

## **Navigating on the Edge - Exploring the Entrepreneurial Function of Postdocs**

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Entrepreneurship Education is being promoted as a remedy for the innovation gap at higher education institutions and to the employment bottleneck early-career researchers face when aiming for a tenured position in academia. However, postdoctoral researchers (postdocs) encounter institutional boundaries when moving in the interspace between academia and entrepreneurship. This research builds on deep empirical insights from a series of Entrepreneurship Education training programmes and is guided by the question, how postdocs navigate on the edge between academia and entrepreneurship. A functional perspective on entrepreneurship aims at explaining the boundary-crossing process by identifying four distinct activities: problematisation, enrolment, narration and scaffolding. Through studying the learning and activities that take place in the “border zone” between academia and entrepreneurship, we scrutinise the entrepreneurial function of postdocs.

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## 1. Introduction

Universities and research institutions with their highly skilled and specialised academic staff have the capability to be a powerhouse of innovation. However, particularly pre-tenure researchers are currently far off from exploiting their full potential (Haeussler & Colyvas, 2011; Åstebro, Bazzazian, & Braguinsky, 2012). Since innovation is the driving force of social change and economic development alike, the innovation gap impacts society as a whole. Thus, investigating the conditions of innovation are equally relevant to policy makers and the research community alike (Grimaldi, Kenney, Siegel, & Wright, 2011).

At the same time, early-career researchers in non-tenured positions are affected by an uncertain work environment due to project-based employment, competition for research funding and a lack of opportunities for career development (Herschberg et al., 2018). Praised as a “twenty-first century skill” entrepreneurial acting and thinking has been promoted at higher education institutions (Nabi et al., 2018; Obschonka et al., 2017) as a valuable competence for the academic as well as non-academic labour market, and hence a promising career perspective for “precarious postdocs”. As a consequence, Entrepreneurship Education (EE) courses can be seen as intervention opening a gateway to alternative career paths and a possible remedy for the innovation gap in academia.

This research is guided by the question, how postdoctoral researchers (postdocs) navigate on the edge between academia and entrepreneurship while transcending the boundary between these two domains. A functional perspective on entrepreneurship aims at explaining innovation by looking at activities and processes rather than organisational structures or employment categories. Hence, by studying the activities and learning that takes place in the “border zone” (Kerosuo, 2001) between academia and entrepreneurship, we scrutinise the professional development of postdocs and identify their function in the early stages of the entrepreneurial process.

The purpose of this paper is to shed light on entrepreneurial acting and thinking of postdocs in the institutional context of academia. As pointed out by Foss et al. (2019) contemporary entrepreneurship literature has largely neglected the context, in which aspiring innovators operate. Hence, investigating the entrepreneurial function of researchers in an advanced academic setting intends to fill this research gap. We contribute to understanding entrepreneurship as a function within the specific context of an advanced academic settings. Furthermore, we generate valuable insights into the opportunities as well as constraints postdocs face while navigating on the edge between academia and entrepreneurship.

This study builds on deep empirical insights from a series of educational training programmes offered through the “postdocs to innovators” network (p2i network), an initiative consisting of five leading European higher education institutions (HEI) and three global enterprises. The shared goal of the initiative is to support and strengthen the innovation mindset in postdoctoral researchers and encourage not just commercial activities but to apply an entrepreneurial mindset and skill set to various sectors (industry, public sector, third sector etc.). This paper is based on 20 interviews with postdocs who have actively engaged in entrepreneurial learning programmes offered by the p2i network. In-depth interviews with recent alumni of EE courses offered through the p2i network provide grounds for the identification of four activities postdocs undertake while navigating at the interface between academia and entrepreneurship. The four activities identified are closely linked to

particular needs of postdocs on the edge and therefore provide valuable implications for the design of future EE programmes. For a holistic enquiry into the function of entrepreneurship and the antecedents of entrepreneurial activity in a postdoctoral academic setting, we review previously unconnected findings from educational psychology, sociology, management studies, entrepreneurship literature, science and technology studies as well as governmental reports. The paper establishes a framework for understanding the context of postdoctoral researchers undertaking entrepreneurial activities and revisits entrepreneurship literature on the notion of entrepreneurial function. After a brief section on the research design and methodology, the analysis models the entrepreneurial function of postdocs as four activities of boundary-crossing. Eventually, we discuss how the results of the analysis relate to the research question and advance current entrepreneurship literature.

## 2. Theoretical Framework

### 2.1. The Postdoc Situation

Project-based postdoctoral employment at higher education institutions in Europe has proliferated in the last decades (Herschberg et al., 2018; Stephan & Ma, 2005). Due to an increase in non-tenured postdoctoral positions, early-career researchers face an employment bottleneck in the competition for a small number of tenured positions (Science Europe Working Group on Research Careers, 2016). These postdocs are affected by an uncertain work environment due to short-term contracts, competition for research funding and a lack of opportunities for career development (Herschberg et al., 2018). Fewer postdocs get tenured positions, and about 80 to 95%<sup>1</sup> eventually move into roles in industry, entrepreneurship and the public sector (Sauermaun & Roach, 2016; Powell, 2015). Praised as a “twenty-first century skill” entrepreneurial acting and thinking is being promoted at higher education institutions (Nabi et al., 2018; Obschonka et al., 2017) as a valuable competence for the academic as well as non-academic labour market, and hence a promising career perspective for “precarious postdocs”.

