ThinkBox

The cumulative transitions of the deep tech entrepreneur

Introduction

This paper focuses on the journey of the scientist who becomes an entrepreneur, henceforth the deep tech entrepreneur. Deep tech entrepreneurs are founders of so-called deep tech companies or startups. This essay assumes that a deep tech startup is an organization driven by a scientific discovery that aims to produce technological innovations loaded with high uncertainty regarding results and impacts. Deep tech startups have specificities regarding business maturation time, capital intensity and uncertainty, which require new or adapted approaches compared with traditional startups (Basilio, Murray, & Frolund, 2022). Deep tech startups' specificities stem from their constitution and growth, suffering from the challenge of transitioning ecosystems – the transition from the knowledge ecosystem to the entrepreneurial ecosystem and from the latter to the innovation ecosystem. Therefore, to understand deep tech startups, we must focus on unveiling the actions of deep tech entrepreneurs in each of these ecosystems and the transitions between them. In this regard, this essay aims to explain the transitions of deep tech entrepreneurs between different ecosystems. Our argument is based on uncertainty, entrepreneurial judgment and ecosystem management.

The deep tech entrepreneur

Concerning the phenomenon we have investigated, we characterize scientists as the ones who make scientific discoveries. They publish articles and register patents to legitimize and protect their scientific discoveries. Still, focusing on our phenomenon of interest, entrepreneurs are the ones who create a new company by investing economic resources to produce and market goods and services. Deep tech entrepreneurs tend to be scientists and entrepreneurs simultaneously. In such cases, deep tech entrepreneurs are scientists who have made a scientific discovery and, despite publishing articles and patent registration, are interested in taking the innovation to society by offering products and services through a company (deep tech startup). Once this new company is established, the scientist-entrepreneurs will look for ways to expand the commercialization of their innovations in the market without abandoning the innovation principle and scientific orientation, as these are the engines and the distinctive nature of their companies.

The critical shift from scientist to entrepreneur is complex and nontrivial. However, there is one element that unites the persona of the scientist and entrepreneur: uncertainty. A deep tech

© Felipe Mendes Borini, Fábio José dos Santos, Leonardo Gomes and Silvia Tommaso. Published in *RAUSP Management Journal*. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence maybe seen at http://creativecommons.org/ licences/by/4.0/legalcode

This essay is based on the bibliographic and field research of the project in "Network Project – Pro Humanities" of CNPQ under process number 420767/2022-3.

RAUSP Management Journal
Vol. 59 No. 1, 2024
pp. 67-72
Emerald Publishing Limited
2531-0488
DOI 10.1108/RAUSP-02-2024-277

entrepreneur's central characteristic is the willingness to face and deal with uncertainties in multiple dimensions such as scientific, technological, marketing, resources and organizational. On the one hand, as scientists, they face and deal with the uncertainty of scientific discovery. On the other, as entrepreneurs, they face and deal with uncertainties in a product category and a market absence. Besides, because of the nature of their invention, deep tech startups are generally linked to radical innovation. Accordingly, an essential fact to explain the transition from scientist to entrepreneur, in many cases, is entrepreneurial judgment. Thus, the ability to structure entrepreneurial judgment governance may explain the deep tech startup growth.

The entrepreneurial judgment is a promising theoretical perspective to understand how entrepreneurs deal with uncertainty when deploying economic resources. Entrepreneurial judgment is a reasoned and subjective process in which individuals purposefully select a course of action related to sensing, seizing and transforming opportunities into valuable innovations under conditions of uncertainty (Klein, 2016; Foss & Klein, 2015). Gomes, Flechas, Facin, and Borini (2021) argue that individuals exercise judgment when they define a set of options, compare and evaluate them, imagine the potential consequences and undertake efforts to sense, seize and transform highly uncertain opportunities. Judgments are made by decision-makers who combine objective reality with subjective and tacit interpretations based on incomplete and sometimes incorrect knowledge, without right or wrong judgments ex ante (Gomes et al., 2024). Therefore, scientists become deep tech entrepreneurs when they exercise their entrepreneurial judgment.

