societal impact.

3. Methods

This study adopts a qualitative, exploratory research design grounded in a multiple case study approach (Eisenhardt, 1989; Yin, 2009). We decided to adopt these methods due to the contemporary, complex, and context-dependent nature of the phenomenon of interest (Gartner & Birley, 2002). Case studies enable in-depth exploration of processes within real-world settings and are particularly well-suited for theory-building in emerging or under-explored domains (Eisenhardt & Graebner, 2007).

We selected the urban mobility sector as an empirical setting. Urban mobility issues intersect with environmental concerns, infrastructure constraints, evolving regulatory frameworks, and diverse stakeholder needs, making it a fertile ground for studying stakeholder engagement within LSA. The sector also represents a dynamic context of digital transformation, where emerging technologies are increasingly deployed to reimagine smart cities.

A heterogeneous sampling strategy was employed to capture variation across technological domains (hardware and software startups). The focus has been on digital startups with innovative solutions. This criterion ensured that the selected startups were leveraging cutting-edge technologies and methodologies, aligning with the research's emphasis on innovative approaches to tackling wicked problems in the mobility sector. Lastly, the selection process targeted startups that explicitly utilized Lean Startup principles. This requirement was emphasized in all engagement emails sent to potential participants. Ensuring that the selected startups adhered to LSA was essential for exploring how these principles are applied in real-world scenarios to validate and pivot MVPs based on stakeholder feedback. The use of Lean principles is a key aspect of the research, as it aligns with the goal of understanding iterative development processes in addressing complex, multifaceted problems.

The unit of analysis is related to the evolution of value proposition and the business model of 5 startups (see table 1). Primary data were collected through 13 in-depth, semi-structured interviews with key informants, including early-stage startup founders and industry experts. These informants were selected for their direct involvement in or observation of stakeholder engagement practices during entrepreneurial experimentation. The interviews were designed to probe the rationale, strategies, and perceived outcomes of stakeholder interactions at different stages of the Lean Startup cycle (Gioia, Corley, & Hamilton, 2012). Interview guides were informed by themes from the literature review and organized into sections aligned with the research framework. All interviews were recorded, transcribed verbatim, and coded for further analysis. To enhance data triangulation and strengthen the validity of the findings (Denzin, 1978), secondary data sources were also integrated, including company whitepapers, press releases, public interviews (e.g., podcasts and conference talks), and media coverage. These materials provided contextual insights that helped to situate and interpret the interview data more robustly.

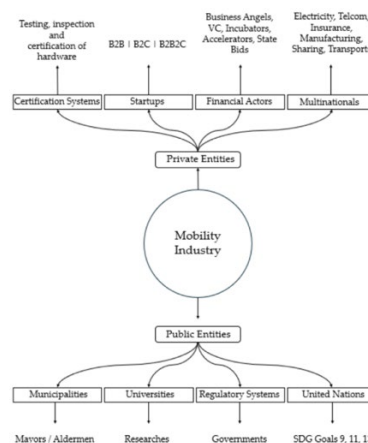


Figure 1: Mobile industry stakeholder mapping

The data analysis followed a Grounded Theory-informed inductive coding approach (Gioia et al., 2012). Coding proceeded in several iterative rounds (figure 1). In the first phase, in vivo codes were generated to remain close to participants' language and meaning. These were then synthesized into higher-order conceptual categories using constructed codes developed by the research team. Following Eisenhardt and Graebner's (2007) logic of replication, each case was treated as a standalone analytical unit, and both within-case and cross-case analyses were performed to identify patterns of convergence and divergence.

The coding process led to the emergence of three overarching categories that map onto and extend the Lean Impact Startup framework (Bacq & Wang, 2024):

1. *Value Search* – how stakeholder input shaped initial problem framing and hypothesis formulation;
2. *Value Creation* – how feedback informed MVP development and iterative experimentation;
3. *Value Distribution* – how entrepreneurs engaged stakeholders in co-defining long-term impact and inclusivity goals (not the focus of the article).

These categories offered a structured understanding of how stakeholder engagement practices evolve throughout the experimentation process and how they inform the pursuit of lasting social impact within entrepreneurial settings.

Table 1: Case selection

Case	Description	Year of Foundation	Solution Type	Type of Primary Stakeholder	Active Cities
Case A	Pioneering startup specializing in innovative urban mobility solutions with smart parking systems using IoT technology	2021	Hardware	B2B	3
Case B	Mobile energy solutions startup specializing in on-demand mobile battery recharging for electric vehicles	2021	Hardware	B2B	2
Case C	Digital platform company dedicated to simplifying urban parking through advanced technology solutions	2021	Software	B2B, B2C, B2G	104
Case D	Technology company specializing in streamlining business onboarding processes through AI and ML algorithms	2019	Software	B2B, B2G	10
Case E	Technology company focused on revolutionizing transportation through advanced vehicle-sharing platform	2018	Software	B2B, B2C, B2G	6

4. Findings

This research examines urban mobility startups to understand how they navigate stakeholder engagement during different stages of development. Startups were clustered based on the complexity (wickedness) of the problems they address and whether they produce hardware (higher complexity) or deliver digital services (lower complexity).