However, postdocs moving in the interspace between academia and entrepreneurship, are confronted with conflicting demands of two distinct and historically grown institutions. These two domains have hardly had any touching points until what Etzkowitz and Leydesdorff (Etzkowitz, 1998, 2003 & 2004; Etzkowitz & Leydesdorff, 2000) call the “second revolution” in the 1990s, in which universities started to add economic and social development to their agenda. The institutional boundary between academia and entrepreneurship both separates and connects by “being simultaneously part of both sides” (Kerosuo, 2001). Hence, the boundary between these two domains enables and at the same time constrains entrepreneurial activities of postdocs. Instead of being stable constructions, organisational boundaries, as those of a university, are constantly recreated as source for sense making and identity constitution. Santos and Eisenhardt (2005) define organisational boundaries as the demarcation between the organisation and its environment and distinguish four boundary conceptions: efficiency, power, competence, and identity. In particular the identity boundary - an unconscious mindset of understanding who they are as researchers and postdocs and who they are not - plays a central role in the context of entrepreneurial postdocs. Research activities follow a specific “logic of identity” that shapes how things are

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<sup>1</sup> Varying by country and discipline.

done (Santos and Eisenhardt, 2005, p. 492) in academia and thereby may conflict with the logic of entrepreneurial activity. Postdocs are on the edge between two systems with distinct languages, registers, cultural issues and local worlds of meaning (Katz & Shotter, 1996, p. 929). In everyday actions, the boundaries between the two systems become tangible when a person encounters a problem or dilemma as an expression of those boundaries (Kerosuo, 2001).

However, it is also at these boundaries that extensive learning takes place. Professional development is indispensable, since “crossing boundaries involves encountering difference, entering into territory in which we are unfamiliar and, to some significant extent therefore, unqualified” (Suchman, 1993, p. 25). Encounters in what Kerosuo (2001, p. 53) calls the “border zone” lead to a “purposeful ground for learning and development.” Kerosuo (2004) suggests boundary-crossing as a promising unit of analysis for future studies of boundaries and boundary-crossing in interaction and discourse. In order to understand the processes of learning and development that may be at play at this interface, we draw on activity-theoretical research on professional learning and change in the context of professional development and workplace interventions. This body of research highlights the importance of boundary-crossing (Kerosuo & Engeström, 2003), relational expertise (Edwards, 2011; Hofmann & Vermunt, 2017), and emergent scaffolding (Rainio & Hofmann, 2015) as elaborated on in the analysis section.

## **2.2. The Entrepreneurial Function**

As part of their job description researchers are encouraged to explore and go beyond of what has been regarded as established knowledge. Novel techniques, technologies and artefacts developed during research activities can be introduced to the market as products and services. Hence, early-career researchers who have become highly skilled experts in their particular fields and undertake cutting-edge research can be regarded as being surrounded by entrepreneurial opportunities to transfer research into innovation.

In this study we do not look at entrepreneurship as an occupational category or market structure but rather as an activity, process or function (Klein, 2008, p. 177). While previous literature focuses on outcome and abstract functions of entrepreneurship, antecedents and context of entrepreneurial activity have been neglected (Foss et al., 2019). This research is an attempt to answer Foss et al.'s (ibid.) call to investigate the entrepreneurial function in its specific contexts. We regard the entrepreneurial function of postdocs as a series of activities to cross the institutional boundary between academia and entrepreneurship and a professional learning process that takes place simultaneously. The functional perspective on entrepreneurship aims at explaining innovation, while focusing on the professional development and behaviour of the individual innovator. Various functional concepts of entrepreneurship attempt to describe the interaction between an entrepreneur and his or her environment - in particular in relation to opportunities. The two main interpretations of the entrepreneurial function are the “opportunity discovery” and the “opportunity creation” approach.

Austrian economist Israel M. Kirzner's (1973, 1979, 1997) functional perspective of entrepreneurship as “alertness to profit opportunities” is one of the most influential interpretations. Kirzner regards opportunities as pre-existing in the market and independent of the observer. An opportunity as understood by Kirzner is an unexploited potential, an error in the market. The function of the entrepreneur as defined by Kirzner is to spot these errors

and exploit them for profit. Several authors (Eckhardt and Shane, 2003; Shane, 2000, 2003; Shane and Venkataraman, 2000; Venkataraman, 1997) have expanded the discovery approach by highlighting the individual-opportunity nexus. The so called nexus perspective is based on the discovery perspective and describes entrepreneurship as discovery, evaluation and exploitation. Although opportunities are still regarded as objective phenomena, their discovery is seen as a subjective process (Korsgaard, 2011, p. 662).

However, the discovery view has been criticised for overestimating agency while neglecting social and relational aspects as well as mistakenly assuming a linear entrepreneurial process (see Korsgaard, 2009 for a review of the critique). An alternative approach models entrepreneurship as creation of opportunities. This perspective advocates that the entrepreneurial process itself creates the opportunity. Concepts such as effectuation (Sarasvathy, 2001), enactment (Gartner, Carter & Hills 2003), creativity (Dimov, 2007) and investment (Foss & Klein, 2008) have been deployed to grasp entrepreneurial processes. These accounts regards the entrepreneurial function as “an active creation of the circumstances; a form of world making” (Korsgaard, 2011, p. 664). Foss and Klein (2008, p. 28) propose to treat opportunities as a “latent construct” to avoid ontological discussions, whether opportunities are created, imagined or exist independently in the world ready to be discovered. Instead, they suggest to focus on the entrepreneurial actions evoked by latent opportunities (Klein, 2008, p. 187).

In order to look at entrepreneurial action without ignoring the concept of opportunity, Casson and Wadeson’s notion of projects (Casson & Wadeson, 2007) proves beneficial. They define a project as a stock of resources “committed to particular use over a considerable amount of time.” These resources can be time, labour, office space, equipment and others. Opportunities are seen as “a potentially profitable but hitherto unexploited project.” Hence, realising a project through entrepreneurial action is probing a potential opportunity. For the purpose of this research, we conceptualise the entrepreneurial efforts of postdocs and the antecedents of starting a business - their investment of time, labour and equipment in certain activities - as ongoing projects.

