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## 5 Towards Lean Science

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1 The PhD as a Start-up

This chapter explains:

- Why your PhD is a start-up
- Which lean principles are most relevant to your PhD start-up
- How to manage your energy instead of your time

1.1 The PhD as a start-up

There is no definition of the term ‘start-up’ that any two entrepreneurs or investors agree on. Most would likely concede, though, that start-ups are firms that are (relatively) young which attempt to set something in motion.\(^{20}\) Start-ups are increasingly popular among university graduates. Twenty-eight per cent of graduates from the Master of Business Administration (MBA) programme at the Stanford Graduate School of Business now seek jobs in start-ups, up from less than 20 per cent five years ago. Only traditional banks remain more popular, with 31 per cent of graduates choosing them for their further professional development.\(^{21}\) Meanwhile, in a recent piece for MarketWatch, journalist Catey Hill lists ‘academic’ among the ‘5 once-prestigious jobs that are now B-list’\(^{22}\) as fewer and fewer top talents are drawn into this sector.

However, while seemingly disparate from a perfunctory first sight, the PhD student (in the dusty world of academia) and the start-up entrepreneur (in the shiny offices of Silicon Valley) share many commonalities, as also pointed out by academic Patrick Dunleavy.\(^{23}\)

First, both the start-up entrepreneur and the PhD student launch endeavours that usually commence as one-man/one-woman shows, i.e. where the one running it is, at root, alone. Much has been written about loneliness among entrepreneurs in recent years. For instance, Jonathan Hefter, the founder of Neverware, a start-up that provides software to make old computers run like new ones, shared in a Business Insider feature that ‘starting Neverware [...] was the most isolating experience of my life’.\(^{24}\) Another feature, published by tech.co,
hypothesized that being a start-up founder may be ‘the loneliest job in the world’. Meanwhile, Dunleavy writes that ‘researchers are always, at root, alone’. Doctoral education in the United Kingdom, in particular, embraces independent and self-directed study, which can isolate the one pursuing it. Half of all PhD students report suffering from psychological distress these days.

Second, both the start-up entrepreneur and the PhD student must create something novel from scratch to succeed. The start-up entrepreneur needs to create an original business model that is able to disrupt and eventually outcompete the incumbents in the start-up’s target industry. Meanwhile, the most essential requirement for successfully completing a PhD is ‘the discovery of new knowledge’, as the website of the University of Cambridge outlines. Similarly, the University of Warwick, also in the United Kingdom, states that ‘a thesis must constitute a substantial original contribution to knowledge’. If the start-up only copies and pastes existing business models, it is unlikely to survive; the first-mover advantages of the incumbents will wipe it out in most instances. Similarly, the PhD student that does not create something novel during their PhD journey is certain to fail at any serious university.

Third, both the start-up entrepreneur and the PhD student can only draw upon limited resources for their endeavours. Indeed, there are multiple start-ups that are only funded at first by bootstrapping – with the initial budget taken from the founders’ limited savings and, possibly, their family and close friends. For instance, the start-up Litmus, which provides email designs and marketing tools, was launched in 2005 with only USD 800 chipped in by its three founders. The firm now has annual revenues of more than USD 6 million. Meanwhile, many PhD students live close to or below the poverty line, as defined by their respective governments. For instance, one report found that between 15 and 20 per cent of PhD students in the social sciences and history in Germany live off less than USD 1,000 per month; the poverty line in Germany is at about USD 1,200 per month. Life as an (early) start-up or PhD student can be about (financial) rags instead of riches.

Fourth, both the start-up entrepreneur and the PhD student face tremendous uncertainties. After all, both endeavours revolve around developing and executing novel ideas. These new ideas – by definition – are always a journey into the unknown and are thus high-risk. The PhD may be a bit less risky than the start-up, though. Sixty per cent of traditional start-ups go bust, while roughly 50 per cent of PhD students in the United States drop out, compared to 30 per cent in the United Kingdom. However, both the entrepreneur and the PhD student are frequently required to hide the messy aspects of their journey that result from this uncertainty, possibly creating additional pressures. The venture capitalist demands a polished presentation to invest in a start-up, whereas, in the main, the professor does not want a PhD student that seems lost in the literature or data.

Fifth, there is one certainty that both the start-up entrepreneur and the PhD student share: there is a thorny journey ahead of them. Those running Dreamit,
a start-up accelerator, write that ‘even founders who have multi-million dollar exits to their names [...] face constant rejection with their current ventures’. After all, initially, only a few understand the novel idea pursued by the company. Otherwise the firm would have been founded a long time ago. Many PhD students can identify with this. Harsh criticism of their work by their supervisor(s) and assessors is the norm, and with more papers churned out than ever before even B-journals (which are acceptable, but not particularly renowned) reject most papers submitted to them these days. For instance, one B-journal in my field rejects almost 70 per cent of all papers submitted to it. Meanwhile, more than 92 per cent of all submissions to Nature are rejected.