The analysis focuses on two primary dimensions derived from the Lean Impact Start-Up Framework: *Value Search* and *Value Creation*. Furthermore, the analysis was carried out in two phases: the first identified key stakeholder categories (Figure 1), and the second explored which challenges arise in the value search and creation steps (Table 2).

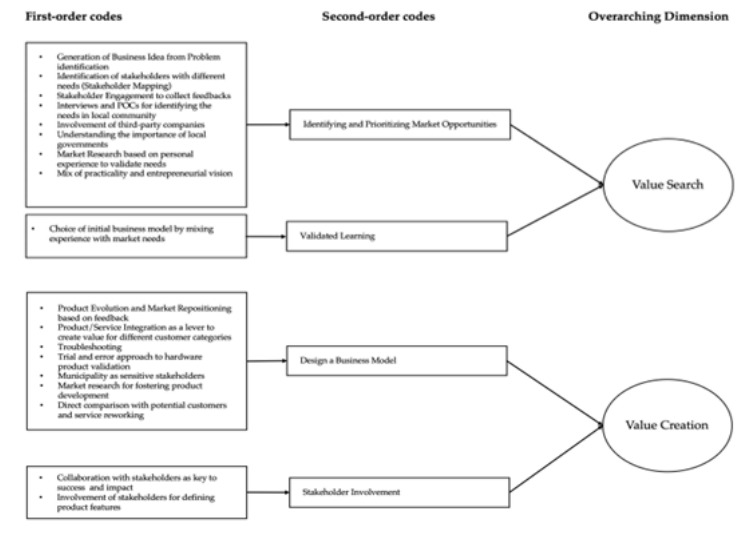


Figure 2: Data Structure

4.1 Value Search

According to the Lean Impact Startup framework, the value search phase encompasses two core activities: stakeholder discovery and stakeholder validation. Our analysis reveals that this phase is shaped by two critical dimensions: the *complexity of the problem* being addressed – reflected in the number and diversity of stakeholders – and the *complexity of the product* (hardware vs. software).

The complexity of the problems significantly influenced the categories of stakeholders involved. Startups addressing higher degrees of complexity, such as Startup D and Startup E, engaged with a broader range of actors, including public entities, local administrations, and private sector partners. This extensive engagement was essential for understanding the multifaceted nature of the urban mobility challenges they aimed to solve. However, practical insights from users and market analysis led to a significant shift. As Startup A founder explained: *"We realized that starting with city models was not feasible due to complexity. Instead, we needed to begin with a more controlled environment"*, he explained. This shift involved focusing on long-term parking solutions in the initial phase and gradually expanding to include short-term parking and other services.

For instance, Startup D engagement with local transport agencies highlighted the significant impact of local administrations in shaping urban mobility solutions. The founder stated: *"We realized that the role of local administrations in some cities is quite substantial."* This engagement with multiple stakeholder groups was crucial for gaining a comprehensive understanding of the problem context. Similarly, Startup E collaborated with various players, including car dealerships and insurance groups, to validate their initial concept and streamline operations. Startup E's founder emphasized, *"We started with vehicles from dealerships because starting directly with private vehicles involved complexities"*.

In contrast, startups addressing lower degrees of problem complexity, such as Startup A and Startup B, focused more on industry experts and potential users. For these startups, the stakeholder discovery process was more targeted, involving direct engagement with industry stakeholders to validate the feasibility of their future prototypes. Startup A's founder, initiated the process by engaging with potential users and industry experts at smart mobility fairs, which revealed the need to integrate parking sensors with electric charging stations. The founder noted, *"With a big corporate, they first brought up the issue, asking if we had considered connecting the sensor to electric columns"*. The complexity of the products developed also influenced the stakeholder discovery process. Hardware-focused startups like Startup A and Startup B, dealing with more sophisticated and costly solutions, emphasized early validation with industry experts to minimize spending and ensure feasibility of the development of their prototype. On the other hand, software-focused startups such as Startup C, Startup D, and Startup E started with a more detailed stakeholder mapping and thorough market analysis. For these startups, the market is full of possible consumers and/or people that bring interests to the future solution, making stakeholder mapping and feedback analysis essential. For instance, the founder of Startup C conducted comprehensive market research and stakeholder mapping, beginning with private parking operators and expanding to public parking authorities. The founder highlighted, *"I mapped out the stakeholders, starting with*

private parking operators who were more responsive to this type of approach, gradually moving to more complex stakeholders like public parking authorities".

In conclusion, the value search process is deeply contingent on the complexity of the problem and the type of product being developed. Startups adapted their stakeholder discovery and validation strategies accordingly – ranging from focused expert consultation to broad institutional engagement – highlighting the need for context-sensitive approaches in the early stages of innovation.