However, in conventional accounts of the creation view, relational aspects have been sidelined. Korsgaard (2011) contributes to developing the creation view by drawing on the Actor-Network Theory (ANT). ANT has its origins in Latour and Woolgar’s (1986) research on scientific practice and the processes of knowledge production but was later applied to other areas of practice, such as technology and innovation. ANT suggests “that the identity of any object, human, non-human, abstract etc. is the result of the relations into which it enters” (Korsgaard, 2011, p. 664). This insight is derived from semiotics, which postulates that “words derive their meaning from their relations to other words and therefore have no inherent qualities nor derive meaning from an extra-linguistic reality” (ibd.). Korsgaard (2011, p. 665) explains how through the lense of ANT “social entities such as organizations, entrepreneurs and markets are seen as effects created in relational exchanges.” An ontology of becoming (Chia, 1995; Steyaert, 2007) is central to the ANT approach. The ANT typical combination of semiotic insights and “attention to constitutive force of everyday practice” applied to the field of entrepreneurship allows to model a process in which entities are constantly collectively reproduced. Hence, the focus of analysis shifts to the processes of becoming rather than on characteristics of social entities. ANT assumes social and material elements, as well as human and non-human actors as part of the network of any social situation. ANT treats them symmetrically in analysis as illustrated by this famous quote by Latour (1999, p. 179): “You are different with the gun in your hand; the gun is different with you holding it. You are

another subject because you hold the gun; the gun is another object because it has entered into a relationship with you." According to this view, "agency is not the privilege of reflexive humans but of networks of human and non-human elements" (Korsgaard, 2011, p. 665). Hence, even an entrepreneurial undertaking is a collective, constructive effort.

Anne Edwards (2005, 2010, 2011) describes this form of distributed agency as relational agency, which she defines as "the capacity for working with others to strengthen purposeful responses to complex problems" (Edwards, 2011, p. 34). Edwards suggests a two stage process within a constant dynamic: expanding the task being worked on by taking the interpretations and skills of other professionals into account and aligning one's own responses with the responses of others. Based on the idea of relational agency, Edwards developed the notion of relational expertise. Edwards (2010, p. 33) argues that when professionals work across practice boundaries, they negotiate with other specialist practitioners and clients/customers about tasks and ways of accomplishing them. Edwards (ibid.) points out two features of collaboration, which may be observed: "First practitioners come to recognise the specialist expertise that are distributed across practices and settings and second they bring to bear both their core expertise and an additional form of expertise." Edwards calls this additional form relational expertise. Relational expertise involve expanding the understanding of the work problem and "the ability to attune one's responses to the enhanced interpretation with those being made by other professionals." We use the concept of relation expertise to capture relational aspects of the entrepreneurial function.

### 3. Research Design and Methods

The analysis of this paper is based on 20 semi-structured in-depth interviews with former participants of multi-day Entrepreneurship Education (EE) courses for postdocs offered through a network consisting of five leading European universities and three industry partners (p2i). The interviewed postdocs had successfully applied for fully-funded participation in the programmes. Hence, even before selecting interview partners from the pool of participants, a self-selection has taken place based on prior interest in entrepreneurship. The interviewees have been sampled theoretically (Glaser & Strauss, 1967) from the pool of p2i alumni taking gender, academic discipline, location and type of affiliated organisation, and prior exposure to entrepreneurship into account. The aim was to interview a selection of postdocs as diverse as possible. The interviewees - that we synonymously call entrepreneurial postdocs - are at different stages of their entrepreneurial journey. Some of them have participated in multiple EE interventions, others just returned from their first course. Among the 20 interviewed alumni are four postdocs employed by industry partners of the network. As a follow-up to the attendance of an EE course, stakeholders within the network conducted the interviews with alumni between July and September 2018. Each interviewer started out with the same interview guide but asked additional follow-up questions. The interview guide was developed with the goal in mind to evaluate the programmes offered by the p2i network as well as to understand the professional learning process of the participants. The themes explored in this paper result from a combination of an inductive and deductive approach of coding the data; hence codes are drawn from theory as well as emerged from the transcribed interviews themselves. Since the interviewed postdocs are still in a rather early-stage of their entrepreneurial projects, it was not possible to capture the whole innovation process. Hence, the four activities identified in the analysis model the process of crossing the boundary from academia to entrepreneurship. Using the concept of entrepreneurial function as a collection

of boundary-crossing activities guides our enquiry in understanding what early-stage researchers need to do in order to turn research into innovation.

## 4. Analysis

The process of crossing the boundary from academia to entrepreneurship has been repeatedly described as translation, transformation or transfer by the interviewees themselves. Interviewee D3 describes her motivation behind trying to launch a company as the wish to “*translate* the scientific expertise and the technical skills” she has into “real-life applications.” D1 remembers how he started thinking about some interesting business aspects of his research and whether there is a chance “to *transfer* the research into a more practical ground.” He started to attend entrepreneurship programmes with the aim to learn about “the *transfer* of knowledge and how to concretise a research project into a more business-oriented project and planning.” D18 describes how he is building up a team of students “that will work on projects within the faculty of medicine and, basically, *translates* the research project into potential start-ups or at least more translational research.” D16 defines his personal goal as “just finding that *translation*” that takes “the idea out of its scientific context into a more marketable aspect. On the other hand, he is worried that his project “gets lost in the scientific *translation*.” He is concerned that a too detailed account of the technical background will diminish “the appeal of the idea.” In the analysis of the twenty interviews, we highlight four activities of crossing the boundary between academia and entrepreneurship while translating, transferring and transforming an academic into an entrepreneurial project. These activities are based on four main themes, which emerged from the analysis of the interview material. We deem these four activities useful to grasp the entrepreneurial function of postdocs, because it is their ability to successfully move between the academic and the entrepreneurial domain that allows them to become innovators. These four activities do not necessarily take place chronologically. They have no fixed order, might overlap or even happen simultaneously.