Start-up entrepreneurs and PhD students both launch as one-person shows. Both must create something novel from scratch with limited resources. Both face an uncertain journey ahead of them with the only certainty being many obstacles along the way. Hence, the start-up and the PhD are remarkably similar undertakings. However, the success of an academic often seems a result of individual determination or mere luck, while successful start-ups increasingly share the same set of underlying principles. Indeed, some of those founding a start-up have developed a set of working principles in the past which help them to launch firms that become almost instantly successful. For instance, it took Dropbox seven months to get its first million users. Meanwhile, Spotify hit its first million users only five months after its launch, Instagram after only 2.5 months. Given the various commonalities between start-up entrepreneurs and PhD students, PhD students may be able to learn much from the working principles of start-ups.

1.2 Going lean

Start-ups come in all shapes and sizes. However, many now share a common underpinning: the lean start-up approach. Successful start-ups such as those we have already mentioned – Dropbox, Spotify and Instagram – as well as start-ups such as Wealthfront, an algorithm that manages your stock investments, or Aardvark, a social search engine recently acquired by Google, have built their businesses with lean methodologies. And the dominance of lean methodologies continues to grow with organizations like Start-up Weekend now expanding to almost every larger city around the world. Start-up Weekend runs 54-hour events that create a business model prototype within this timeframe. The entire event is centred around the lean start-up approach, thus introducing hundreds of prospective entrepreneurs at a time to these principles. Also, more than 25 universities around the world now teach lean methodologies to the next generation of entrepreneurs and an online programme on lean working principles is one of the most popular at Udacity, a start-up offering massive open online courses
The Lean PhD (MOOCs), which itself deploys lean working principles for its growth. Indeed, there are only a few left in the start-up landscape that have not been influenced by the lean start-up approach.

The term ‘lean start-up’ was coined by entrepreneur Eric Ries in a blogpost in 2008. It went mainstream after the publication of his 2011 book *The Lean Startup* which sold 100,000 copies and it was further popularized by the 2012 book *The Startup Owner’s Manual* by the entrepreneur and academic Steve Blank and entrepreneur Bob Dorf. Whereas the lean start-up approach is mostly grounded in Ries’s book, the term gained so much momentum that a variety of users embraced it and amended it once it was applied. Thus, the term is now a buzzword that means many different things to different people – keeping Ries busy posting articles which attempt to further clarify his interpretation of the term. This book is not attempting to comprehensively apply the lean start-up approach outlined by Ries. Rather, I took (my interpretation of) those ideas from Ries that I found most relevant to the academic context and then modified them, at times significantly, to suit it.

The three main ideas from the lean start-up approach particularly embraced in this book are the concept of a minimum viable product, rapid prototyping and end-user orientation:

- **Minimum viable product.** Academicians are infamous for their perfectionism, with the website insidehighered.com even devoting an entire subsection to this topic. With many at the top of the academic ladder embracing perfectionism, more and more generations of perfectionist academicians are nurtured. Meanwhile, those who advocate the concept of a minimum viable product (MVP) are fundamentally at odds with perfectionism. MVP adherents want to build a product that is not perfect, but ‘good enough’. This means that the product needs to entail its envisaged core features, but nothing else. (This already indicates that the paper route is the preferred format for the PhD approach I outline in this book; I further discuss this in Section 2.5.) MVP adherents attempt to build the MVP as fast as possible while deploying as few resources as possible.

- **Rapid prototyping.** However, the ambition of those embracing the MVP concept is still to deliver a perfect product, and rapid prototyping is chosen as a means for achieving this. Rapid prototyping means that the MVP is exposed to its potential end users once completed, feedback is then collected from these users, the MVP is amended according to this feedback and it is then exposed again to the end users for additional feedback. Ries calls this a ‘build-measure-learn’ loop which continues until the end users wholeheartedly embrace the product developed. Again, this approach is at odds with the academy since its perfectionists are conditioned to only share their products – which can be a
presentation for a conference, an academic paper or a thesis – with their peers (their primary end users) once these products are as polished as possible.