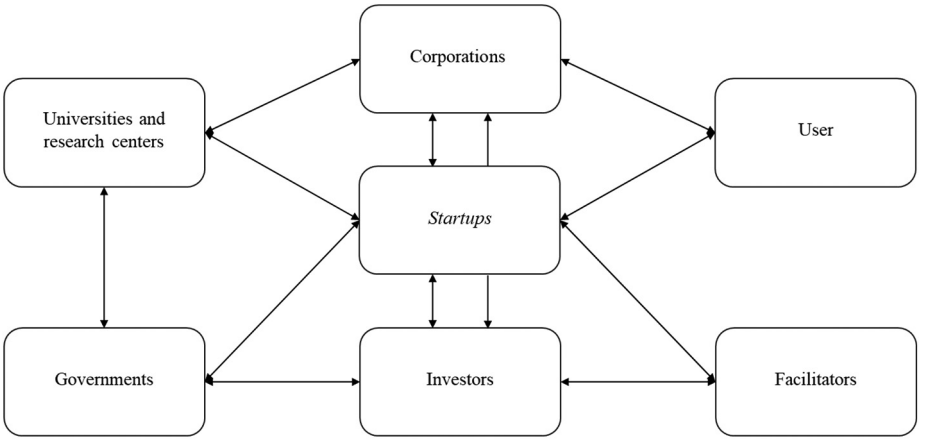
In turn, the deep tech entrepreneur can promote their startups and, perhaps, scale their innovation using entrepreneurial judgment governance (Gomes et al., 2024; Foss, Klein, & Bjørnskov, 2019). Governance is characterized by determining who has the mandate, the standards and guidelines for judgment, and when, why and how to exercise entrepreneurial judgment. Thus, entrepreneurial judgment governance happens when the founder grants the decision-making rights for the exercise of judgment to other company members or external stakeholders. Generally, when the startup is in a sustained growth phase, the entrepreneur alone cannot exercise all new judgments and needs to delegate them. To be precise, when they face the challenges of dealing with multiple economic and social actors from different ecosystems. In this sense, the role of the entrepreneur will be to orchestrate these actors for a value-creation proposition.

From understanding the deep tech entrepreneur persona and the primary role of entrepreneurial judgment, it is necessary to contextualize how entrepreneurs and startups act in each ecosystem.

The challenge of transitioning through different ecosystems

An ecosystem is an environment that brings together a set of interdependent and complementary actors (companies, governments, startups, suppliers, customers, universities, etc.) engaged toward a value proposition (Gomes et al., 2022; Thomas & Autio, 2020). In this sense, an ecosystem adds value as a business model when it allows actors to coordinate their dependence under similar rules but in different roles, and there is no need to establish customized contractual agreements with each actor to create and capture value (Jacobides, Cennamo, & Gawer, 2018; Adner, 2017). Therefore, an ecosystem is conceived as a transactional community of interacting actors in which everyone affects each other through their activities (Jacobides et al., 2018). Figure 1 illustrates the actors and relationships in the ecosystem in a simplified way. All actors are autonomous but interdependent (arrows) to generate a value proposition.

By analyzing the journey of deep tech entrepreneurs and their startups, we are interested in the interaction of three ecosystems: knowledge, entrepreneurial and innovation. These ecosystems are composed of the same actors, such as those depicted in Figure 1. However, both their value



Source: Adapted from La Tour *et al.* (2019)

