

Tough Challenges and Real Solutions for Hardware Startups



seedsprint.com/tough-challenges-and-real-solutions-for-hardware-startups

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Hardware startups grow differently than software-only startups, but when founders take advantage of new resources, we believe they can claim their rightful place among the most successful tech companies in the world.

The hardware narrative

Everyone knows about the Meteoric rise of Lyft and Spotify. Software – and particularly consumer-facing apps – have an edge in venture capital, in that it is easier for them to model growth and promise quick returns.

Hardware startups are different. These startups attack some of the hardest problems in tech: breakthroughs in engineering, computer science, biotech, and other disciplines. The complexity of working in the physical world means there is a greater need for upfront investment, and less flexibility around product/market fit.

Here are some key challenges hardware startups tend to face:

- **Navigating complex regulations**
- **The need for expensive equipment and other investments**
- **Disrupting capital-intensive industries**
- **Long gestation periods (length of time required to prototype and test)**
- **The need to hire talent with specialized skills**

All told, these factors can make it more challenging for hardware startups to get venture capital dollars in the door. These challenges make hardware startups a bigger risk for investors and raise the spectre of the **“valley of death.”**

Hardware better, faster, stronger

But what do entrepreneurs do when they face challenges? They innovate.

Today's hardware startups have new resources at their fingertips for prototyping, funding, and networking. These new resources are setting the hardware startup community up for success, despite the struggles of the hardware world.

Here are some of the resources that leading hardware startups can take advantage of as they finetune their tech – and sail carefree over the “valley of death.”

- **Agile design processes.** New tools for hardware design are making startups more like software companies. Additive manufacturing and new design tools can make it easier to iterate on a product design and reduce complexity of prototyping.

- **Use visuals to tell your story.** One huge advantage that hardware companies have over software companies is the visual nature of a hardware pitch. Make a video that shows someone using your product. Hardware has a visual nature that makes your startup more compelling to journalists (email them your video), investors and partners (show them your video on [Seedsprint](#)), and potential crowdfunding audiences (like this [\\$20m fundraise for a smart watch](#)).
- **Tap into local institutions for in-kind resources like space and equipment.** Universities and cities often provide venture support services for faculty startups or entrepreneurs who want to license university IP. These services might include access to makerspaces and manufacturing equipment. Some metropolitan areas are even starting to do the same – for example, New York City’s initiative [Futureworks Shops grants entrepreneurs access to advanced manufacturing facilities in the city](#).
- **Seek out active communities of makers.** Hardware geeks love to gather. What’s more fun than showing off something you built from scratch, or discussing the newest 3D printing tools with fellow hardware enthusiasts? [Meetup groups, local makerspaces, and gatherings like Maker Faire](#) are a great place to find talent.
- **Find a specialized accelerator to boost growth.** [HAX \(below\), EnterpriseWorks, Cicada, CITRIS Foundry, and others like them can be an excellent resource for networking and expert guidance.](#)
- **Travel to get further, faster.** Sometimes, an accelerator program that’s far from your home base could pay off. We find the [HAX model to be very compelling. The accelerator takes promising hardware startups from all over the world and incubates them in Shenzhen, China to bring entrepreneurs closer to potential factories and reduce the cost of product development.](#)
- **Partnerships with large enterprise – including software companies.** On the day that Google acquired Nest, everyone in the hardware community took a step back to reassess who their potential partners were. Overall, partnerships can make or break your hardware startup – so keep an open mind. You can use [Seedsprint to see which big companies are interested in what you’re doing. We agree with TechCrunch](#)

Running A Hardware Startup In India Is Hard! [Interview With Bahubali Shete Of Gecko]

 nextbigwhat.com/hardware-startup-in-india-challenges

January 28, 2014

What are the challenges of building a hardware product from India?

Quite a few:

1. Funding: It is not easy to get funding for tech-hardware startup as compared to software solutions. Even the finance community in India is yet to understand the potential of hardware startup and their valuation is very low. The finance community is not willing to take risks.

Upfront investment is mandatory for hardware startup, which means we need to live with seed funding only. This is also because of the fact that there are not many success stories in India.

2. Visibility: Getting visibility is difficult. Marketing and e-Marketing expenses are still prohibitive.

3. Customer acquisition: Customer acquisition is very difficult without ready product, market acceptance for hardware products and long penetration process.

4. Ecosystem: This is the most important challenge; The ecosystem is not conducive for hardware startups. Most of EMS are settled with defence projects or PSU or large CE product manufacturers and not willing to support small tech-start ups.

The lead times for hardware and enclosures are so high that we find it easier, cheaper and faster to get it done in China.

