



HOW CAN WE STIMULATE AND SUPPORT ACADEMIC ENTREPRENEURSHIP IN THE DIGITAL SCIENCES?

A guide for academic researchers and their universities

INTRODUCTION

The aim of this guide is to provide inspiration on how to foster academic entrepreneurship, particularly within the digital science.

It is aimed both at researchers who are interested in engaging in entrepreneurial activities and at universities, university managers and innovation support staff who wish to encourage and support academic entrepreneurship.

The guide presents 8 tips – 4 aimed at researchers, and 4 aimed at university management and staff working with innovation and entrepreneurship.

Though the guide focuses on academic entrepreneurship within the digital sciences, most of the points are relevant for other fields of science also.

ACADEMIC ENTREPRENEURSHIP IS ABOUT ADVANCING THE USE AND IMPACT OF YOUR RESEARCH

Academic entrepreneurship is not just about starting a company. Rather, it includes all activities that contribute to the translation and commercialization of knowledge and technology derived from scientific research. This includes, but is not limited to:

- ▶ Technology transfer (protecting and licensing IP rights) and academic spin-out companies
- ▶ Contract research and consultancy
- ▶ Joint R&D collaboration with industry, public sector & other research users
- ▶ Informal collaboration and knowledge exchange with research users and stakeholders
- ▶ Other forms of collaborations, e.g. participating on advisory board or joint training efforts.

Both formal and informal activities are crucial for knowledge exchange and translation.

Some forms of entrepreneurial activity may pave the way to other forms. For example: researchers who have experience collaborating with industry are more likely to later start a company.

ACADEMIC ENTREPRENEURSHIP CAN **BENEFIT SCIENTISTS' RESEARCH AND CAREER BY...**

- ▶ **Augmenting the societal impact of your research:** By helping to increase the dissemination of your research, explore possible applications, and scale inventions, entrepreneurship can offers a means of increasing the impact of your research on industry and society.
- ▶ **Increasing your visibility** to research funders, policymakers and stakeholders. This can open doors to new collaborations and research funding.
- ▶ **Providing access to research funding**, including direct funding, for example in the form of financial compensation for contract research or "soft funding" to explore and develop the commercial potential of an invention or technology.
- ▶ **Providing access to research ideas and resources outside academia**, including for instance proprietary knowledge, data, research equipment, infrastructure etc.
- ▶ **Providing opportunities for supporting education** (for instance cases and guest lecturers) and **access to collaborative projects, internships and job placements for students.**
- ▶ **Fostering entrepreneurial learning & mindset:** entrepreneurial experience improves your ability to spot new opportunities for collaboration and impact through entrepreneurship.
- ▶ **Attract new talent** i.e. entrepreneurially-minded students and early career researchers.

ACADEMIC ENTREPRENEURSHIP AND ACADEMIC PERFORMANCE ARE **COMPLEMENTARY, NOT COMPETING**

- ▶ Many academic studies have examined how collaborating with industry, starting a research-based spinout, or engaging in other forms of entrepreneurial activities affects researchers' scientific performance, that is, how much they publish and how highly cited their publications are. These studies provide strong evidence that academic entrepreneurship and scientific performance go hand in hand. In other words, entrepreneurial researchers also tend to have strong academic performance, as indicated by a high number of publications and a high number of citations to their published work. This is in part because external collaborators tend to seek out academic researchers who are already accomplished within their field. Also, well-established researchers also tend to have more resources and experience with which to engage in entrepreneurial activities.
- ▶ But entrepreneurial activity has also been shown to have a direct, positive impact on research. For instance, studies show that scientists who started a company subsequently produce more highly cited research. This is because collaboration and other forms of entrepreneurship enable academics to gain new knowledge and insights, which in turn can inspire new research paths and projects. Working with the application and commercialization of academic research can thus enhance future research through idea development and novel directions of research.

WHAT IS SPECIAL ABOUT ACADEMIC ENTREPRENEURSHIP IN THE **DIGITAL SCIENCES**?

- ▶ Digital technologies are so-called **“critical technologies”** that play a crucial role in innovation and are vital for economic security. This creates opportunities but also responsibility for digital entrepreneurs to reflect on the ethical and societal impact of the technologies they develop.
- ▶ Digital technologies can have many types of commercial applications. There are at least **four roles** that digital technologies can play in an entrepreneurial setting (Steininger [2019](#)): They can be a **facilitator** that takes over and often increases the efficiency of certain activities. They can serve as a **mediator**, that is, a mechanism that connects a company to its customers. They can be an **outcome** in the form of a physical or digital stand-alone product or service based on digital technology. Finally, they can be **ubiquitous** in cases where digital technologies are central to all elements of a company’s business model & operations.

