

Engineering Entrepreneurship: From a Great Idea to a Big Exit

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Let me start by defining the term “Entrepreneurship”. Entrepreneurship can be defined as the activity of setting up a business or businesses and taking on financial risks in the hope of making a profit. Entrepreneurship is a full-time multi-year (6–10) commitment. Entrepreneurs must wear many hats, from a Janitor to a Chief Executive Officer (CEO). I have described below 5 steps/5 missteps which most successful entrepreneurs take/avoid respectively in their journey towards success. Let me explain each step one at a time, both in theory and with a practical example from my 35-year entrepreneurial journey.

5 Steps for a Successful Technology Start-Up

Step 1: “Start with a Great Idea”

- Great idea is needed for a successful startup
- A Great Idea should be:
 - Novel/Unique
 - Disruptive/Not incremental
 - Satisfy the pain/unmet needs of the target customer
 - Address a big market
 - Should be Intellectual Property (IP) centric and lead to patent(s)
 - However: **The idea is only 20%, while its execution is 80% for success.**

Make sure you spend enough time in getting your idea vetted or changed/modified by talking to experts in all fields, namely technology/science, marketing/customers, business strategists etc. This will be very well worth it as changes at this stage are easy and cost virtually nothing but in later stages could prove very costly and even can kill a business.

Here is an illustration of this based on my entrepreneurial journey:

Right from my Indian Institute of Technology Madras student days (1981–85), I always wanted to be an entrepreneur and have my own chemical company. I went to a top US University for my MS in Biochemical engineering, but my mind was always on how I can start my entrepreneurial journey. It was by sheer chance that I met a research scholar in Baltimore, MD who told me about “Chitin–Chitosan”. I became so enamored by the bio-

chemical and its potential applications that I left back for India mid-way through my MS in 1986 and founded my 1st start-up.

Chemopol Complex (I) Pvt. Ltd (1987–1991)

I formed this company with 3 other chemical engineers in 1987 to build India’s 1st Chitosan manufacturing plant. We developed the technology in 2 Government of India labs and obtained a \$125,000 loan in 1988. We even applied and got India’s 1st ever “Line of Credit” \$50,000 working capital. We got all the loans mentioned above without any collateral, which is quite unheard of, even today.

So, what exactly is Chitosan? Chitosan is a linear polysaccharide. It is made by treating the chitin shells of shrimp and other crustaceans with an alkaline substance, such as sodium hydroxide.

The plant became operational in 1989, and I even won the “Best Young Entrepreneur of India” award that year. We were way ahead of our times as no one in India had ever heard about Chitosan and its numerous applications, such as being the best compound for wound healing and for making biodegradable medical sutures. We had to develop local and export markets in an era where there were no phones or e-mails because everything was done through letters. Even though we had great profit margins, we could not become profitable due to a severe time lag between an enquiry from US, sample shipment, testing, acceptance, order placement, fulfillment, delivery, and payment. Ultimately, I sold my shares to my partners and returned to US in 1991 to complete my MS.

The lesson I learned from this venture was that you can produce anything you want; however, you can only sell what your customer wants. I also learned that the pursuit of science may not result in pursuit of business success, especially if you are much ahead of the market needs. The creation of a new market is much more difficult than meeting the existing market’s unmet needs.

Step 2: “Hire the Dream Team”

- A great management team is the next 20% in the master success recipe
- The Management Team should include:

- **CEO:** Someone who can raise capital and hire and assemble a good team based on his or her credentials
- **Chief Technology Officer (CTO):** Someone who can build, test, deploy and support the technology and product
- **Chief Financial Officer (CFO):** Someone who can manage the finances and accounts of the business
- Hire good **Industry/Academic Experts** in the field as **Advisors**

Hiring of Advisors is very key to success and funding. In 2007, when I had started Sriya Innovations to commercialize my SCW technology to convert biomass to sugars, I hired 8–10 experts from MIT, U. Mich., Iowa, Auburn, and Clemson as my advisors. So, when Kleiner Perkins (KPCB), a world leading venture capital firm based in California, tried to do due diligence on my technology, they could not find anyone because all the experts were already on my team. They approached me about it, and I told them that if all the best technologists are with me then my technology and business idea must be exceptionally good. Kleiner agreed and invested \$35 Million.

Moreover, an example of this critical step is my current AI startup Keydabra (2017–present). Keydabra has invented a proprietary mathematical formula that dynamically measures and automatically assigns weights to scores of variables that define the level of engagement a visitor has on any digital platform. We then converted that into a single index/score. This index correlates positively to visitor conversions. Keydabra gives recommendations as outputs to improve the index and enhance conversions; sometimes by even 10X (1,000%) as proven in over 10 beta tests. The index can also be used to enhance profits as it can auto eliminate price discounts based on engagement scores. This technology could lead to global digital revolution and enable the attainment of the “Holy Grail” for e-commerce companies where they achieve ~10% conversion rates from the current <3% global average. It may be noted that neither I nor my co-founder had any previous e-commerce nor AI expertise when we started this project, hence we hired advisors from Clarkson University and the University of Texas Austin to educate us and help us launch our company.