What in your opinion has changed from the past to make the ecosystem conducive for hardware startups?

New government policy announcements are raising a ray of hope but we are yet to see the real impact.

Why did you decide to go for crowdfunding? Did you face any challenges raising funds?

As a startup, the above mentioned challenges are really hard to overcome. Crowdfunding offers the best solution for all the challenges. If there is a credible idea, presented well with facts, crowd funding provides, funding, visibility, market penetration and customer acquisition. hence it is the best way to go for hardware startups.

Do you think the government's plan to support the electronics and fabrication Industry will help startups in the hardware product space?

The ecosystem needs subsidies, relaxed taxation and statutory norms to enable hardware startups. Funding from government will surely help.

Outsourced Product Design is a big space in India. What has changed so that startups have started launching their own hardware products?

It is time that design houses start realising the potential of hardware products, instead of looking for quick money, long term product and brand development, as it is more important for themselves as well for the country.

One thing that every startup should think and act is to see global market as their playground for the game not just India. Focussed approach and doing one product at a time is very important.

Innoz Founders Return Money to Seedfund; Raise \$500k for Q&A App Quest in Silicon Valley

Mobile value added services startup Innoz is returning the money it raised from Seedfund, as its founders move to the Silicon Valley to build another app called Quest.

Deepak Ravindran, the CEO & Founder of Innoz told NextBigWhat in an e-mail:

This is a separate entity outside Innoz. Hisham and I will be running both Innoz and Quest in parallel.

The company had raised \$3 mn from Seedfund in April 2012. Ravindran & Hisham, his co-founder at Innoz, have already moved to the Valley.

The company has also raised \$500,000 from Valley based incubator 500 Startups to develop Quest, a location aware app that uses people nearby to get questions answered for the members of its community (via). Quest has advisers like Pranav Mistry, Asha Jadeja and Kyron founder, Louis Monier on board.

The VAShout of VAS Business in India

Innoz made it to the Limca book of records for being the “largest offline search engine,” in October last year.

At the time, it had answered 1.3 billion queries from 7 different countries over its SMS based platform called Smart SMS. Users can send a query to 55444 as a text message for replies.

In December last year, the company served a billion queries over its SMS platform.

Value added services in India, has lost much steam in the last few months as the telecom regulator made it tougher for operators to sell them to customers (for instance Airtel, one of Innoz key customers is promoting messaging apps/data over SMS) .

Moreover, Innoz, which is an SMS based platform might not be favorably positioned for the future as mobile Internet picks up increasingly fast in India. As we'd written in our 2014 startup predictions, this year will be a Vashout year.

Apps like Whatsapp & Line have gathered millions of users in the country (Read: The Indian Mobile App Race: The Race Mobile Messengers Are Winning), dealing a blow to SMS services. Telecom companies, are also now pushing data based services as they invest in 3G and 4G infrastructure.

**We are talking to Deepak for more on this. More updates to follow.*

Love Freebies & Promo Contests? Freejinn Is The Site For You

Everybody likes freebies. I like them, and there are more people like me out there on the Internet, who are actively looking for freebies and such offers. On the other hand there are brands giving out freebies through offers and contests on the Internet to improve their brand presence. But discovery of these contests has always been an issue.

Currently, brands mainly use Facebook banners or promoted Tweets for running contest and spreading the word, but their discoverability is limited. What if you can have a pin board of freebie contests & offers?

Freejinn is trying to help bring together both these groups on one platform. No matter what the product is, fashion or food, the portal curates all offers and contests from the internet for users to search through.

For example, if you are looking for an iPad, just search for it on the site and you'll get a list of contests that are offering iPads as a prize.

Registered users, known as Jinnions, can browse through contests and offers based on interests or location. They can also order a free product sample, share contests, and browse for offers by attributes like category, ending soon, popular.

On the other hand brands can use this service as an alternative platform to advertise their products.

The service, only a few weeks old, currently has an active user base of over 4000 users and has curated more than 100 contests and offers.

The portal has a network of people who report and curate contests that are running online. While the process is done manually for now, the portal is looking to automate it soon.

Currently the service is focused on building traffic volumes and plans to generate revenues only once the customer base reaches a sizeable amount. Some of the planned monetization models for the future include display advertising, targeted sampling opportunities and running customized brand-centric contests on-site.

The service plans to launch an update with twitter contest integration soon. The freebie search engine also will launch a feature to figure out a user's choice and recommend freebies accordingly.

The Freejinn founding team consists of Sheetal Vanwari and Jetesh Menon, two former digital advertising professionals.