- ▶ Digital technologies have certain **entrepreneurial advantages**. For instance, barriers to starting a firm are often lower than for e.g. hardware technologies. Barriers to entry are relatively low, because starting a company based on digital technology does not require a substantial investment of capital. Moreover, the path from the lab to market can be short: lead times and iteration cycles are short, as digital technologies are relatively easy to prototype, edit and re-program. They can also be easily scaled, which can provide access to customers, investors and resources on a global scale.
- ▶ But digital technologies are also associated with **challenges** for entrepreneurs. The high velocity of change entails high levels of market unpredictability and competition. This also means that companies based on digital technologies face not just technological uncertainty, but also market uncertainty, especially if there are many competing technologies or technologies are easy to imitate.
- ▶ Finally, classic technology transfer models based on e.g. patent protection are often not relevant for digital sciences and technologies.

8 TIPS

FOR RESEARCHERS

#1 KNOW *WHY* YOU WANT TO ENGAGE

#2 THINK ABOUT *HOW* YOU WANT TO ENGAGE

#3 BUILD ENTREPRENEURIAL SKILLS AND NETWORKS

#4 DON'T GO IT ALONE: ENTREPRENEURSHIP IS A TEAM SPORT

FOR UNIVERSITIES

#1 STRENGTHEN INCENTIVES FOR ENTREPRENEURSHIP

#2 HELP RESEARCHERS REAP BENEFITS FOR THEIR RESEARCH

#3 HELP RESEARCHERS BUILD SKILLS AND NETWORKS

#4 DEVELOP AN ENTREPRENEURIAL CULTURE AND ORGANIZATION

FOR RESEARCHERS

#1 KNOW WHY YOU WANT TO ENGAGE

- ▶ Whether you're new to entrepreneurship, or experienced, **consider the 'why'**: what aims & desired outcomes are you hoping to achieve?
- ▶ If you're just starting out, you may not know yet. But as you build experience with entrepreneurship, take some time to reflect on how you can align your entrepreneurial activities with your research and career aims. The clearer you are on what results you're aiming for, the better prepared you are to choose the right types of entrepreneurial activities for you to engage in, and to design your efforts to support your end goal.
- ▶ Research shows that academics' motivations for partaking in entrepreneurial activities can influence the outcomes they experience from these activities. For instance, when researchers are motivated to engage in entrepreneurship in order to obtain benefits for their research, it is more likely that they will achieve such benefits. This is because they will plan their entrepreneurial activities accordingly. Where you can, **design your entrepreneurial activities** to support what you want to achieve; for instance, if you want to strengthen your research activities, ensure your entrepreneurial activities are aligned with your research.

WHAT CAN MOTIVATE RESEARCHERS TO ENGAGE IN ENTREPRENEURIAL ACTIVITIES?

- ▶ To strengthen their **visibility and recognition** from stakeholders and/or academic peers.
- ▶ To access **funding, knowledge, infrastructure and other resources** to pursue research aims.
- ▶ To demonstrate or increase the **societal impact** of their research or test its practical applications.
- ▶ To strengthen their **teaching activities** – e.g. through access to cases and guest lecturers.
- ▶ In some cases: for **personal financial gain**. Most researchers are not strongly motivated by financial gains. However, research shows that fair royalty sharing policies can strengthen researchers' incentives to disclose inventions and start new ventures, and that a steady stream of revenues from such activities is crucial for researchers to maintain their entrepreneurial activities.
- ▶ For faculty members: opportunities to create **funding & job opportunities for early career researchers**. Senior academics can be incentivized to engage in entrepreneurship by the opportunity to create possibilities for Ph.D. students, postdocs and Masters' students.
- ▶ For early career researchers in particular, entrepreneurship can offer a possibility to explore and craft **alternative career paths** outside academia.