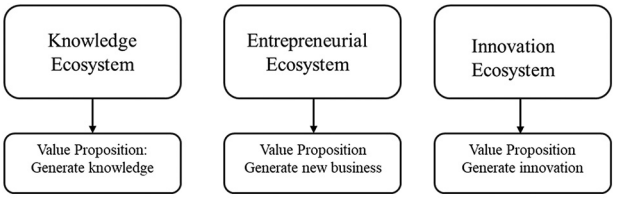
Figure 1. Ecosystems simplified schematization

proposition offer and their relationship's flow differ. Each ecosystem is unique in its value proposition offer (Autio & Thomas, 2021). Finally, each ecosystem usually has a different interdependence structure, with varying governance logics and particular forms of orchestration and leadership. Figure 2 illustrates the three types of ecosystems we are interested in discussing in this essay. For didactic purposes, Figure 2 shows three separate ecosystems. However, they strongly interact, and their boundaries are not so clear. The ecosystems do indeed overlap.

The value proposition is what distinguishes an ecosystem from others. The knowledge ecosystem value proposition is the generation of new knowledge. In general, the focal actors of this ecosystem are universities and research centers. The entrepreneurial ecosystem value proposition aims to generate new business. In general, the focal actors are the startup hubs, accelerators, incubators and startups. The innovation ecosystem value proposition is the creation of innovation. Corporations (digital or nondigital platforms) are predominantly the focal actors, but governments can also play this role.

Deep tech entrepreneurs face the challenge of navigating these different ecosystems in their entrepreneurial journey. In our research, we developed a model identifying three phases of the deep tech entrepreneur's journey and two transitions (Figure 3).

Phase 1 is the development of the research idea within the knowledge ecosystem. Deep tech entrepreneurs are still scientists and slightly intend to be entrepreneurs. They are often associated in some way with an educational or research institution. Backed by scientific methodology, they find themselves absorbed by the development of an uncertain idea. After consolidating the idea,



Source: The authors

Figure 2. Ecosystems characterization

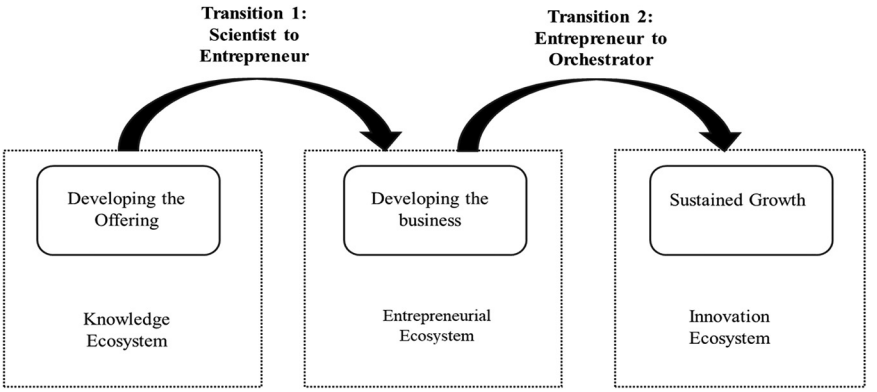


Figure 3.
Phases and transitions of the deep tech entrepreneur's journey

Source: The authors

the scientists carry out a whole stage to develop the offer prototype, tests and adjustments until reaching a minimum viable version. At this stage, they have already published scientific articles and developed patents (published or not) to legitimize their discoveries.

Between Phases 1 and 2, we have the first transition, characterized by the *transition from scientist to* entrepreneur. That is when scientists decide to become entrepreneurs. At this stage, scientists exercise their entrepreneurial judgment as they choose to invest economic resources to become deep tech entrepreneurs. In this phase, deep tech entrepreneurs are still more scientists than entrepreneurs. However, they deal with two different ecosystems: the knowledge and the entrepreneurial ecosystems. That is not something trivial; it requires a new race in the face of uncertainty. In this sense, deep tech entrepreneurs who have just overcome the uncertainty of scientific hypothesis (publishing articles, registering patents) launch themselves into a new uncertainty track: their market hypothesis. They transition from the knowledge ecosystem, which they are familiar with mastering its functioning, to a new ecosystem with a market hypothesis based on uncertainty. We highlight that transitioning from one ecosystem to another does not imply abandoning the previous ecosystem but accumulating another ecosystem journey.