Top 5 Challenges Facing Hardware Start-ups

 reliancecm.com/blog/2013/04/top-5-challenges-facing-hardware-start-ups

By admin

April 3, 2013

It seems that nearly daily we read about new product ideas from startups across the country and even the world. Hot new products that are looking for investors or end-users to purchase as part of their Kickstarter campaigns. It all seems very fast-paced, lucrative and fun, but the road to product success is not paved in ease. It can be challenging and from where we, RelianceCM, are sitting we see these budding companies hit roadblocks along the way. With our unique perspective in mind, here are the major challenges we see facing hardware start-ups today.

1. Credit – Many component vendors expect credit applications to be filled out in order to receive payment terms. As a start-up, without much of a credit history, this can be a huge hurdle in just getting the components necessary to build your product and turn your ideas into a tangible reality.

2. Quantity vs. Price – Startups fall into this trap all too often. Many times startups are focused solely on unit price, and often times the easiest way to achieve this is to buy in larger quantities. This can tie up a lot of cash in a hurry, which can be a major issue for already cash-conscious startups.

3. Component Lifecycle – Sometimes startups get all the way to their contract manufacturer only to find that a necessary part is no longer available. It is a very basic and avoidable issue, but ensuring that crucial parts are not obsolete can help prevent a startup from going all the way back to the design phase, wasting not only more money, but crucial time.

4. Lead Times – This one is very closely related to the component lifecycle above. Startups are often too busy with other details to manage and monitor the lead-times of their many components. It can be a disaster if a component has a lead-time that exceeds your planned launch date. We recommend working closely with your CM to be sure that this is not an issue and that you are aware of the lead times for all of your critical components.

5. Feature Creep – Essentially, this is the same as scope creep. Every additional feature added into a product comes with an associated cost. For startups it is often commonplace that you think of more and more ways to make your product awesome; however, you have to determine the “must haves” vs. the “wants.” Some of the “wants” may have the potential to be sold as accessories or add-ons, which could ultimately be an additional source of revenue.

5 Ways to Increase Your Hardware Startup's Likelihood of Success

E entrepreneur.com/article/279672

John Teel, John Teel

By [John Teel](#) November 1, 2016

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As an entrepreneur, you already know bringing a new hardware product to market involves risk. You have a vision, and you want to profit; however, it's not guaranteed.

Risk can be a part of the thrill, but ignoring threats can lead to recklessness. You cannot eliminate risk, but you can certainly minimize it, protect your investment, and increase your chances of success.

Here are five ways to gain a competitive edge, when you bring your new hardware product to market.

1. Utilize manufacturer resources.

Most manufacturers have resources that can help you. These include free help with design, engineering, 3D modeling and prototyping during product development. They can also connect you with valuable contacts, such as component and packaging suppliers.

They may also extend you credit (allowing you to pay between 30 to 90 days after shipment) if you have a viable product and demonstrate consistent sales. This improves cash flow, which is important during times of explosive growth.

Typically, tooling represents a major upfront manufacturing cost. Large projects or complex molds can easily cost tens of thousands of dollars.

When you work with your manufacturer, they may allow you to amortize your tooling costs. Amortization adds the tooling fee into the unit cost. You make payments instead of paying a lump sum payment. For example, they could tack on \$25,000 on your tooling costs to the first 25,000 units, so you pay \$1 more for each unit.

2. Use multiple engineers.

It may be convenient to use only one engineer, but you're relying on them to produce a flawless design single-handedly. Large companies use multiple engineers to review hardware designs, and eliminate problems. You should too. Lower your risk, and hire at least two engineers.

Hiring a second engineer to review the design can save you time, money and costly mistakes before investing in prototypes.

At my product development company, [Predictable Designs](#), we always have multiple engineers review designs, and we review designs for other engineers. Design reviews are key to preventing mistakes.

3. Sell sooner, not later.

People may praise your product, but all the accolades in the world mean nothing unless they're accompanied by sales. You need to pre-sell your product, and test it out in the market.

Getting a reaction quickly lets you know whether you have a worthwhile product and whether it's worth spending more resources on. Why waste thousands of dollars, and your life, developing a product no one wants?

When you market software or an online product, you have a definite advantage. You can create a [lean version of your product](#), and get it on the market quickly. If you're marketing hardware, you'll need to mimic this strategy to minimize risk.

Crowdfunding, email marketing and engaging your existing online audience are your best bets because these resources can drastically improve your success. Crowdfunding websites, such as [Kickstarter](#), serve a greater purpose than just revenue. They're the ideal place to get the market feedback you need, and your customers demonstrate their needs with actual money.

Instead of fully developing and manufacturing your new hardware product in volume, sell it while it is still in the development stage. Track comments and sales to see what works.