FOR UNIVERSITIES

#1 STRENGTHEN RESEARCHERS' ENTREPRENEURIAL INCENTIVES

- ▶ Engaging in entrepreneurial activities is essentially a discretionary activity, dependent on the willingness of the individual researcher to invest time and resources. Researchers' motivations and attitudes towards entrepreneurship are the most important in determining whether and how researchers will engage in entrepreneurial activities.
- ▶ There is **no "one size fits all" approach** to strengthening researcher incentives. Researchers' motivations to engage in academic entrepreneurship vary according to their personal preferences, prior entrepreneurial experience and academic rank. Moreover, motivations change over time, especially as researchers build entrepreneurial experience. For instance, researchers with patenting experience are more responsive to both financial incentives to engage in further patenting, but also to incentives related to their opportunities for career progression. Check in regularly with researchers to assess what motivations are important to them.
- ▶ Design appropriate **"bundles" of incentives**: Academic researchers respond not to single incentives but to "bundles" of incentives that balance financial gains (either funding for their research or personal income, calling for fair principles for royalty sharing and equity in spin-outs etc.) with the freedom to continue to pursue their academic research and recognition for their entrepreneurial activity in their performance assessments and career progression.

- ▶ Remember that different incentives matter for **faculty members & for early career researchers**. For instance, early career researchers may be particularly concerned about how entrepreneurship might aid or hinder their academic career, and they may also be interested in entrepreneurship as a way to explore alternative career paths outside academia. Established faculty are generally less responsive to incentives, but as they gain experience with entrepreneurship, for instance patenting, they are nonetheless more likely to be concerned about personal financial gains and effects on their career.
- ▶ Motivations and attitudes matter, but so do obstacles to entrepreneurship. Research shows that even if researchers are positively inclined towards entrepreneurship, this is no guarantee that they will actually engage in entrepreneurial activities. Therefore, identify **perceived and experienced barriers** to academic entrepreneurship among your researchers and help them mitigate these barriers.
- ▶ Give particular attention to **PIs**. They often play a key role in initiating and undertaking entrepreneurial activities, and they can be very effective gatekeepers between their group and research users, for instance companies interested in collaboration.
- ▶ Consider how to **unleash untapped potential**. Female researchers are less likely to engage in entrepreneurial activities, but a supportive environment can increase female participation in entrepreneurship. Moreover, foreign-born staff and “returnees” (who have spent a period of time abroad) can be more likely to engage in entrepreneurship but may require help to get started.

FOR RESEARCHERS

#2 THINK ABOUT *HOW YOU WANT TO ENGAGE*

- ▶ There are many different ways in which you can approach academic entrepreneurship. What works for you depends on, for instance, your personal preferences, your academic field and your motivation to engage in entrepreneurial activities.
- ▶ Scientific fields also differ in the entrepreneurial opportunities they offer; for instance, some fields have a strong tradition for consulting, while others hold more opportunities to engage in patenting.
- ▶ Remember that **there are many ways in which you can engage** in entrepreneurial activities. Think about which approaches best suit your aims, but also your personal preferences, your field of expertise, and your level of experience in engaging with research users. For instance:
 - ▶ If you want to learn from users and stakeholders, consider pursuing opportunities for research collaboration, contract research or consulting.
 - ▶ If you want to work more directly with applications of your research, consider consulting or exploring possibilities for licensing an IP-protected invention or starting a spin-out.

#2 HELP RESEARCHERS REAP BENEFITS FOR THEIR RESEARCH

- ▶ Entrepreneurial activities should be designed to help researchers increase the likelihood of succeeding. Provide **guidance and mentoring** to help researchers identify entrepreneurial opportunities and to ensure that their entrepreneurial activities are closely linked to their research aims. For instance, offer advice on entrepreneurial opportunities in the development of research grant applications that have to document economic and societal impacts. Focus attention on large research centers and projects that may not have their own resources to support entrepreneurship.
- ▶ Encourage researchers to **maintain and develop their academic research** alongside their entrepreneurial activities (unless they are actively looking to craft a career path outside academia) – otherwise, they are less likely to reap benefits for their research. Support a wide range of entrepreneurial activities, acknowledge entrepreneurial achievements, and provide attractive career paths (e.g. by placing more value on entrepreneurial experience in hiring and promotion).
- ▶ Support researchers in striking an **appropriate balance** between research and entrepreneurial activities during a period of intense engagement – and **“keep the door open”**: provide flexibility for researchers after a period of intense entrepreneurial activity or upon re-entry into academia after working in a spin-out, for instance by allowing additional time for research and helping early career researchers mitigate the effects of a higher PhD age than peers with similar academic achievements.