4.2 Value Creation

The value creation phase marks a shift from exploring where to play to defining how to win – that is, how startups develop viable, desirable, and feasible solutions with key stakeholders. While all startups recognized the importance of stakeholder engagement in value creation, the nature and depth of this engagement varied substantially depending on the *complexity of the problem* and of the *solution*.

Startups developing hardware-based solutions, such as Startup A and Startup B, centered their value creation efforts on early-stage technical prototyping and validation with experts and ‘early evangelists’. These actors played a critical role in shaping the product’s functional specifications. Startup B’s founder, emphasized the importance of rapid iteration: *“Validating the idea is complex, especially when that validation requires hardware... we put up a fully functioning prototype within three months.”* Similarly, Startup A pivot from a standalone app to a fully integrated sensor system emerged through close feedback loops with municipalities and infrastructure providers. Founder Andrea Buri explained, *“We approached a lot of customers... to understand whether having an extra app on the citizen’s phone was really useful”.*

In contrast, startups developing software-based solutions – like Startup C, Startup D, and Startup E – that faced more complex problems, required multi-stakeholder engagement across institutional, commercial, and user domains. These startups placed greater emphasis on stakeholder integration throughout the value creation process. For instance, Startup D adopted what the founder called an ‘artisanal approach’, deliberately avoiding mass communication to engage in-depth with core stakeholders. This allowed for the co-design of modular features tailored to diverse urban contexts.

The complexity of the solution directly influenced the scope and intensity of stakeholder involvement. Hardware startups tackled relatively bounded, though technically challenging problems, allowing for concentrated engagement with domain experts. For example, Startup A responded to feedback from a big utility’s corporate to ensure their sensors could support real-time monitoring of charging station parking: *“We have a contract with a big corporate for installations... the user will know if the parking lot is free or occupied.”*

On the other hand, software startups operated within more ambiguous, socially entangled problem spaces, requiring iterative stakeholder mapping and negotiation. Startup C had to balance the expectations of public authorities, private parking operators, and end users – each shaping different layers of the solution. Startup D highly abstract architecture emerged precisely to accommodate this diversity, as the founder explained: *“We created a solution with such a level of abstraction that it can succeed with different data sources but deliver the same value.”*

In summary, value creation in urban mobility startups is shaped by the interplay between product complexity and problem complexity. Hardware startups pursued tightly scoped, expert-driven experimentation to refine technical reliability. Software startups, by contrast, embraced broader, iterative stakeholder integration to navigate complex, multi-actor systems. In both cases, stakeholder co-creation emerged as essential.

5. Discussion

This study investigated how LSA is applied by entrepreneurs who engage stakeholders across different phases of the experimentation process, particularly when addressing wicked problems (Rittel & Webber, 1973).

Our study in the context of urban mobility startups highlights that stakeholder engagement is not peripheral but central to experimentation in contexts marked by high uncertainty, and systemic interdependencies. Startups operating in wicked domains must continuously navigate feedback from diverse stakeholder groups – including public institutions, private actors, and end-users. This supports prior claims that innovation under grand challenges requires collaborative and adaptive approaches (Ferraro, Etzion, & Gehman, 2015). However, we go further by showing how the complexity of the problem and of the solution influence stakeholder engagement. A core insight of this study concerns the differentiated stakeholder strategies between hardware

and software startups, reflecting structural differences in experimentation dynamics. Hardware ventures, constrained by high capital intensity and longer development cycles, tend to frontload engagement with domain experts and infrastructure partners to ensure technical feasibility before broader scaling. In contrast, software startups benefit from shorter iteration cycles, enabling ongoing feedback integration and adaptive responses to stakeholder.

Our findings support the growing view that Lean Startup principles – when adapted – offer valuable mechanisms for tackling wicked problems (Bacq & Wang, 2024). However, doing so requires entrepreneurs to develop contextual sensitivity, especially in calibrating experimentation according to the nature of the technology (physical vs. digital), stakeholder number and type, and institutional environment.

Finally, we acknowledge that this study is exploratory in nature and is based on a limited number of cases, which constrains the generalizability of our findings. Future research could build on these insights by employing a larger and more diverse sample of startups, as well as designing the case selection to better control variance ex ante. Moreover, longitudinal studies could further illuminate how stakeholder engagement strategies evolve over time, particularly in response to technological maturation, regulatory shifts, and changing stakeholder dynamics. Comparative analyses across industries facing different types of wicked problems could also refine our understanding of how experimentation strategies interact with contextual complexity.

AI Declaration

AI tools were utilized exclusively for the purpose of language enhancement, including assistance with grammar, spelling, sentence structure, and clarity. The authors retain full responsibility for the accuracy, originality, and intellectual content of the final paper.

Ethical Declaration

This research did not require ethical clearance as it did not involve human participants, personal data, or any activities requiring formal review under institutional guidelines.

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