4. Start with small volumes.

You want to get your product to market quickly and inexpensively. Consequently, you may choose to set up manufacturing in Asia, and order large quantities to lower per unit cost and increase profit margins. But does it minimize your risk?

Manufacturing in Asia increases risk for several reasons.

First, it takes longer to get production up and running than it would closer to home. Second, it is much harder to monitor quality from abroad so you'll need to dedicate more time to the project. Finally, you'll need to order a larger quantity than if you manufactured elsewhere.

If you decide to go this route, you could find yourself stuck with a large amount of inventory that you can't sell, or you may end up with a defective product because you were unable to monitor it properly during the production process.

Of course, no one believes this will happen to them. You want your product to sell quickly and consistently, but the reality is that new startups often fail. Why take any unnecessary risks?

Manufacturing small batches, using a local company, is less risky. You'll be able to order less, and you're more likely to get what you want because you can monitor the manufacturing closely.

5. Build your audience before you build your product.

Developing a new product based on what you think people want is almost always a mistake. You should begin building your audience on day one so you can get immediate feedback while developing your product.

When you build your audience first, you get market feedback from potential customers. You also build trust with people who will want your product when you're ready to sell.

Hardware startups face steep challenges, but you can lower your risk and increase your chances of success by exploring these tactics. You can get your hardware product to market and make it profitable. Choose wisely, not recklessly.

The Hardware Code: How Hardware Startups Succeed Or Fail

 medium.com/sosv/the-hardware-code-how-hardware-startups-succeed-or-fail-82136f435864

November 29, 2018

We cracked the code!

A few weeks ago, the folks at CB Insights dug into their data to identify the causes of hardware startup failures.

Their short list included:

1. Lack of consumer demand,
2. High burn rate,
3. Lack of interest after initial crowdfund,
4. Product strategy mistakes.

Yes, make something people want, and don't run out of money.

But how to prevent that? We looked into what happened to our pool of 200+ hardware companies and came up with some insights, which became the presentation we gave in Paris at the ATOMS conference organized by Hardware Club (an early stage hardware VC). More details below.

Following the Toyota “Five Why” method for “prevention of repeat mistakes” (再発防止対策), we tried to find the root causes.

How to avoid lack of demand?

- Do proper research
- Clarify your and
- Determine , don't get carried away by the appeal of the spectacular-yet-useless (the “” problem)
- Make sure your price is ok (too expensive = no sales)
- Don't forget PR, marketing and distribution (the best tech won't win without visibility and a clear message)

How to avoid high burn rate?

- Move to where you have , and where you can . Time is money! The most suitable location might change depending on the focus (R&D, prototyping, production, sales, etc.).
- If your gives you not just a good price but . They can act almost like a bank and save your cash flow. Same deal for .

In fact, startups die because **they don't reach milestones that unlock new resources**. In some cases, it's not really "verified" demand — look at Magic Leap who raised billions without a product on market. In hardware, those milestones are generally: Lab prototype / Work-like-look-like / DFM / Product / \$1M sales, then \$3M, \$5M, \$10M... until profitability (though it doesn't seem to be necessary — Razer just IPO with a loss and is now worth almost \$5B).

How do you reach milestones?

By understanding it's all about **learning**, and **learning curves**. Beyond tech, founders need to learn about positioning, prototyping, manufacturing, PR, marketing, sales, distribution, logistics, financing, customer service as well as product management, team management and... self-management.

Learn fast, then execute. HAX was designed to accelerate learning. Our programs cover most of the skillset described above thanks to our team, curriculum, mentors, peers and alumni. Having over 100 experts in the same room is a tremendous advantage for problem-solving of any kind.

Which Startups Failed?

We haven't had major failures of late, but the **four main reasons for past failures** were:

- Sometimes they can expand, sometimes not. This was more common in the early HAX programs 4–5 years ago. Much less today.
- While not frequent, this is probably the highest risk before shipping.
- If founders tried hard for 2 years, are broke, and see no hope, we'll probably understand (and help). Before that, it might feel you just didn't try hard enough and that our money and efforts would have been better spent on someone else.
- You're running against the clock. Execute slowly and you'll surely run out of money before your next milestone. In some cases, this happens when founders go back to R&D — a risky move — instead of delivering a first less-than-ideal-but-still-acceptable product.

Which Did Well?

A fairly large number! To share a few examples (you will also see how Kickstarter results don't predict much):

- is a STEM robotics company. Came to HAX with early prototypes. Ran a Kickstarter, raised \$185k, shipped quickly with almost no extra cash. It became profitable in its first year thanks to a low-cost HQ in Shenzhen and online sales. It kept growing, raised a \$6M series A from Sequoia, then a Series B of \$30M. About 500 staff now and dozens of millions in revenue.