#3 BUILD ENTREPRENEURIAL SKILLS AND NETWORKS

- ▶ Entrepreneurship requires a **wide range of entrepreneurial skills**, from more formalized skills such as business- and project management to fuzzy skills such as entrepreneurship awareness, opportunity recognition and creativity. Investing in entrepreneurial skills is valuable to entrepreneurs and non-entrepreneurs. Engage in deliberate practice to build specific skills. Identify a skill you seek to improve, understand its core elements, and draft a plan that allows you to repeatedly practice each element through numerous iterations.
- ▶ Build insight and skills through **courses and training**. Contact your university for suggestions.
- ▶ **Extend your network** to industry and other relevant stakeholders by participating in conferences and events – or through mentoring programs. A stronger network helps build your entrepreneurial skills, identify potential co-founders, and increase your ability to recognize potential opportunities for the technologies you master. Ask your university for suggestions for how to get started.
- ▶ **Prior experience working in or with the private sector** increases the likelihood of engaging in entrepreneurial activities ▶ Consider options for collaborating with users of your research. Particularly if you're an early career researcher, you may even want to spend a period of time or part of your working time at another organization, for instance in connection with an industrial postdoc position or as part of a collaborative research project.

FOR UNIVERSITIES

#3 HELP RESEARCHERS BUILD SKILLS AND NETWORKS

- ▶ **Offer entrepreneurial training and education** (or connect researchers to external offerings) to help researchers develop entrepreneurial insight and skills and encourage them to develop their entrepreneurial ideas. Focus on researchers who show an active interest in entrepreneurship.
- ▶ **Matchmaking and networking opportunities.** Connect researchers to potential student collaborators and experienced entrepreneurs (as possible mentors, co-founders, investors or the like) through internal programs (e.g. mentoring or co-founder programs) and events (e.g. investor meet-ups, business plan competitions etc.) or external programs and events.
- ▶ **Help researchers explore possible roles in spin-outs.** There are many ways in which academic inventors can be involved, and many ways in which to assemble a strong team around a spin-out. Offer advice for researchers on how to identify and select among the options. Universities that produce the most spin-outs tend to have formal strategies for the use of “surrogate entrepreneurs”, that is, experienced entrepreneurs who help found and lead academic spin-outs.
- ▶ **Promote and support sector mobility** (e.g. employee exchanges, part-time positions, and re-entry).
- ▶ **Offer direct support** for entrepreneurs, incl. early-stage soft funding and entrepreneurial advice.

FOR RESEARCHERS

#4 DON'T GO IT ALONE: ENTREPRENEURSHIP IS A TEAM SPORT

- ▶ Academic entrepreneurship requires **a blend of technological knowledge and entrepreneurial skills** – whether you're collaborating with industry or other research users, or starting a new company.
- ▶ Entrepreneurship is **a team sport**, and a single individual does not need to perfect all of these. However, having a strong knowledge of each skill improves communication and team dynamics.
- ▶ Especially if you're looking to start a company, building a strong team which includes not only scientific expertise but also commercial skills and networks is crucial: **look for experienced entrepreneurs, faculty members, early career researchers or students** who could help co-found or invest in your company. Contact your university's innovation support staff for help to connect with relevant profiles through mentoring and matchmaking services.
- ▶ Researchers can play **many different roles** in a spin-out, so seek advice on which kind of role might suit you and the company. Considering which role you would like to play in the company, and how involved you want to be, especially if you want to maintain your academic career.

ACADEMIC ENTREPRENEURS CAN PLAY MANY DIFFERENT ROLES IN A START-UP

- ▶ Sometimes people think that academic entrepreneurs have to be “all in” to start a company (i.e. the lone entrepreneur), or leave the development of the company entirely to experienced entrepreneurs willing to step in. But, in reality, researchers can play many different roles in the companies they start.
- ▶ In fact, the team behind a research-based start-up can consist of any thinkable combination of faculty entrepreneurs, early career researchers (like PhD students or postdocs), students (including business students), and experienced start-up and industry professionals.
- ▶ It’s important that the academic researcher remains involved, though: Research-based spinouts perform better (that is, they grow more and are more profitable) when scientists with insight into the research behind the company remain involved in the company, but it is lead by an experienced entrepreneur, sometimes referred to as a “surrogate” entrepreneur.
- ▶ Moreover, taking a limited role in the start-up provides researchers with more opportunities to maintain their university employment and research activities, and therefore reap possible benefits for their research, if this is something they would like to do.