### 4.1. Problematisation: Redefining a Problem and its Solution

“So entrepreneurship, for me, means a way to define problems and work to solve them in an innovative way,” interviewee D18 summarises. When asked for her understanding of entrepreneurship, D17 responds: “Entrepreneurship means innovation, thinking differently and maybe even looking at problems in different ways and finding solutions to problems as well.” Before considering to develop a product based on their previous research, postdocs have usually already invested several years of their time and labour to build up expertise in their specific field. While their academic research had been guided by a research question, this question does not necessarily correspond to a real-world issue of potential customers. In this section, we are looking at how entrepreneurial postdocs formulate problems they want to solve through innovation as well as their changed perception on how to approach these problems.

D18 describes how he learned during p2i seminars “to define problems much more precisely” while before he “started out with general goals and general problems.” Taking part in two p2i seminars helped him to “narrow down and to define very specific questions.” He concludes that a redefinition of problems is not only applicable to entrepreneurial ventures but could be as relevant for “academia, in whatever environment; just a way to work in a more innovative direction than usual.” D18 emphasises the importance “to start with the



problem and try to solve it, and not the other way around, particularly if you have a problem that can have a great impact in the world [...] it could be a question that is scientifically important or it could be from industrial importance or it could be from a different point of view. But it is to start with an important problem and find the best way to solve it.” D8 however adds that it is not just about “having a nice idea, having a nice solution to a problem, but really being able to understand the value of it, being able to understand that what you initially thought the value of it is, may not be the way you end up going.” D8’s reference to value, can be interpreted as the subjective value that a potential customer assigns to the solution. The process of “understanding the value” is thus a negotiation process with other actors involved in the problematisation.

Part of defining a problem that needs to be solved is pinning down people who are actually affected by this problem and assigning them into roles that were proposed for them in the postdocs' definition of the problem as well as the proposed solution. D10's story resembles this process. He developed a synthetic biology kit to be used as classroom material by teachers and students in schools. D10 is planning to test his kit in a school to see if the roles he assigned to the schools, students and teachers are accepted and performed by them. He explains:

*“So, basically, I just want to try it out. If that works, that is great. If it doesn’t, so. Anyway, it will work. If schools are not interested, for instance, and there are internal reasons like the curriculum, which is very rigid and you cannot put things in it, and say teachers are overwhelmed with whatever duties they have, I will definitely be able to get publicity from this project. That is the minimal goal for me: get the publicity and, on top of that, get to see the people who may be interested [...].”*

From observing the students’ and teachers’ reactions to the kit, D10 wants to adapt the kit or develop something entirely different they might be interested in. Hence, the interaction of the entrepreneurial postdoc with other actors are crucial for learning about their potential customers and co-creating the definition of the problem as well as its solution.

However, actors may as well reject the problematisation presented to them. D2 recalls how the farmers she was targeting with a sensor she had developed as part of a research project declined the role proposed to them: “So I am just checking my network, my market – who are my customers? What do they want? So my whole idea came out of the project, and I recognised, by talking to the farmers and talking to the consultant people that, what this project had written, is not really true.” Despite the fact that the project had gained funding with a proposal assigning a specific problem to farmers, D2 discovered a different reality when speaking to them. “So the project was a little overblown to get funding, and it was funded. But then, when I took that idea to put it in as a motivation, a reason why we are doing this, I recognised that the farmers would say, ‘Yes, that’s nice, but we don’t have a problem with that’.” She realised that a lot of details in her initial project description did not fit with reality. D2 remembers how she came to realise that she needs to approach farmers and ask them: “‘What is the reality? What do you do every single day? How can I help you? What is your problem? What are your biggest issues and how can these be solved?’”

Not only when it comes to defining a problem postdocs encounter irritation caused by boundary-crossing, entrepreneurial thinking also challenges their understanding of the solutions to this problems. D20 summarises the conflict between academic and entrepreneurial logic as follows:

*“As academics, you want to have results, but you want these results to be accurate; to be verified. For example, you want to have simulation, you want to have experiments, you want to have theory, but, in industry, once you have that, you don’t care about having some details [...]. You want to have something developed, so you have the financial part, you have the technology part and you have the communication part. You have to have all of this together to make it work, not just the technological part. This is interesting because I heard that a lot of scientists, who wanted to develop their idea, they usually put a lot of effort into the technological part, but, when you want to sell your product, there is a lot of work to be done on the financial part and the communication part, and to discover all of these new areas.”*

D20 reflects on how it is not enough to develop a flawless technology but how this technology needs to be woven into a network of resources and actors to become a product. D19 reflects on how even in her role as a postdoctoral researcher she started “to consider [...] how useful something could be or applied something could be.” She elaborates: “If we have an idea, we could really make a product out of this; these things that you sometimes don’t think, you just look for a paper if something is significant, you deliver and you try to publish it. But there is the point of view that you want more people to know.”

When moving from postdoc to entrepreneurship, D3 considers it “a massive mindset change [...] to start thinking in terms of what is actually the minimal required thing needed to get the job done quickly.” She describes how she came to understand that in entrepreneurship “the focus was achieving milestones within a given period of time rather than achieving milestones of the best quality possible but taking an indefinite amount of time.” For herself, she wants “to find a balance between the two. You need to ensure quality - it doesn’t have to be perfect; it has to be good quality – but it has to be within a reasonable amount of time.” Also, D19 came to the understanding that one should be more risk taking, “more adventurous when you are really persuaded by the idea, and not wait until something is perfect, like in the lab.” She realised that the earlier you test your idea in the market, the less likely you will lose time moving down an unsuccessful path. In other words, the sooner opportunities are probed the less resources are wasted in an entrepreneurial project. “You cannot wait until you have the perfect product or the perfect idea because maybe you have invested one year of your life in this business and then it didn’t work. So, when you have half an idea, start it,” D19 calls to action.