Step 3: "Raise Capital/Funding"

- Having adequate funding for a startup is analogous to having like adequate oxygen in a body to sustain life
- Funding Rounds:
 - Friends and Family
 - Pre-Seed and Seed Round with Angels
 - Series A Financing with Venture Capitalists (VC)
 - Remember: Something of something is infinitely times better than 100% of nothing

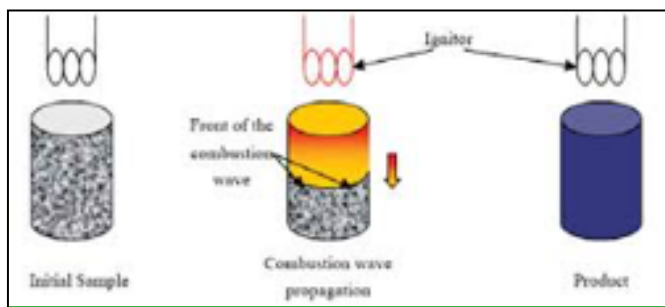
Bootstrapping vs. Capital Raising is a million-dollar question. Many first-time entrepreneurs hate to raise outside capital as it will lead to dilution of their equity and loss of control. So, many spend many fruitful years with very low capital and hence cannot scale their business. By the time they realize their folly, either competition catches up or market window has closed (remember - nothing waits for you forever no matter how great you are). All great tech startups like Google, Amazon, FB and many more have become what they are because of right capital infusion at the right time. Bootstrapping may work well for service-oriented companies but not in growth-oriented ones.

Also, it is important to remember and understand that a technology startup cannot be taken as a hobby or as part-time project. It requires 100% full time commitment from the Founders. It is 100% certain that part-time technology product/growth startups will fail while a full-time may succeed. If you cannot even invest your time in your own startup, how can you even expect any investor to invest their money in it? Verdecem, Inc. represents a good illustration for this crucial step.

Verdecem, 2010-15

This technology involved production of Portland cement without a kiln at 1200°C lower starting temperature using self-propagating high temperature synthesis (nano technology).

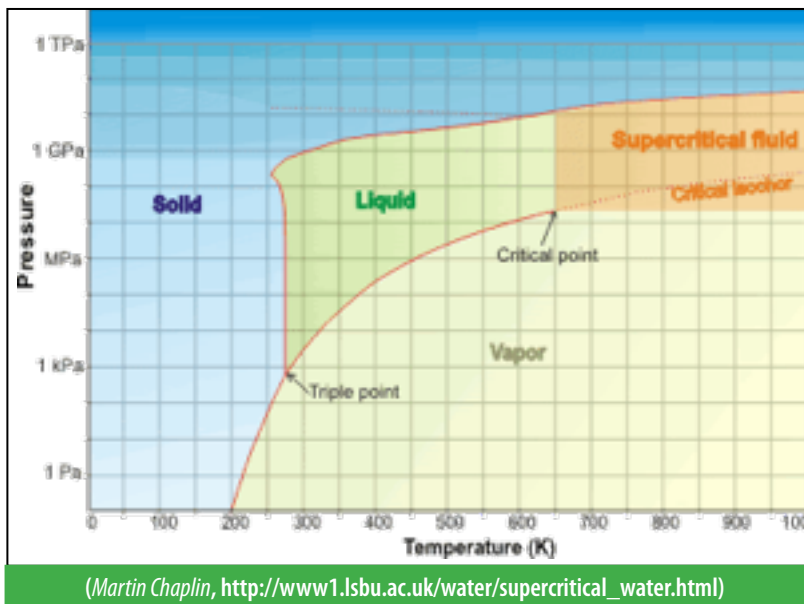
Self-propagating high-temperature synthesis is a method for producing both inorganic and organic compounds by exothermic combustion reactions in solids of different nature. Reactions can occur between a solid reactant coupled with either a gas, liquid, or another solid. Below is a graphic to illustrate how this was done.



(https://www.sensorprod.com/news/white-papers/pbg/wp_pbg.pdf)

Kleiner Perkins initially invested \$3 million in the company. Kleiner was the big investor in the project which en-

abled me to start Verdecem with very little of my own money. I purchased the company back from them in 2011 and joined hands with one of the largest cement companies in the world who invested and tested the cement and found it remarkably close to commercial grade cement.