- is a brain stimulation medical device to treat depression, founded by a neuroscientist and a clinical psychologist. They came to HAX with an early prototype. Raised seed funding on an advanced prototype.
- makes camera-free home security devices. Came to HAX with little more than a concept. Clarified positioning. Ran a first Kickstarter, raised some angel funding, delivered their first product, signed B2B customers, raised seed funding, now running a new Kickstarter for their (2 years after the first) that is almost ready to ship.
- makes commercial cleaning robots for airports, hospitals, etc. They came to HAX with a rough prototype, which they greatly refined. Built the team in Canada at lower costs, signed customers, shipped products. Raised funding on traction.
- makes headphones that tune to you. They have been praised all over the web. They came to HAX with a rough prototype of earphones (not headphones), pivoted to an in-ear-over-ear design. Ran a Kickstarter and raised the most money for an Australian startup (). Raised a strong seed soon after. The press is now as they are shipping.
- is a watch to help kids build good habits. They came to HAX with a rough concept and prototype. We refined positioning, dropped all non-core features. They went to Kickstarter and , then prepped for retail immediately. Within 18 months they went from concept to shipping to Kickstarter backers, over 1,000 Target stores, and to Softbank in Japan. It was busy but they did it. They raised a seed round quickly. Today, their R&D team is in France, their sales in US, their manufacturing in China. They are taking advantage of several ecosystems.

As you can see from the examples above, **the milestones and trajectory of each company is different.**

What they have in common is **setting good milestones, being frugal, and executing well.** Funding comes, increases, and terms improve as you show time and again that you get things done and that money is in good hands with you.

What successful startups have in common is **setting good milestones, being frugal, and executing well.**

Bootstrapped

These are even more extreme cases: **startups entirely bootstrapped.** Multiple milestones with no extra VC money after HAX! It's hard to believe a hardware startup could do that, but it's true, and not even that rare.

- is a ping-pong training robot. The two Taiwanese founders (both Forbes Asia 30 under 30) prototyped furiously during HAX (one new version per week!), raised on Kickstarter and decided to live in Shenzhen frugally until they shipped. It's imminent.

- is a desktop printer for PCBs. The Canadian company won some awards (TechCrunch Hardware Battlefield, Dyson Award, etc.) and some grant money. They built their team in Canada, and shipped their product. They are now growing organically, and profitably.
- is a shape-shifting tool for manufacturing. It's a R&D-heavy product. The team is split between Canada and Shenzhen. Won some grants. Bootstrapping.
- is a "home barista" coffee maker. + amazing online marketing and pre-sales. Thai team based in Shenzhen until they ship (soon).
- is a desktop waterjet cutter. Team between Shenzhen (hardware) and New York (business / software). Raised —they could have shipped with that alone but raised a seed for safety and speed. Shipping first units soon.

Last but not least: Recoveries

When all seems lost sometimes there is hope, and some teams rose like phoenixes after a painful setback.

- , the IoT connectivity solution, had before joining HAX. They pivoted at HAX. The rest is history.
- is a smart toy for cats. Or more precisely, a tiny, low-cost, fast and smart robot. Despite cats and robots, the product scored just above (the custom rap song wasn't enough). The 3 founders (PhD in robotics) went back to R&D for 2 years living on... whatever they live on in Illinois, raised a seed round when a local angel realized the incredible tech they had (cats were not mentioned). Shipping their first product soon — your cat won't believe it.
- on Kickstarter, then one of the two co-founders left. Tough spot! The remaining one rebuilt a team (and lost some time of course), got the interest of B2B customers, then . Boom! Not your average Juicero here ;)
- , the everyday smart glasses. Their first product was a bluetooth earpiece to help drivers avoid drowsiness, a fairly niche business. The second product — over 2 years later — (I know that's a lot of HAX projects over \$1M —they are just good. And don't imagine they had tons of advertising money for it!). It wouldn't have happened without the knowledge gained from their first product!
- the anti-stress patch. A wellness device, borderline medical. Investors were reluctant to finance it before FDA or clinical trials. Almost out of money, they turned to Kickstarter and raised , the highest amount for such health tech device. They are now manufacturing in Shenzhen.
- the pipetting robot for biotech labs. Initially targeting big labs. We suggested crowdfunding it in case there was an audience of biohackers. They but got useful visibility with university labs and biotech startups. They also realized big labs were slow or unwilling to change they ways. Today most of their customers are uni labs and small startups. Interestingly I think something comparable happened to FormLabs (the 3D printer): their customers are neither individuals nor big companies, but smaller engineering and design shops.

