Editorial: Five principles for overcoming obstacles in deep-tech startup journeys

Deep-tech startups are specific types of entrepreneurial ventures that are based on disruptive technologies that are capital-intensive, research-intensive and require lengthy development processes. These characteristics make deep-tech startups more difficult to finance and commercialize than other kinds of entrepreneurial ventures. As such, failure rates are particularly high, which precludes certain opportunities to make societal and commercial impact. From our experiences with deep-tech startups, we believe they often fail due lack of tailored support, too few valuable connections and poor funding. Overall, today's innovation systems are not very well designed for deep-tech startups.

In this editorial, we argue that it is essential for innovation systems to be tailor-made for the needs of deep-tech startups that can make far-reaching and important differences. Our argument comes in the form of five guiding principles to help tech accelerators, science parks and other innovation-based systems and programs' fast-track deep-tech startups and help them secure the support they need to explore their full potential. Drawing on our experience working with both innovation systems and aspiring deep-tech startups in Scandinavia, we introduce and explain the five principles in what follows.

(1) *Supporting funds through long and expensive development and testing stages.* This means having the right financing in place to develop and then commercialize the technology. Unfortunately, accessing the necessary financial resources can be difficult for deep-tech startups due to the length and uncertainty of the process. To ensure a successful support system, it is important to focus on the tech and ideas with the highest potential instead of judgment on how "safe" projects are in terms of calculable return on investment which would continue be biased toward shallow tech at the stage where a sketch and a budget can be obtained. It is also important to separate systems that fund high-potential entrepreneurial ideas that create real novelty from systems that support unemployed who start non-entrepreneurial businesses. Both might be important but should not be conflated. Financial support at the early stages for deep tech can be done through providing start grants, investments and provide access to seed capital.

(2) *Mobilizing necessary human capital and expertise.* Securing the right human capital is also essential for the success of a deep-tech startup. A good innovation system must be able to mobilize and connect deep-tech startups with the most fitting professional expertise that can join the startup and work through the experimentation, commercialization and industrialization phases. This expertise will be crucial in helping to drive the innovation process, from the initial development of the technology to its ultimate full-scale deployment in the marketplace. The team should include professionals with a variety of experience, including those with technical, commercial and legal backgrounds. By carefully selecting the right individuals for the job, the startup can ensure that their deep-tech venture has the best chance of success. Furthermore, the team should be connected to a larger network of

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professionals who can provide additional guidance, resources and expertise as the project progresses. This network can help to move the innovation forward and ensure that it is deployed effectively. By connecting deep-tech startups with the most fitting professional expertise, a good innovation system can help to bring the most promising technologies to life.

(3) *Assembling a network of complementary partners in the specific industry or sector.* Financing and human capital are both essential components of an effective innovation system, but it is, moreover, as important to seek out the right networks and partners that can assist in the industrialization process to get a fair chance of reaching the full potential of the project. It is important to early in the process to fully understand that creating a successful deep-tech startup requires a great deal of planning and preparation far beyond what one or a few tech entrepreneurs and engineers can achieve in isolation. It is therefore critical for the startup to have access to a wide network of complementary knowledge, door openers and resources beyond the single firm and the focal innovation system. A good network makes it possible to access a breadth and depth of resources, know-how and know-who knowledge as well as good testbeds for instant feedback early in the journey. Our findings have shown that only with the right and supportive network in place, deep-tech startups can be successful in developing, commercializing and scaling production of their technology to have an impact and benefit society. Despite the tendency to connect startups with local partners, all the best fitted network partners are unlikely to be found locally and perhaps not even nationally. Instead, it is important to help deep-tech startups with great potential to access a likewise great network of partners spanning across geographical borders early in the process. To facilitate this network building, we believe that the innovation systems are far better organized by technological specialization (e.g. robotics, genetics, etc.) rather than by geographical area.

(4) *Reducing information asymmetry in the financing journey.* It is important to make sure that venture capitalists have access to the right information and have the knowledge to properly assess the value of the technology. Private venture capital can be difficult to obtain for deep-tech startups, especially when the assets they are offering have low security values, much uncertainty and high risk. This is due to the information asymmetry in the financing process, making it hard for venture capitalists to assess the potential and value of the deep technology. Reducing this asymmetry will ensure that the financing process is more accessible, and that the startup can secure the funding they need to properly go forward and commercialize their technology. Based on our experience we would argue that domain-specific innovation systems are far better positioned to help explain the startup's potential to would-be investors then generalist innovation systems. This is because deep tech typically requires a very deep understanding of the underlying technology such as advanced engineering, data science, or other very specialized skills.

(5) *Cultivating an entrepreneurial mindset.* An entrepreneurial deep-tech startup requires an equally entrepreneurial minded innovation system. That means a proactive innovation system prioritizes potential over risks and strives for proactiveness by embracing courage and disruptive solutions. An entrepreneurial-minded innovation system must be willing to challenge the status quo and accept the possibility of uncertain outcomes and numerous failures. It must, moreover, be focused on the greater potential of radical disruption of markets, designs and human behavior rather than settling for short-term returns on investment from shallow-tech innovation projects, even though these may be easier to plan and budget for. It is only through

this entrepreneurial mindset that we can unlock the true potential of the deep-tech startup's creativity and ambition.

These five principles can help innovation systems support deep-tech startups and cultivate better chances for success, while providing resources to overcome obstacles, explore their full entrepreneurial potential and offer benefits to commercial markets and society.

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