D12 describes how he can transfer problem-based thinking back to his academic occupation. “I have identified so many other problems in the system. I think, if I were to write research grants, I can write really practical research grants that solve problems for the biomedical industry or healthcare industry. Just because of the entrepreneurship process, I was able to go out and actually talk with the people.” This shows that crossing the boundary between the domains of academia and entrepreneurship is not a one-directional process but allows postdocs to move back and forth between worlds.

During problematisation postdocs attempt to make themselves and their research indispensable to the solution of a problem they have defined. The definition of the problem is a co-creative process with the aim to lock other actors in the particular roles assigned to them. However, the actors involved in the problematisation process might as well reject or transform these roles. This often leads to an adjustment of the questions and problem statements that have initially guided the postdocs’ research. When it comes to finding a

solution to the respective problems, the interviewed postdocs also encounter a tension between the priorities set by academia and entrepreneurship. In academic research, accuracy has the highest priority irrespectively of the time needed to get to a perfect result. Entrepreneurial solutions on the other hand need to be tested against reality as soon as they are functional, in order to not waste resources in the development process of a product. Eventually, the accounts of postdocs suggest that crossing from academia to entrepreneurship is a reciprocal process, in which entrepreneurial acting and thinking feeds back into their research practice.

#### **4.2. Enrolment: Building a Network and Drawing from Relational Expertise**

*“I actually have an idea; it is part of my PhD project, what I want to do. The goal is to start up as soon as possible. For that, there are a number of things I need to do which involve going and doing customer research, validating the market, getting all this data that I needed to convince investors, and then apply for grants and fellowships to be able to get into this area.”*

D12 describes how he needs to assemble a network of investors and customers that support his idea before “starting up”. Besides potential customers, other actors play an essential role in the venture creation process. Entrepreneurial postdocs also need to gather and enroll allies, supporters, experts and superiors. D15 describes how he came to understand that “we cannot do everything by one person, ourselves.” Instead, he realised that he needed “someone who can cover what we don’t know yet in order to compliment the expertise of the team.” D15 elaborates:

*“So, when you are a scientist, you are used to do things on your own, you are used to, ‘OK, when I can’t do something, I just have to learn it and adopt it, and it works.’ Especially when it comes to the business side, you think, ‘Oh, it’s numbers. I’m good at numbers.’ You think, ‘It’s just selling things. I know how to sell because I know what the chemical does.’ But, actually, to sell the idea in a way that other people understand you, it is really tough, because, as a scientist, you just start with, ‘The chemical does this, this, this, and therefore it can do something special.’”*

He explains how he reached his limits in fulfilling all the various tasks connected to the development and marketing of his product. He understood that drawing from other people’s expertise would allow him to succeed. The initial feeling of “having to know and do it all by yourself” appears to be quite common among entrepreneurial postdocs. Also D1 recaps: “Before my attitude was, ‘OK, you could do everything, or you should be strong in all aspects.’ But, actually, interacting with mentors and after going through different sessions or lectures, I noticed that you do not need to pick up all activities, and there will be specialists for all other activities as well. For example, skills in marketing, public interaction or engagement.”

Anne Edwards (2011, p. 33) uses the concept of “relational expertise” to describe the “confident engagement with the knowledge that underpins one’s own specialist practice, as well as a capacity to recognise and respond to what others might offer in local systems of distributed expertise.” D18 sees the strength of EE programmes for early-career scientists in offering the chance to “find people able to help you and to guide you to the right people and the right information.” “You just find people who will instantly connect with you and bring

you two or three steps further,” D15 retrieves from his experience attending a p2i seminar. D2 however describes how she first had to learn how to draw from relational expertise and took this as a mission with her to a p2i seminar in Paris: “My biggest problem was that I never got the menu of how you do it. I just stumbled on things, and you learn by mistakes. I had a lot of partners who, in the past, were very much interested, but, because I learnt from mistakes, I lost them.” She explains that when she attended the seminar in Paris, she thought to herself: “OK, I have this information, I have these guys who want to work with me. What do I do now?” She remembers that before taking part in her first p2i seminar in Cambridge, she had trouble locking people into supporting her entrepreneurial project: “I would meet people and I would set up a Skype meeting, and we would talk [...]. I would meet let’s say 50 people who could be useful for me, and we would say ‘Yeah, let’s do it,’ and then we just don’t. So I never got to this level.” D2 reflects on her engaging in networking during a seminar in Cambridge:

*“So it really does work. And also the people who were with me there, there was one girl who was into brain surgery, and she told me, ‘I have a person who might help you with sensors.’ Bring it on. I will talk with all of them. I am not making a selection anymore. I will talk to all of them because I recognise the more people you talk to, there is always somebody who knows somebody who knows somebody.”*

When she returned from the seminar in Cambridge, she felt comfortable enough “to pull people by the sleeves.” D12 reports how it was particularly relevant to him to connect with peers: “I found out that there are other people who are interested in entrepreneurial journeys within my own university. From the university, what sort of support is available, which is a lot, actually. This was one of the great aspects. I found out which people I can reach out to when I have a problem.” Also D1 explains how he and his colleagues were able to provide each other with information: “So I shared with my colleagues and other people about, for example, this Berliner Startup Stipendium.” The same colleagues also helped D1 to extend his network during a p2i seminar: “They were all very supportive, helping me to find out the people during the events.” A postdoc employed at an industry partner met colleagues from his company at the event: “Now that the course has finished, they are still helping me to put together a proposal for the fellowship application, and I am in contact with them.” D3 reflects how enrolling relevant actors in his project allowed him to materialise his idea: “Once that idea was developed, that Venture Creation Weekend allowed me to find a cofounder; it allowed me to access the right sort of mentorship and expertise, which actually helped us build a team and start building the idea and the technology that was required.”