Why Most Hardware Companies Fail--and How to Make Yours Succeed

 inc.com/mike-farley/why-most-hardware-companies-fail-and-how-to-make-.html

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Startup

It's time for entrepreneurs to think beyond gadgets.

By [Mike Farley](#), Co-founder and CEO, Tile@[mikegfarley](#)

Getty Images

An [aspiring entrepreneur](#) recently asked me how to win as a consumer [hardware company](#). My advice? Don't do it.

Most [investors](#) want nothing to do with hardware. It's expensive, has lower margins than software, and production and iteration cycles take longer.

A few years ago it looked like the consumer hardware industry was staging a comeback. But lately it seems the industry outlook is less optimistic. A number of companies the world expected to win big -- including Coin, Jawbone and Pebble -- are struggling, shutting down or fire-selling.

Yet crowdfunding sites -- which take a slice of every dollar start-ups raise on their platforms -- are clamoring for more. Kickstarter announced its "[Hardware Studio](#)" in May, which aims to help hardware startups figure out how to acquire the right components, find manufacturers and set the best price. IndieGogo [advises](#) builders of tech gadgets to "build a prototype" and "be open to change." It's a bit like taking violin lessons as your cruise ship slowly sinks.

With all that said, building a hardware business is worth pursuing if you understand why some companies fail and others succeed. Here are a few critical things I learned while building Tile:

1. Keep innovating and solving new problems

In the consumer hardware business, as soon as you ship a new product, you need to start planning what's next. Two startups best illustrate this: Jawbone and Pebble.

Jawbone raised \$930 million before liquidating in July, making it the most expensive consumer electronics startup shutdown of all time, [according to CB Insights](#). Business Insider pegged its downfall to a combination of flawed production and testing, and a failure to stay ahead of competitors.

Pebble, the smartwatch company that had crowdfunding investors swooning, reportedly received acquisition offers as high as \$740 million in 2015. Last year it sold to FitBit for an estimated \$40 million -- barely enough to cover its debts. What went wrong? Reviewers thought Pebble stopped evolving its product and lost its edge to newcomers such as FitBit and the Apple Watch.

2. Sell some razor blades

Every entrepreneur knows the maxim about razors and razor blades. There's a reason Gillette is a case study for success: Selling replacement parts are akin to subscription businesses, which are more predictable, have steadier revenue and lower churn rates.

Subscriptions can also be a winning strategy for tech hardware companies. Dollar Shave Club sells razor subscriptions as low as \$1 a month and was bought by Unilever for \$1 billion. Dropcam charged \$10 per month for a service that lets you control its security cameras with your smart phone and access video from the cloud. That additional services revenue stream attracted Nest/Google, which purchased the company for \$555 million. The company has since added even more subscription based products.

3. Tie your gadget to a critical service

In tight markets, nice-to-have solutions get crushed. Instead, build a must-have service that solves a critical problem. Ring makes a doorbell with a camera built inside, which it sells for \$199. The real value is in its app and service, which allows you to answer your door through your smartphone for \$3 a month. People are willing to pay for the monthly service fee because it gives them peace of mind.

4. Create a network effect

A network effect is when a service gets better as more people use it, drawing more people in. At Tile, our devices use Bluetooth to help people find misplaced items nearby. But when their items have moved from the last place seen, people can tap the global community of Tile users to help them out. Whenever a person with a Tile app walks past a Tile device, it sends an anonymous ping to our network so that they can find their things even halfway around the world. The more people who use Tile, the more anonymous heroes there are -- that's the power of network effects, and that's the part of our vision that our investors are most excited about.

If all you're doing is building a gadget, don't expect a lot of VC interest. If you want to win in the big leagues of Silicon Valley, wrap your product in a business model with a recurring revenue stream and a valuable service.

Jul 27, 2017

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Ideas To Focus The Challenges For Hardware Startups To Avoid Failure

 arpatech.com/blog/hardware-startups-failure-common

Hardware startups commonly observe to fail for certain reasons. Even, large business tycoons have disappeared from the scene. But, it does not mean that your will power had also suffered from that failure. Firstly, you should know the mutual reasons of failure in hardware startups. You should organize yourself along with your team to avoid barriers of the startups.

A common saying reveals that *hardware is hard*. But, it does not mean that it is not conceivable. You can dare say that the introduction of any hardware product is not that much easier. If you have started as the initial platforms; somehow, you must consider to proceed with the innovative idea of products.

Here, some ideas present to focus arising challenges on hardware startups and avoiding failure.