(Martin Chaplin, http://www1.lsbu.ac.uk/water/supercritical_water.html)

Step 4: "Ensure Rapid Growth"

- Ensure Growth by:
 - Hiring the right talent pool
 - Having a constructive Board of Directors and Advisors
 - Getting repeat and new customers
 - Ensuring growing revenues and profitability
 - Raising adequate growth capital from Big VCs or Strategic Investors
 - Become a "Unicorn"

This is probably the most exciting and the longest stage of a technology start-up, and you as a Founder may have to think if you are the best person to lead your company from the current stage to become a Unicorn (>\$1Billion valuation). If needed, bring a professional CEO and give him/her a free hand subject to your Board's supervision to hire the team and run the company. You decide what is right and seek advice, but don't say yes to a new CEO just because an investor says so. Sriya Innovations illustrates this growth step the best.

Sriya Innovations (Renmatix 2007-12)

I returned to the USA in mid-2007 with a technology based on super critical water (SCW) to convert biomass to sugars in only 5 seconds instead of 5 days.

Let us first define what is SCW? Water becomes supercritical at 374.2°C and 225 atm pressure. At this state, SCW is both a gas and liquid as it has the solvating properties of a liquid and dispersion properties of a gas. It has a very low dielectric constant, is completely non-polar, and behaves more like an organic

solvent. The figure above right describes this unique state of SCW very well.

Furthermore, Bill Joy, Co-Founder of Sun Microsystems, Inc., liked my technology and his VC firm Kleiner Perkins (KP) invested \$6M in 2007. Later, John Doerer, an early investor in Amazon and Google, invested \$15 M through KP. The company was a big success and I exited the company in 2012 after an additional investment by a consortium of big players and investors like Gates Foundation. The success of Sriya Innovations was due to the rapid growth of the company from 1 person to over 100 in less than 24 months.

Step 5: "Have a Big Exit"

- Exiting a startup at the right time and valuation is critical or else many companies later bite the dust due to many factors like market down turns etc.
- Exit Strategies:
 - Initial Public Offering (IPO)
 - Merger & Acquisitions (M&A)
 - Have/Hire an "exit focused experienced team". This team is usually quite different than your operating team. They have a different skill set and you may need an external team like an Investment Banker.

Having a big exit is the desired outcome of a technology startup. In financial parlance, an "exit" means financial and not personal. Exit means a liquidity event where the shareholders have the flexibility to freely sell their hereto restricted stock to prospective buyers. This happens usually through an IPO or an M&A. You can still stay and work for the company physically, but financially now you are "free".

Do not fall into the trap of keeping your startup forever illiquid, as many companies who missed the right IPO/M&A window later failed to either exit or did so at a fraction of the previous value. My IPO companies from the Commodore family best illustrate this final step. I finished my MS in 1993 and my PhD in Jan 1996. My PhD resulted in 4 patents. In 1995, instead of looking for potential job, I

began to look for partners to commercialize my PhD technology “Supported Liquid Membranes (SLM)”.

Let me first define what is an SLM is. A Supported Liquid Membrane (SLM) is a liquid membrane (LM) that is formed by a thin layer of organic phase (usually with dissolved reagents) between two aqueous phases of different compositions. My partnership with Commodore Group, who funded my SLM startup, illustrates the “Great Idea to a Grand Exit” the best.

Commodore Group (1995-98)

I met Commodore Group in NY in October 1995 and from this meeting began my 2nd entrepreneurial journey. I gave a presentation on my technology and was told to wait. After a short time, their CEO came and gave me an incredible offer. The offer was a job as Vice President of a new startup with a 6-figure starting salary, a 250,000 stock grant, and a signing bonus of a brand-new car! I signed and handed over the technology to Commodore and from there two startups emerged. For the two startups, I was the Chief Science Officer of one company and the Chief Science Advisor of the 2nd. Both startups went on to become US IPOs raising \$97 Million in 1996-97. I created two Commodore companies/spinoffs which went from 1 to over 100 employees in less than 18 months. This was a dream come true. I moved to Atlanta in 1997 and Commodore even paid \$40,000, the down payment my 1st home in Marietta, GA in 1997. I had big financial payouts from both Commodore companies which laid the foundation for my subsequent entrepreneurial success.

Now that I have talked about the 5 steps to a technology startup success, here are the 5 common missteps which often lead to a tech. startup failure.

Five missteps sure to lead to startup failure:

1. Do not get caught in “Founder’s Syndrome”: do not think only your idea is the best and belittle others and/or ignore competition. This is one of the biggest mistakes nearly every 1st time entrepreneur makes or has made in their startup career. Every founder thinks that his/her idea is the best. Nothing is wrong with that idea except that many make the follow-on assumption that rest of the ideas in the world in the same space are bad or useless. Here is where most fall flat because most of the time the converse is true, so you should learn and adapt. What matters is what the market thinks about your idea/project and NOT what you think about it.
2. “Not Invented Here Syndrome” (NIH): If I did not think of the idea or the technology then it must not be good. This is the 2nd common mistake every tech. founder makes. They think so highly of their technology knowledge and skills that they ignore, and sometimes even belittle, their competition

and mostly to their own peril.