Eventually, postdoctoral researchers also have to deal with the fact that superiors at their workplace may not be supportive of their entrepreneurial undertakings. D5 remarks how she felt guilty towards her “boss”:

*“When I started, when she gave me the position, I made a promise that I would not pick this up, and she sees that I am doing this. I wouldn’t say she is trying to block it, but she is not really eager. For example, I went for the course, and she didn’t ask a single question. It is like I came from holidays. If I went on holiday, she would ask me, ‘How was your holiday?’ She didn’t ask anything. That is why I feel guilty.”*

The interviews with entrepreneurial postdocs show that in addition to co-creating potential customers, entrepreneurial postdocs also need to assemble a network of people that help them materialise their projects beyond the boundaries of their organisations by providing expertise and support. This network built through enrolment of peers, colleagues, professionals from other fields as well as superiors at their workplace. Not doing everything by themselves but drawing from relational expertise is a skill postdocs actively need to learn. In the interviews, postdocs recount how EE seminars offered them a platform for sourcing expertise from other people as well as building networks of mutual support.

### **4.3. Narration: Storytelling and Sense-Making**

“I didn’t need theory. I needed an exact example,” Interviewee D2 states. She recalls how she was looking for stories of other entrepreneurs that helped her to identify the next steps. The interviews show that storytelling plays an essential role in the boundary-crossing process. D6 explains how she identified her own learning needs by listening to other people’s stories during a p2i seminar. She considers it a source of inspiration to see how other entrepreneurs are “taking their project even that one step further” that she would not have thought of. To illustrate this observation, she gives the example of colleague’s project, who developed a device for early detection of heart attacks. Seeing that somebody with the same background, another biologist, cooperated with engineers to develop a prototype of the device, encouraged D6 “to not just stop at the concept and send it to a middleman to do the rest.” D19’s goal of participating in an EE seminar was to understand “what it really means for people who have made this break or change from research to being an entrepreneur and having their own company and ideas.” She wanted to know “how they made this step.” Even more important than working on an own business idea was for her “to see these people, [...] to get to know other people who may have similar ideas or they may have similar questions or maybe went through this step and now they are on the other side of the bridge.”

When interviewees recount stories of other participants, mentors or lecturers, they frequently emphasise that the experience belongs to “people like me.” While interviewees repeatedly mention that receiving feedback from people with diverse academic backgrounds and perspectives helped them to advance their projects, they emphasised the importance of seeing people who are PhD students or postdocs going down the same path as they do. For D1 it was impressive to get to know people with experience in academia who know how it is to “transform from research into industry.” He stresses that at “normal international conferences” he doesn’t have the opportunity to meet that kind of people. “Finding examples of people [...] who are not just computer scientists or people who can be entrepreneurial just say in a small office at home” was an incentive for D19, a biologist, to take part in the course. D11 points out that “the most important thing for [him] was to talk to people who had very similar mindsets, who were able to think about different opportunities that they may have in addition to their academic research.” To see that their ideas were not very different from his own gave him confidence “to pursuing those in the future, if I ever want to pursue those.”

In particular, coping with fears, uncertainties, challenges and risk - “failure and hard times” as one interviewee calls it - is a central topic in the stories retold by the interviewees. While one interview partner names as most inspiring moment of an EE seminar, when the founder of a coffee startup showed photos of a fire breaking out in his office, a second interview partner clearly remembers the story of another founder who felt miserable when he still lived with his girlfriend’s parents after she broke up with him. D11 argues that “it was

good to see that the reality can be very different. It is very similar to, when you go on Facebook, you only see happy faces, but you don't know what is behind. I guess, when you see all those success stories, people may also feel intimidated [...]. But I guess everyone should understand that failure is a part of that and we actually learn more when we fail, that is for sure." D2 recalls how she talked to a mentor during a EE seminar and admitted to him that she was worried to lose the ground under her feet. "You are scared," she remembers his response, "Do you know what, I was made bankrupt three times. The first time it happens it is like, 'Ooh,' but then you recognise that is not such a big deal." In order to assess his response, she wanted to know from him whether he had a family to take care of. When he responded "Yes, I am a single parent with three daughters," D2 remembers that she had no arguments left and thought "OK, I'll do it." For interviewee D16 it was comforting to hear that others experience the same challenges. For these entrepreneurial postdocs facing their fears through the stories of others, allows them the conclusion that even failure "is not the end of the world" (D4).

D8 sees the value of stories in learning "how they went about it, some of the obstacles they hit and how they overcame those, and just the perseverance and how they fit in with their life." She was particularly impressed by "how they believe in it and keep going no matter what obstacles are thrown in their way and no matter if struggling with potential funding, struggling with getting their tools out to market, but still persevering and coming up with solutions to overcome these." D10 stressed that besides analysing "failed history," it was essential for him to look into "perseverance and positivity - how did you work on that?" D17 elaborates on the aspect of perseverance:

*"For me, the main message was about your attitude and mindset. So hearing people's stories and listening to the people on the panel, it was really clear that people who have this success and are entrepreneurial are people who are very adaptable and approach problem-solving and thinking in a different way, especially turning negative things or what you might perceive as negative things into positive [...]. For me, that has been the most important message, and that is something which I feel has really helped me since going to the event."*

D2 describes how a positive attitude played out practically in her life: "Two days ago I found out that there is a huge problem in the market for me. There is a new prototype that has come out by some other company, and I was looking at it for two hours and I figured out, 'Actually, it is not bad. It just proves that I have a market, and what they do, I can do better.' Somehow, it just made me optimistic, and I see the challenge and I am just, 'Let's go for it.'"