Misjudging Product Development Expenditures

It works well when necessary steps are taken to develop a product from scratch. It comes out with a huge budgeting which means its success to starting a new business using all the resources. But, you will find yourself still facing the expenditures on the trail to commercialization. Even, you may have heard several tales for other businesses which show what can truly occur. Something, when we do not precisely estimate our real costing budgets. Even though, huge organizations are earning millions and billions of dollars of revenues. Yet, they have forced the shutdown. Thus, the hardware startup underestimated not only the budgeting costs. But even, their development timeline ended up with a lot of irritated customers and major delays.

Dearth of Targeted Market Research & Confirmation

Market Research provides one of the major needs of any business startups and of course it is really significant when you plan to enter any industry. You got to have a proper research over the targeted market and should be continuously confirming the researching facts. It will help you focus your targeted market so that you can easily get the idea of specific industry which you are venturing into. Having quite many startups can create a situation with the products in a void, so only realizing that later will not be meeting the needs of their targeted consumers. So, you should have proper understanding of your customers and obtaining their feedback all the way through the process of development. This means quite good and necessary to have a successful startup.

Reluctance To Alteration Original Product Concept

For a startup of any business; sometimes, you think that the original idea will not work as you have thought to be. It means the product you finalized for your startup might not be as good as you dreamt of, so you might alter your thought over having a new product. Even, your designing concept might change due to giving preferences to your customers and manufacturing limitations. No wonder what the motive be exposed to have a change, but it makes clear a great thing to have a good idea. It will surely make you embarking and successful on this journey in the first place. But, you should feel ready to alter that idea if you think it necessary in the future.

Incorrect Manufacturing Companion

Finally, think over your business, you should remain confident to have the right manufacturing companion. It is necessary when coming to the level of manufacturing phase of your precise products. You will be attracted to certain things which will inspire and provide you an effective trail to your success. Your manufacturing companions must add services in different means to you as to speed up in every process. They should accurately confirm the reliability and the importance to remain open in communication. You will observe the precise characteristics to seek for contracting an authentic manufacturer who will make the most of your business needs on time. Many startups appreciate working with small business groups at the beginning. It observes to be advantageous because they think that their products will get real attention to them.

The Biggest Challenges for Electronic Hardware Startup



computingforgeeks.com/the-biggest-challenges-for-electronic-hardware-startup

Josphat Mutai

August 25, 2021

Bringing a new electronic hardware product to market, you will definitely face numerous challenges. The best way to overcome them is to identify and further learn about them in order to develop a plan to succeed. In this article, we will discuss such major challenges and strategies to cope with them.

1. Product Prototype

Developing a prototype is the first barrier that arises on your path to product realization. While a Proof-of-Concept (POC) prototype is relatively simple in creation, a production-quality prototype is very similar to the final product that you will manufacture at scale. For this reason, the latter is much more difficult to create. To be more specific, a production-quality prototype often needs both PCB for electronics and a plastic enclosure. Creating these two parts requires different types of engineering. So, it is nearly impossible for one engineer to cover both aspects. In order to overcome this challenge, you will have to outsource at least some of your development to experienced engineers. For example, you can contact an experienced team of Axonim that will help you to create both PCB and a plastic enclosure for your prototype. Still, outsourcing of any work requires financial resources, so if you want to launch a startup, you should either fund the development costs yourself, raise money from peers, or find an early-stage professional investor.

2. Scaling to Mass Manufacturing

Another important challenge is scaling your product up to mass manufacturing. This challenge is one of the most difficult to overcome. Its difficulty stems from a lack of understanding of the complexity and cost associated with going from a prototype to mass manufacturing of a product in large volumes on the part of entrepreneurs. To overcome this challenge, you should design your product from the very beginning with manufacturing in mind.

3. Low Profit Margins

In the case when your product is manufactured in small batches, your profit margins will be low. However, you can overcome this challenge by benefitting from the so-called economy of scale. In other words, with the increase of your manufacturing volume, the production cost per unit will decrease, thus resulting in higher profit margins. Be careful and optimize your manufacturing process before getting a higher profit margin.

4. Marketing

Finally, in order to be sold, your product should be properly marketed. Nowadays online marketing is of the highest importance, however, it is a very slow process. To overcome the challenge of online marketing, you should start to market your product as soon as it is possible. The sooner you start, the more time your online community will have to grow. You can also use the idea of crowd development involving customers in your product at the early stages of production.

Naturally, this list of challenges in launching a startup is not exhaustive. There are also numerous other challenges for electronic hardware startups. However, in this article, only the biggest challenges are mentioned. Hopefully, you will overcome all the challenges on your way to product realization. If you need assistance, contact Axonim. We will gladly help you to launch your hardware startup.