3. Take money when it is on the table. This is the toughest problem some entrepreneurs may face. Should they keep running their startup in search of a grand exit or exit with the 1st available offer? Unfortunately, there is no simple solution for this, and each case is different. Please seek outside advice and decide.
4. Do what you want and not what your customers want. This is the classic case of “Did the dog eat your dogfood?”. If you produce dogfood and your dog does not eat it, then it is a total waste and a flop product. Modify or close shop. The customer is always right, and they know what they want and for what they will pay. You cannot decide for them, but instead they will decide for you.
5. Make ideas complex while thinking big. This is a common mistake most entrepreneurs make. Make sure the dog is wagging the tail and not the tail wagging the dog. The market should dictate the technology as what the product should do and feel like, and not the vice versa of technology trying to tell the market needs.

One example from my entrepreneurial journey which illustrates misstep # 3 above is:

Dilato Inc. (2000-2003)

This was my 1st Information Technology (IT) startup based on Artificial Intelligence (AI)-Expert System. I got an offer for a buyout in August 2001 which I refused; then, 9/11 happened and I had to sell my company in 2003 for a much smaller fraction. The lesson I learned here was when there is money on the table you should take it first, else it may disappear soon. This explains misstep # 3 well because I did not exit at the right time.

Conclusions:

In conclusion, I have outlined the 5 steps anyone should take and 5 steps you should not do to have a successful technology startup in any country, especially in the USA. I have illustrated specific examples from my 35-year entrepreneurial journey to explain the 5 steps and 5 missteps. It must be noted that a startup should be a full-time passionate commitment rather than a part time hobby for it to have any chance of success.

Some of the published articles relating to my entrepreneurial journey:

1. Global Online Business Magazine. (n.d.). Retrieved August 16, 2020, from <https://www.mirrorreview.com/magazines/>
2. Mirror Review. (2019, November 13). Learn How Businesses Can Increase Productivity Using Machine

Learning. Retrieved August 16, 2020, from <https://www.mirrorreview.com/how-modern-businesses-can-increase-their-productivity-using-machine-learning/>

3. Stories, L. (2018, June 06). Meet Srinivas Kilambi of DXILOGY. Retrieved from <http://voyageatl.com/interview/meet-srinivas-kilambi-dxilogy-johns-creek/>
4. Path to Improved Conversions: DXILOGY LLC, a SaaS-based Solutions Provider, Plans to Grow by Diversifying its Product Offerings. (2018). Retrieved from <https://thesiliconreview.com/magazine/profile/path-to-improved-conversions-dxilogy-llc-a-saas-based-solutions-provider-plans-to-grow-by-diversifying-its-product-offerings>
5. DXILOGY: Boosting Customer Conversion with Machine Learning insights. (2018, December). Retrieved from <https://www.ciobulletin.com/magazine/dxilogy-boosting-customer-conversion-with-machine-learning-insights>

Some of my relevant US Patents:

1. Kilambi, S. 2013, *Solid State Combustion Synthesis Cement*, 20130092054 (Verdecem, Inc.)
2. Kilambi, S. 2010, *Bio-Refineries*: 8,282,738 (Sriya Innovations, Inc.)
3. Kilambi, S. ET.AL, 2000, Supported liquid membrane separation: 6,096,217 (Commodore Inc.)
4. Kilambi, S. 2002, Artificial intelligence manufacturing and design, 20020049625 (Dilato, Inc.)



Srinivas Kilambi I hold a Ph.D in Chemical-Environmental Engineering from University of Tennessee Knoxville and Oak Ridge National Lab, a MS from Johns Hopkins and Clarkson Universities, B.S from IIT Madras and also a Chartered Financial Analyst (CFA). I have been CEO/CTO of multi-billion dollar Private and Public companies/divisions in the USA and India, like Tatas and Reliance, and also a founder of 6 startups. I have over 20 US and 10 International patents.

I have received several awards such as the Entrepreneur of India Award (1989). In 2009 I received The Indus Entrepreneur (TiE) Atlanta Entrepreneur of the year award and in 2010 TiE Global Pioneer award. In 2010 I was also selected by the prestigious World Economic Forum for its technology pioneer top 25 in the world award and in 2011 by Frost & Sullivan as the North American Greentech award winner. In 2011 the state of Georgia (GA) selected me as the Technology Pioneer Award Winner and GA Savannah Finalist.

I currently run Sustainability-AI-Biotech (SAB) Technology Group, a social media platform for technology discussions, information dissemination and mentoring of young minds to make them future entrepreneurs (job creators rather than job seekers).

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