Even though most of the interviews took place several months after participating in the last EE course, interviewees were still able to recount stories in detail during the interviews. They highlight various functions of stories for their own entrepreneurial ventures. Stories of "people like them" - fellow scientists or postdocs - were highlighted as having specific value. On the one hand, these stories serve as a sense-making tool by helping to understand why postdocs become innovators. On the other hand, they provide the postdoc with a road map by identifying potential next steps in their entrepreneurial projects. The interviews suggest that stories also play a dominant role in building up perseverance and confidence in order to overcome challenges while crossing the boundary from academia to entrepreneurship.

#### 4.4. Stabilisation: Scaffolding and Cultivating Entrepreneurial Practice

As a fourth activity we identified the stabilisation of entrepreneurial practice. This happened throughout the events but also through subsequent scaffolding efforts by the interviewed postdocs. EE seminars themselves play a crucial role as a training ground for entrepreneurial practice. “I mainly went to see how entrepreneurs operate and gain those skills as much as I could,” D9 a postdoc employed at an industry partner remembers. During the event she engaged in “peer networking” and exercised how to approach other people and explain her ideas. “So now I feel I know better how to approach discussing or networking around business or entrepreneurial ideas rather than social networking. So I am a bit more focused and I think I know how to approach networking for the purpose of business,” she concludes. D7 came to understand during the seminar that she was taking part in a “training” rather than an “informative workshop.” She realised: “if you are trying to develop people, it takes a lot of coaching. But my impression, when we first joined was that it was informative, hence my surprise.”

While D7 appears to be rather overwhelmed by the active engagement that was asked from her, D12 described it as one of his highlights: “So they almost put you in the pool and then you learn to swim straight away. You make a few mistakes there and then but that is how it is done in real life as well.” He also stresses the importance of “physical presence.” While there is “a lot of support out there electronically” and “you can go on YouTube and learn almost anything,” he points out that “it is the actual interaction with people, that is very important. That is how most of the things start.” D12 admits that he hated to networking. “I think a lot of scientists don’t really like to talk publicly. So, before that point, I never stood up and gave a presentation or anything as such, apart from my own work. But there were so many networking opportunities, [...] you knew these people slightly, so it gave you a comfortable environment.” Also, D10 noticed how he is getting more and more confident “in networking and talking to people” with every single event he is attending. D20 is trying to explain where the confidence is coming from:

*“I think there is a link between having a better idea about the industrial world and to be more confident, because, once you know this world better, [...] you better understand why, for example, when we have meetings with industries, they behave like this; they are driven more by financial aspects, whereas scientists are more driven by science and to be accurate and things like this. So you are more confident in a lot of ways because you better understand how they think, and then you understand how they behave and then you understand how you have to behave with them. This is all linked.”*

D2 takes away from the EE seminar she attended in Paris that she does not know “the five steps” in her head but instead she has built up a rather intangible form of knowledge. “I know when I have a step finished, I know what my next step will be,” she explains. D9 shares his impression that the event he attended was very intense but rewarding due to the fast progress he made: “it is more like a marathon but for entrepreneurship, because it is very, very long, but it was quite nice for me to experience this way of doing things, like a hackathon type of mentality.” D15 explains: “The course was really, for me, starting at 4 o’clock in the morning, preparing the session, then going to sleep at about 2 o’clock, I still had more energy than before because I wanted to do it, it was very clear and I just saw an opportunity to work

with all these really, really great and appreciating people.” D11 calls the immersion during the seminar the “push element” and resumes that for future programmes it would be essential “to let people know that this is also one of the important things about these events, even before they attend [...] This is happening because we want people to interact with each other. So, I guess, if people had this ideology before certain events or if the Postdoc Office made sure that people understood that, I think that would be even more beneficial.”

Besides being a practice ground for entrepreneurial thinking and acting, entrepreneurial courses themselves provide the opportunity to hold on and dedicate time and energy to advance a business idea. Interviewee D12 highlights “the full dedication for a couple of days” as a major reason for the success of these programmes. The challenge of balancing a full-time occupation and dedicating oneself to developing a venture has been highlighted by several interviewees. D8, who is working in a technical role for an industry partner, explains: “A lot of what I am struggling with is essentially having the time to do my normal job and then working on new ideas in addition to that.” D9 admits that due to a limitation on time she is able to spend in advancing her idea, she “would choose such an accelerated pace as the last one, simply because it would be harder to sacrifice longer periods of time than a weekend.” However, the meaning of the event itself goes beyond its ability to provide time and space for entrepreneurial projects. D15 explains the impact the event had on him:

*“Two or three weeks ago, when I really felt very stressed and I didn’t want to start over again and it was just a moment where I really was down, and I just closed my eyes and thought back to the Ignite programme and I really got the spirit back. There was something very strange in the air there, when you just feel a lot of energy is moving through your body and you really want to do this.”*

He describes it as “a memory which gives me a lot of energy and pushes me through hard times.” D12 even speaks of the EE course he attended in Berlin as “almost like a spiritual experience.” Several participants reported how their venture ideas manifested as they received affirmation from peers and mentors. D2 explains: “What I did gain was confidence in what I am doing, and I gained the feedback. So, even though I may have had doubts about what I am doing, I talked to the people who are experts in the field who told me, ‘Do you know what, that is a good idea. You should chase it.’ That kind of gives you encouragement: ‘OK, I am not wasting my life on something that doesn’t exist.” D3 outlines how attending a seminar gave her the confidence to advance her own entrepreneurial project: “To actually see those people pursue those ideas, and now I am actually starting to see some of them come to light, has been extremely inspiring. It has also been very confidence-building because these are my peers who have been able to achieve that. That kind of builds the confidence that you can do it too.”

