Dissertation, Inc.

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This "EIC's Message" column offers a few key takeaway thoughts for anyone interested in trying to turn a Ph.D. dissertation into a business.

This May 2024 special issue discusses students and faculty moving their academic research into for-profit ventures. This is a topic that I had hoped to publish on earlier but that didn't materialize. Here, I offer a brief message as to why I remain intrigued by this topic.

To begin, my first real job after grad school was an attempt to turn my computer science dissertation into a business. This message offers a few key takeaway thoughts from those years. Please read this message with a grain of salt—this is an old story, and some of these takeaways may not be relevant given today's speed of innovation and if your dissertation already has a tool ready for commercialization or monetization.

1. *Milk your dissertation:* The dissertation was *all I had*, so I derived as many articles from it as feasible. Such articles are mini-stories about what your technical idea is, and people can meet you through these stories. But don't let articles (in the public domain) prevent you from filing for patents.

2. *Postdoc:* Get one if you are in a financial position to do so and are considering a start-up from your dissertation. A postdoc is very useful to help solidify the ideas in a dissertation.[1]

3. *Early collaborators:* Continue working with whoever on your Ph.D. committee would be willing to work with you after your graduation. For me, that key person was Prof. Keith Miller (University of Missouri–St. Louis). And try to find early adopters to create testimonials.

4. *Type of business:* Here is your first key decision. You're starting from a dissertation. It probably got you to the point of being good enough to defend before your committee, but like most dissertations, it could be improved indefinitely since many dissertations present more questions than answers. Consider using your dissertation to start your business out as a research lab.

5. *Drop-dead date:* Start with a realistic deadline for any progress after incorporating. Mine was 12 months. If I saw no signs that the business was viable, I had plans to walk away.

6. *Office:* Start without an expensive physical office—an apartment or garage can be miserable during the

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ALSO IN THIS ISSUE

Editors in chief rarely know with precision what will be submitted to their magazines and journals. It is a blessing when acceptable and unsolicited articles appear discussing similar topics because that makes forming a new issue (or grouping articles for later use) easier. For May, I'm adding two articles discussing *electric vehicle (EV) technologies*.

In the first article,[A1] the authors begin by stating that digital twins (DTs) are used in applications including robotics, smart cities, and aerospace; however, DTs are less used in the automotive industry. The article discusses how the spatial representation of a DT is developed in a Unity3D environment by using an independent simulation that runs in parallel with the real physical system. To reduce the error between the spatial model and the physical entity, controllers are developed and tested with data from a self-driving EV.

In the second article,[A2] the authors discuss the importance of establishing an efficient communication framework between EVs and charging stations. The article states that when multiple EVs simultaneously send vehicle status parameters, a network receiving that information can suffer. This article discusses charging management systems for EVs that efficiently select the charging station based on vehicle-to-vehicle communication while preventing broadcast overload problems, and the article offers simulation results.

—*Jeffrey Voas* ⓘD, *Editor in Chief*

APPENDIX: RELATED ARTICLES

A1. A. Rassõlkin, P. Maksimkins, A. Stupāns, V. Rjabtšikov, A. Šenfelds, and V. Kuts, "The spatial representation of a self-driving vehicle for the virtual entity of a digital twin," *Computer*, vol. 57, no. 5, pp. 58–66, May 2024, doi: 10.1109/MC.2023.3319108.

A2. A. Khan, A. Saeed, F. Ullah, M. Bilal, Y. Muhammad, and H. El-Sayed, "Charging support communication system based on vehicle-to-vehicle communication for electric vehicles," *Computer*, vol. 57, no. 5, pp. 67–77, May 2024, doi: 10.1109/MC.2024.3350871.

early days, but it is cost-effective. You really don't need to look flashy on day one. Put your money toward hardware and travel for speaking opportunities to promote your technical idea.

7. *Avoid outside funding:* There are four points here.
   a. Venture capital and angel money can be tempting in the early days, but try to hold off as long as reasonable.
   b. Government grants and contracts that are set aside for entrepreneurs are excellent (and possibly the best) early funding; no equity is sacrificed with these.
   c. Crowdsourcing for start-up funds is an option. (Today, there are many ways to get early funding. But always remember that the expectations that you will put on yourself may not match those of your benefactors, and that may quickly erode your relationship with them.)
   d. Once you take outside money, that changes everything.

I should mention that free entrepreneur mentoring services are offered by government agencies. Free services can include help with writing business plans, setting budgets, patent filing, and even incorporating. And some universities offer low-equity or no-equity incubator services, including small office space.

8. *Hiring and recruiting technical staff:* Hire people much smarter than you are. (This article[2] provides a good story here.) Recruiting by using faculty from both your undergrad and grad school days is valuable because they can vouch for you. It is hard to compete for talent. Consider this—when the student employee candidate goes home for the December holidays and says to Mom and Dad, "*I got a job*

offer from Microsoft and Google" or says, "I got a job offer from some one-person start-up." Which sounds more impressive? Which opportunity do you think Mom and Dad will recommend?

9. *Hiring and recruiting sales and marketing staff:* Hiring people with the appropriate sales and marketing background to match a brand-new technical idea could prove difficult. The problem is finding sales staff that understand your technology. And handing them your dissertation probably won't help. If your ideas are too complicated, the sales staff has little chance of explaining them correctly to a prospect. And you can only imagine how bizarre and embarrassing some of those explanations to prospective customers can become.

10. *Culture:* Possibly the most important thing you will do to retain employees will be based on the working culture that you create. The culture should reflect you and your technical ideas.

11. *Prepare for multiple transitions:* I started out leveraging a dissertation to build a business that started as a research lab. After some years, the business built a commercial software testing tool and then created a consulting services portion of the business. In the end, the business long abandoned the dissertation and the tool and wound up as a cybersecurity consulting business with an associated research lab. The marketplace decided this outcome for me. By having an active research lab, our consultants could argue to customers "Would you rather hire the people who *wrote* the books or *read* the books?". This worked.

So, what was this dissertation-based venture? It was Reliable Software Technologies, which was founded in Virginia (USA) in 1991, renamed itself Cigital in 2001, and was acquired by Synopsys in 2016. ■

REFERENCES

1. J. M. Voas, "A dynamic failure model for performing propagation and infection analysis on computer programs," Ph.D. dissertation, College of William and Mary, Williamsburg, VA, USA, 1990.

2. J. Voas, "The pitfalls of managing superstars," *IT Prof.*, vol. 3, no. 2, pp. 65–67, Mar./Apr. 2001, doi: 10.1109/6294.918226.

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