- **End-user orientation.** The MVP is *what* the lean start-up adherent produces first; rapid prototyping is *how* they improve it. The end user is *why* the lean start-up adherent undertakes this effort. Every action of the lean start-up proponent is orientated towards the end user. The difference between this end-user orientation of the lean start-up proponent and the orientation of the traditional academic can be stark, at least in some disciplines. Although grant funders increasingly pressure scholars to produce work with a societal end user in mind, with societal impact of scholarly work thus becoming more and more relevant, discussing end-user orientation of research can still be frowned upon within the academy, according to my experience.35 ‘Academics do not work for the end users, but for the sake of the academy’, a professor at Oxford University recently told me.

An example to illustrate the three principles outlined above: Nick Swinmurn, an entrepreneur in the United States, wanted to launch a company in the late 1990s that would sell shoes online, a seemingly mundane undertaking nowadays. If Swinmurn had been an academic, he would have developed a polished website for many months (or possibly even more than a year), coupled with the setting up of a complex storage facility as his firm’s back-end that would comprise a selection of his favourite shoes. He would have spent tens of thousands of dollars prior to even knowing if anyone wanted to buy his favourite shoes online. This is not what Swinmurn did.

Instead, Swinmurn went to several local shoe stores, took pictures of their inventory and posted them on one of his existing websites. This was his MVP. When people started ordering shoes from his offering, he went to the stores where he had taken the photos, bought the shoes ordered at the retail price and sent them to his customers. Prior to launching this MVP, an MVP with no dedicated front-end and no back-end whatsoever, Swinmurn had been unsure if his envisaged end users were willing to buy shoes online. His MVP allowed him to quickly and cost-efficiently test this. The company founded out of this MVP was Zappos which sold for more than one billion USD to Amazon in 2009.16,60

Admittedly, Swinmurn the academic may still have been successful with his business idea since the core idea proved to be sound. Nonetheless, the lean Swinmurn would have been able to launch the business much faster – and this first-mover advantage cannot be underestimated in any sector. At the time of the business launch for academic Swinmurn, the lean Swinmurn would have already run a functioning business with many customers. It would have been very difficult for academic Swinmurn to catch up.

There are at least three consequences for those who apply the lean principles in the academy and this story hints at them: greater efficiency, greater quality
and greater impact. The level of efficiency is indicated by the time needed from starting to develop a product such as a PhD until it is satisfactory to its end users. Adopting the principles outlined above ensures that from the very beginning of the PhD much scholarly input is gathered to tailor it to the scholarly community – considered the end user for the PhD – while as little time as possible is wasted by running into dead ends. Meanwhile, the student that embraces traditional scholarly working principles risks that months and months (and sometimes even years) of work will be judged as inadequate once shared with the scholarly community. In this case, the student would have to start again from square one and would lose a great deal of time. Eventually, funding for the PhD would run out and the student may be unable to submit.

Defining efficiency in this way highlights its inherent quality. If a PhD of substandard quality is submitted, it will fail. Hence, it will not be an efficient PhD. Furthermore, quality is (at least in theory) a precondition of impact. It is thus at the very heart of the lean PhD approach. Indeed, the lean PhD is all about radically improving the quality of your research. The result of this is impact: the take-up of a product by its end users. Most within academia distinguish between academic and societal impact. Academic impact is usually measured by the number of citations, as outlined previously. The more feedback that is collected and incorporated from scholars, the higher the quality of the PhD for the relevant community and the greater its visibility. Hence, the higher the likelihood that the work will be cited by colleagues.

Admittedly, citations are an imperfect proxy for academic impact. First, self-citations can boost one’s citation count just as much as citation by colleagues, without indicating any true impact on the field. Some academics justify self-citations by joking that you can never truly cite others until you have learnt to cite yourself. Tellingly, men cite their own papers 56 per cent more than women on average, according to a recent analysis. Second, even citations of your work by colleagues may not indicate scholarly impact. For instance, imagine a citation that reads: ‘Scholar A has also written on this topic, as have scholars B, C and D.’ It would count just as much as a citation that reads: ‘I build my paper on the method developed by scholar A.’ While the latter citation indicates impact on the field, the former does not. Nevertheless, the citation count rises just as much with the former type of citation as it does with the latter.