#4 DEVELOP AN ENTREPRENEURIAL CULTURE & ORGANIZATION

- ▶ **Make entrepreneurship a strategic management priority.** Clear strategies and policies for academic entrepreneurship signal that it is valued and supported. Formulate strategies at both the university and department level. It's also important to ensure that strategies help researchers and departments ensure alignment and complementarities between the three missions of research, teaching and entrepreneurship. Similarly, university strategies must seek to align university, TTO and researcher aims by clarifying the intended aims and outcomes for the university's entrepreneurial activities: for instance, to what extent is value placed on simply starting new firms and building experience with this vs. focusing on potential high-growth firms? The strategy should also clearly set out what results and outcomes the entrepreneurial activities of the institution will be assessed upon. In addition, strategies must also recognize and consider opportunities and challenges in the local and regional ecosystem in which the university is embedded, rather than try to emulate successes of other universities. Finally, ensure that strategies are supported by policies that address key issues e.g. incentive structures and career paths for entrepreneurial academics, organizational support for a wide range of entrepreneurial activities, fair practices regarding royalty sharing and equity distribution etc.
- ▶ **Build a culture which is supportive of academic entrepreneurship.** Researchers' entrepreneurial activity is influenced by their local environment. This includes whether entrepreneurship is encouraged, supported, rewarded, as well as whether researchers' peers engage in entrepreneurship. The university and departments should recognize and reward entrepreneurial role models.

- ▶ **Build an effective organization to support entrepreneurship.** This includes having an effective **central Technology Transfer Office (TTO), Knowledge Transfer Office (KTO) and/or entrepreneurial hub** with clear aims and sufficient critical mass and resources. In entrepreneurially successful universities, it also includes **decentralized support for entrepreneurship**, e.g. persons or units located close to research environments, who can provide field-specific advice, have strong ties to professionals and investors within a particular field or sector, provide support for a wide range of entrepreneurial activities, scout for entrepreneurial opportunities and can build strong ties to local researchers.

For staff providing both centralized and decentralized support, having market and business skills are not surprisingly vital. But it is also highly valuable if they have **research insight and capabilities**. TTOs/KTOs who staff possess research capabilities tend to have better entrepreneurial outcomes. Such capabilities help staff build trust with researchers and align the goals between TTOs and researchers, mitigating any conflicts that may arise. It's moreover important to ensure that it is clear to researchers which staff members have the primary role of helping and advising them, and which have the primary role of negotiating (e.g. royalty sharing or equity) with them on behalf of the institution.

Finally, the university should develop an effective set of **structured programs** that can establish a fertile breeding ground for entrepreneurship, for instance by helping entrepreneurial researchers build skills and networks or helping start-ups reduce market and technological risk. Structured programs include: Education and training in entrepreneurship and technology commercialization; Mentoring programs and matchmaking services that provide access to relevant actors in ecosystem; Accelerator and incubator programs; Business plan competitions; Access to funding (e.g. proof of concept funding); etc.

HOW CAN TRAINING AND EDUCATION SUPPORT ACADEMIC ENTREPRENEURSHIP?

- ▶ The "science" of entrepreneurship can be taught (e.g. business development processes, management skills) through formal training and education, whereas the "art" of Entrepreneurship (e.g. creativity, drive, innovative thinking) cannot be directly trained. This means that an entrepreneurial mindset and skills related to the Art of Entrepreneurship can be developed through training and education. Developing the entrepreneurial mindset can unlock latent entrepreneurial capabilities that would otherwise lay dormant.
- ▶ Developing entrepreneurial skills through education and training is an important way in which to nurturing academic entrepreneurship. This includes encouraging faculty to engage with entrepreneurship workshops and seminars offered such as those offered by accelerators, incubators, and other central ecosystem actors.
- ▶ It should however not be expected that all researchers will develop similar skills and interests from such programs. As such, training programs should primarily be focused on those showing curiosity and a positive attitude towards entrepreneurship.

ABOUT THE GUIDE

This guide was developed by DIKU, DTU Compute and DTU Entrepreneurship as part of the project “Fostering academic entrepreneurship”, funded by DIREC.

Skal projektteamet bag guiden nævnes ved navn?

The guide is primarily based on insights from a review of the scientific literature on academic entrepreneurship. To read this guide, please scan the QR code on the right.

The team behind the guide would like to thank the participants at a workshop held at the University of Copenhagen in November 2023 as well as the participants of a session at the D3A conference in Nyborg in February 2024 for their valuable inputs to the development of this guide.

Tak dem som har bidraget med cases og eventuelt andre input.

Hvis nogen vil have mere info om guiden, hvem skal de kontakte?

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Scan this code to access the review of the literature on academic entrepreneurship that this guide is based on.