Phase 2 is characterized by deep tech entrepreneurs' desire to take their offer to the market and society through their startups. That is when the startup is founded. The deep tech entrepreneurs structure their business model and position themselves within the entrepreneurial ecosystem through deep tech startups. In addition to facing the first sales challenges, deep tech entrepreneurs face all the challenges of managing the company. They must assemble and structure their business, develop a research team and connect with other companies, suppliers and customers. Incubator structures, accelerators, new business hubs or technology parks generally aid them in this phase. Despite all this effort to market the offer to society, owning an innovation is not necessarily accompanied directly by the offer of the leading innovation. In many cases, the core innovation is still undergoing testing and further enhancements to the market. There are cases in which the commercialization of the primary offering happens long after the company's foundation.

To overcome the obstacles inherent to this phase, deep tech entrepreneurs often market secondary offerings derived from the primary offering. In addition, at this stage, entrepreneurs still depend heavily on public funding to survive, usually accompanied by private financing (angel investors, investment funds, venture capital, etc.). Market orders vary from small orders, sometimes units, until they reach sustained volumes. What is common to all startups is that commercialization is gradual, only varying the gradual evolution time.

Entrepreneurs do not abandon the knowledge ecosystem despite moving away from it. They actually continue accumulating knowledge as the foundation of their business is based on original scientific discoveries and other developments. Businesses need to have multiple offerings and not depend on only one. Therefore, deep tech entrepreneurs must consistently improve their performance in both the knowledge and entrepreneurial ecosystems.

Between Phases 2 and 3, we have the second transition, characterized by the *transition from* entrepreneur *to the orchestrator*. The entrepreneurial judgment governance becomes crucial for the sustained growth of a startup. Entrepreneurs, ranging from small- or medium-sized companies to corporations, must transition from the entrepreneurial to the innovation ecosystem to expand their offer to the market. At this stage, the challenge is to actively position the company in the innovation ecosystem and get sponsorship for its growth through corporate investors or demand. Deep tech entrepreneurs face the challenge of making their startups become essential business players among prominent and consolidated actors in the market. It is a fragile moment as deep tech entrepreneurs realize they can no longer make all decisions related to scientific discoveries or business growth.

Phase 3 is called *sustained growth*. Deep tech entrepreneurs face significant challenges when trying to establish and sustain growth for their startups in the innovation ecosystem. At this stage, it becomes crucial to make effective decisions as the founder cannot achieve sustainable growth alone. Prospecting market and technological opportunities become complicated, and managerial demands increase exponentially. Therefore, it is necessary to establish connections with larger platforms to position the startup as a complementor or, in other cases, manage complementors in their own platform. As the company grows, it undergoes several changes in structure and process, with the business model being reviewed, and the strategy must be adapted to meet the demands of the growth phase.

Entrepreneurial judgment is crucial for the success of deep tech ventures. Entrepreneurs must delegate decision-making responsibilities about new markets and scientific ventures to specific team members. Failing to do so can limit the company's growth and make it hard to keep up with the market and scientific advancements. However, the challenge for deep tech entrepreneurs lies in managing the performance of those to whom they delegate the company's management, such as market, operations and scientific discovery decisions. As a result, deep tech entrepreneurs must act as orchestrators of multiple stakeholders to ensure the efficient functioning of their ventures.

Deep tech entrepreneurs can maintain their performance even when transitioning from one ecosystem to another. They remain connected to their original ecosystem by using entrepreneurial judgment and governance and continue to approve their team's decisions in different ecosystems. However, managing multiple ecosystems can be a burden for deep tech entrepreneurs. Despite this, they understand the importance of not abandoning any ecosystem connection.