Meanwhile, a citation that reads ‘scholar A falsely argues that...’ is one that many scholars would like to pass on, but it still also boosts the citation count. However, some scholars may not mind this kind of citation, which indicates some degree of controversy. Indeed, controversy in papers can vastly boost the citation count. A recent example of this is a paper with the provocative title ‘In Defense of Colonialism’ by Bruce Gilley, an associate professor of political science at Portland State University. This piece was published in *Third World
Quarterly, a respected development journal.\(^6^3\) It achieved the highest Altmetric score, a measure for a paper’s social media influence that is also seen as an indicator of its future academic impact, of any paper ever published in the journal.\(^6^4\) (The paper was eventually retracted because the editor of Third World Quarterly received credible threats of violence due to its publication.\(^6^5\))

Discussions abound these days regarding the necessity to also create practical impact with scholarly work. Evidently, practitioners will only integrate such works into their thinking and, ultimately, their conduct if their quality is appreciated. While many supervisors may find that there is not enough time within a PhD to also start chasing practical impact, more and more recruiters (including academic recruiters) want to know about a PhD’s societal impact.\(^6^6\) This impact, for example on attitudes or policies, is more difficult to measure than academic impact and it is particularly difficult in disciplines such as English literature or theology. Any PhD student is well-advised to start thinking about it early. I outline how to specifically maximize the practical impact of a PhD in Section 4.5.

**1.3 Managing your energy**

The approach outlined in this book can significantly increase the efficiency of the PhD endeavour, while boosting its quality and impact. Nevertheless, the proposed lean PhD is still one that requires ample effort and time. A lean PhD is not a cheap one. Entrepreneur Lee Hower writes that any start-up (including the lean one) requires someone ‘fundamentally committed to putting in all the blood, sweat and tears’\(^6^7\) that are needed to get a company off the ground. This is echoed by, inter alios, Marissa Mayer, former Chief Executive Officer of Yahoo, who argues:

> [I]f you go into a co-working space on a Saturday afternoon, I can tell you which start-ups will succeed, without even knowing what they do. Being there on the weekend is a huge indicator of success, mostly because these companies don’t just happen. They happen because of really hard work.\(^6^8\)

She believes that the secret to success is working 130 hours a week.\(^6^9\)

This book does not propagate that you work 130 hours a week to complete your PhD. It also does not promise that you will complete your PhD by adopting the four-hour working week.\(^7^0\) Any PhD will always require many hours. However, the lean PhD will significantly reduce the hours needed. I estimate that it may halve it, given that I submitted my PhD in 45 per cent of the average time needed until submission at my school, as I outlined at the beginning of this book. The lean PhD approach may even save more time for those who are particularly inclined to adopt
the traditional approach to academia. It allows you to work more efficiently (and thus less intensely), while improving the quality and impact of your endeavour.

No PhD, though, requires putting in a certain number of hours until it is completed, although some students seem to think this. They are then surprised if they make little progress even though they invest 60 hours or more per week into their work. Start-up entrepreneurs also frequently boast about the time they put in, and still go bust. Those who count their hours may be better off focusing on their energy. Indeed, much empirical research indicates that productivity has less to do with the amount of hours we invest in a single working day, and more with the rest we have.\textsuperscript{71,72} This may be a particularly encouraging finding for those who undertake a part-time PhD by choice or necessity. If the slots allocated to work on the PhD are slots where one is energized (and thus does not procrastinate – the average American worker wastes around 50 minutes at work every day\textsuperscript{73}), it is still possible to progress quickly.

While I worked a lot on my PhD when I worked on it, I did not always work on it during the 21 months from start to completion. In fact, I did a lot of other things as well which energized me and thus eventually helped me to progress efficiently in my research. For instance, I wrote and published numerous op-eds throughout my PhD on topics entirely unrelated to my research (I enjoy popular writing). I also completed full-time projects with a consulting company while pursuing my PhD. And yes, I also went on vacation. When I felt that my fundamental drive for my PhD topic had dipped (which I believe inevitably happens in any PhD), I often did something else.

This guidance is not meant to suggest, though, only working on your PhD when you feel like it. There will be many days when you do not feel like working on it. After all, the road to PhD completion is a thorny one and thus not always enjoyable. I generally recommend sitting down and starting to work on your PhD even on those days when you do not feel like it. Only when you have worked on your PhD for four or five hours and not made any progress at all could it be time to do something else – if this does not become a routine. To complete the PhD, you will need to sometimes push, even if your energy is low.

I can always push most when there is a clear target that energizes me. One target in my PhD was (and I do not suggest emulating this!) to complete it in 18 months. Reminding myself of this target would help me to push myself through these days where my energy was low. A target that may work for you could be to send out that first paper, or to only go on that vacation to Honduras once that data collection is completed. While some thrive most on the grand targets, many PhD students I talk to tell me that it is the more manageable ones that can be accomplished in a few weeks or even days that boost their motivation most.

So much for initial guidance on how to pursue the lean PhD. I will now delve into how to manage the entire PhD process – from the very beginning to the very end. This journey is summarized in Figure 1.1.
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**Figure 1.1** The lean PhD journey
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