While the participants were able to train certain skills during the programme, they also realised that they needed more scaffolds at a local level. D12 stresses the importance of a “follow-up”. He shares his impression that when “you attend one course, you slip off the radar because you have done it; they don’t want one person to be, I suppose, exploiting all the opportunities.” To counter that, he suggests that there should be local events running “not just the talks but more practical stuff.” He proposes a meetup format “where people who are interested in entrepreneurship just turn up: they present their ideas, if they have any



problems, they get hands-on support. It is almost like a pool from where you can get help whenever you need. That would have been something that could have been very useful.”

D11 acknowledged that another issue was that “it is not very easy to establish such deep connections” that remain active even after the seminar has finished. He regards establishing an entrepreneurial postdoc society at each university as a potential solution. D11 is already active in a postdoc society in Cambridge and wants to motivate postdocs of other universities to organise themselves: “The main reason why I went to Berlin was actually to talk to postdocs, PhD students and also professors in Berlin and to encourage them to establish a similar society like ours, as part of this p2i programme.” D2 reports how a fellow participant started a meetup group in Berlin after returning full of inspiration from a seminar in Paris. D12, a postdoc from Glasgow describes how he wanted “to get the help from Cambridge postdocs to start it [a postdoc society] up in Glasgow, but it never materialised, partly due to the lack of time.” He contemplates about the need for a postdoc “to drive it,” somebody who “takes charge.” However, he also acknowledges that “Glasgow has come a long way forward; three years ago, there was nobody, and now it is something that people talk about.”

D17, a postdoc employed at an industry partner, mentions how she regularly attended events of the postdoc society in Cambridge. Attending these events encouraged her “to take more opportunities” and push herself out of her comfort zone, which eventually inspired her to take on a representative role in her company. A Postdoc from Innsbruck believes that a society should be created at her university as well. However, she is still uncertain about her own role in this undertaking: “So this idea that this should be done, maybe sometimes it is you who is the one who has to start this point.”

Even though the interviewees described how they were able to take advantage of the EE courses as a practice ground for skills necessary to advance their entrepreneurial projects, they also expressed their concern to be excluded from repeated participation. Hence, several interviewees regarded local postdoc society as a way to keep up continuity in their entrepreneurial practice as well as maintain their network even when returning to the academic domain. Hence, scaffolds at the home institutions of the interviewed postdocs allow for reciprocal boundary-crossing even after they return from EE courses.

## 5. Discussion

In the analysis of the interview material, we identified four activities of boundary-crossing. Although, the labels for the four activities are inspired by the four moments of translation in Callon’s Sociology of Translation (1986), the process identified in this paper is specific to the boundary-crossing of postdocs, who move in between the domains of academia and entrepreneurship. The process outlined in this paper does not cover the creation of a startup as an organisational form or the business activities of a company owner. Instead, this account attempts to capture the translation, transformation and transfer process of an academic project into an entrepreneurial project.

We have started off this enquiry with the question how postdocs navigate on the edge between academia and entrepreneurship. The research questions guided the exploration of the entrepreneurial function of postdocs in the specific context of higher education institutions. The concept of boundary-crossing has been helpful in grasping the entrepreneurial function of postdocs. We disassembled the boundary-crossing process into four activities, which do not appear in any fixed chronological order. We deem these activities

to be crucial in envisioning entrepreneurial opportunities within advanced academic settings and acting upon them. The first activity (1) is what we call “problematization”. By redefining an academic problem into a problem of potential customers, postdocs attempt to make themselves and their research central to the solution of the problem they have identified. During “enrolment” (2), entrepreneurial postdocs assemble a network of people that help them materialise their projects by providing expertise and support. Instead of doing everything by themselves, they learn to draw from relational expertise. The interviewed postdocs tend to perceive the choice of starting their own business as a high-risk endeavour, despite the fact that they themselves already cope with a work environment shaped by uncertainties and scarcities. Hence, through “narration” (3), the interviewed postdocs identify a road map for their entrepreneurial undertakings as well as build up confidence by leveraging narratives of success and failure shared by peers and other identification figures. It is through narration that postdocs also manage to overcome conflicting logics of identity between their role as a researcher and an innovator. Furthermore, in many cases the attended p2i courses have been the first practice field for newly acquired skills. In order to manifest these skills, recent course participants are involved in building up more permanent structures promoting entrepreneurial thinking and acting at their home institutions. These scaffolding attempts are summarised as “stabilisation” activities (4) and provide the framework for continuous entrepreneurial practice and reciprocal boundary-crossing.

The question remains, whether the identified activities can be generalised to other innovators regardless of their academic record. Usually, entrepreneurs with a background in research have already invested a large amount of resources into an idea - may it be the result of a research project, their thesis or the investment into particular skills and expertise. As a result, several interviewees described their entrepreneurial aspirations as a one-shot undertaking. Interviewee D9 makes clear that “if this idea is not working out, I am not going to try to just find any other idea, progressing as an entrepreneur. I think I would continue being a scientist.” This previous investment distinguishes postdoctoral innovators from other entrepreneurs. In addition, the boundary-crossing process is not a one-way street. In the interviews, the recent EE participants reflect on how they utilise skills acquired in academia and adapt them to the entrepreneurial context and vice versa. This also included specific moments of irritation when logics of academia and entrepreneurship collide. Navigating these contradictions are specific to the situation of entrepreneurial postdocs.

Although the qualitative interviews were conducted in the course of one specific Entrepreneurship Education programme, we suggest that the insights of this investigation guide the design of institutional support for entrepreneurial postdocs. Further research would allow to investigate each of the four activities in depth. In addition, we suggest further enquiry into the situation of postdocs, who have entered funding opportunities and set up organisational structures of a startup, since it would allow for a retrospective perspective on successful boundary-crossing between academia and entrepreneurship. Another possible research project includes scrutinising the impact of boundary crossing - the exposure to the “world” of entrepreneurship, the learning of the entrepreneurship process and the new networks created - on the academic practice in the research setting.

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