Conclusion

This essay outlines a model for deep tech entrepreneurs' transitions between various ecosystems. Based on research conducted with deep tech entrepreneurs, we developed a framework that includes three phases and two transitions, which we call the "cumulative transition." This framework represents an entrepreneur's journey through three ecosystems: knowledge, entrepreneurial and innovation. The entrepreneur transitions from one ecosystem to another while also incorporating performance management. Importantly, transitioning from one ecosystem to another does not mean abandoning the former in favor of the latter. Instead, it involves accumulating management skills across all three ecosystems in the entrepreneurial journey.

We want to clarify that our concept and model are frameworks that are continuously in evolution. We aim to provide guidance to new research, whether it be an in-depth

exploration of each phase, ecosystem transitions or the dilemmas faced by entrepreneurial judgment. We welcome constructive criticism of our schematization in the interest of an accurate portrayal of the realities faced by deep tech entrepreneurs. From a managerial standpoint, our framework and concept encourage each deep tech entrepreneur and other actors within the ecosystem to engage in self-assessment in each phase and transition. We conclude by stating that uncertainty is inherent in any deep tech entrepreneur's journey.

Felipe Mendes Borini, Fábio José dos Santos, Leonardo Gomes and Silvia Tommaso

School of Economics, Business Administration and Accounting, University of São Paulo (FEA-USP), Sao Paulo, Brazil

References

Adner, R. (2017). Ecosystem as structure: an actionable construct for strategy. *Journal of Management*, *43*(1), 39–58. doi: https://doi.org/10.1177/0149206316678451.

Autio, E., & Thomas, L. D. (2021). Researching ecosystems in innovation contexts. *Innovation & Management Review*, *19*(1), 12–25. doi: https://doi.org/10.1108/INMR-08-2021-0151.

Basilio, O., Murray, F., & Frolund, L. (2022). What is 'deep tech', and what are deep tech ventures?, Working Paper, MIT Global Programs.

Foss, N. J., & Klein, P. G. (2015). Introduction to a forum on the judgment-based approach to entrepreneurship: accomplishments, challenges, new directions. *Journal of Institutional Economics*, *11*(3), 585–599. doi: https://doi.org/10.1017/S1744137415000168.

Foss, N. J., Klein, P. G., & Bjørnskov, C. (2019). The context of entrepreneurial judgment: organizations, markets, and institutions. *Journal of Management Studies*, *56*(6), 1197–1213. doi: https://doi.org/10.1111/joms.12428.

Gomes, L. A., Flechas, X. A., Facin, A. L. F., & Borini, F. M. (2021). Ecosystem management: past achievements and future promises. *Technological Forecasting and Social Change*, 171, 120950. doi: https://doi.org/10.1016/j.techfore.2021.120950.

Gomes, L. A., Facin, A. L. F., Leal, L. F., de Senzi Zancul, E., Salerno, M. S., & Borini, F. M. (2022). The emergence of the ecosystem management function in B2B firms. *Industrial Marketing Management*, *102*, 465–487. doi: https://doi.org/10.1016/j.indmarman.2021.12.015.

Gomes, L. A. D. V., Flechas, A., Facin, A. L. F., Borini, F. M., Stefani, B., & Leal, L. F. (2024). Entrepreneurial judgment governance adaptation for digital transformation in established firms. *Strategic Entrepreneurship Journal*, *18*(1). doi: https://doi.org/10.1002/sej.1490.

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, *39*(8), 2255–2276. doi: https://doi.org/10.1002/smj.2904.

Klein, P. G. (2016). Why entrepreneurs need firms, and the theory of the firm needs entrepreneurship theory. *Revista De Administração (São Paulo)*, *51*(3), 323–326. doi: https://doi.org/10.1016/j.rausp.2016.06.007.

Further reading

La Tour, A. D., Portincaso, M., Aré, L., Tallec, C., Blank, K., & Gourévitch, A. (2019). *The Dawn of the Deep Tech Ecosystem*, Boston: Boston Consulting Group Boston, MA, Disponível em: https://hello-tomorrow.org/the-dawn-of-the-deep-tech-ecosystem/