What are the Biggest Challenges in Starting a Hardware Company?

 ourbusinessladder.com/starting-a-hardware-business-in-india

May 30, 2016

Challenges of Hardware Business

Software startups are not a unique phenomenon anymore. Growing entrepreneurs have access to the best information software that could provide and a strong support system in the software industry. However, the same cannot be said for running a hardware business. It is not a walk in the park for the hardware guys as they must navigate various challenges of the hardware business. First, there is the hardware business plan. Then there is the whole shenanigan of hardware shop business. Having a hardware shop business is more work than one may think.

Hardware business in India is burgeoning as the direction of technological development is becoming a promising one, replete with various opportunities for ardent innovators. But this type of venture differs from other startups, and it requires the consideration of a few key factors. If you are willing to face the challenges of the hardware business, read on to know more.

1. Cost Challenges

The challenge with raising capital for a business is the first and foremost challenge faced by any entrepreneur. Hardware startups require even more funding than software ones. While setting up a hardware business in India, you need to have enough funds to nurture your startup. If you don't have the required capital, it is best to postpone your plan lest you fall in a financial rut. Make a hardware business plan, estimate the amount of capital you will need, and take things from there. Hardware development costs a significant amount of money. Do not underestimate development costs.

Also, you must take into account the money that can serve you in case of unpredicted expenditures. If you are new to entrepreneurship and want to run a hardware business, your best bet would be checking with a hardware business consultant. A business development consultant can help you with fine-tuning your idea and help at each stage of the business cycle. Also, in order to gauge the market, be sure to conduct market research. There are several market research firms in India that could help you. Remember, market research is always a good investment.

The Solution: Be sure to account for all expenses while computing the amount of capital required to run the business.

2. Prototype Challenges

Creating a model for high-tech merchandise takes a good amount of time (and not to mention the costs associated with it). In the course of creating and scaling a prototype for mass production, there are strong chances that your product has changed drastically. You will find the end product hardly resembles the product that you aimed for mass production. This could pose significant challenges in the long run – like issues with mass production, starting from zero, or even a delay in production.

A software product, being a virtual product, can be manipulated endlessly. A hardware solution, by contrast, is a physical asset and doesn't have any room for large mistakes. This means a significant challenge is faced during the development process. Also, the process of distributed development is not easy to manage. Transportation of hardware between locations takes a substantial amount of time.

The Solution: Undertake Design-For-Manufacturing (DFM) practices to make the process more foreseeable. Whatever the challenges are, do not limit yourself with one prototype. Adopt a strategy with supreme attention to visual work management tools, efficient management of resources' application, clear project priorities, and decentralized project management and planning.

3. Investment Challenge

As the world is geared more and more towards a technologically advanced future, it would be only natural that investors would be less willing to invest in a hardware product. They are reluctant to invest in something before it is a proven market. Many-a-times it is connected with their psyche, as most investors have some background in software and engineering, which means they can't assess the hardware with an unbiased view.

The Solution: demonstrate market validation and demand for the product. Crowd funding is your best friend. Tap into any opportunity that will help propel your business forward.

Get Details about Investment Management and Its Importance?

4. Manpower Challenge

The world of software affords a slew of manpower choices. In contrast, the talent pool in the hardware domain is much shallower. It means you might have a hard time finding a specialist who is skilled. Finding the qualified person who will suit your needs might be a bigger challenge.

A hardware startup requires the involvement of more people. Consider this: you will require sufficient manpower for the development process. There is, of course, a software process involved, requiring additional skilled people. You must have a communication strategy in place, and manpower to do the marketing.

The Solution: hire quality people. Prefer quality over quantity. Gathering talented people for making a stellar team is the key to a hardware startup's success. This should be your highest priority.

Read here to Keep Your Employees Happy—Engage Your Employees to Help Your Business

In conclusion, you need to be aware of all the hurdles beforehand and be prepared for everything that life throws in your way. The fact that setting up a hardware business in India is slightly difficult than your run-of-the-mill software company isn't a reason to despair. In fact, take that chance to be creative and make smart choices.

Despite all the challenges that may lie in wait, building a hardware startup from the ground up is a unique and inspirational experience. If you need help with your hardware business, then we can help you. We are one of the leading business development consultants and market research firms in India. We will help you from ideation to execution and everything in between. **Contact us today to know more.**

Why do most Hardware startups fail?

 zerynth.com/blog/why-do-most-hardware-startups-fail

Karim Hamdy

September 28, 2021

If you've ever been involved with a startup of any kind, you know that starting, managing, and scaling are the tipping points between their success and failure. Statistics tell us that about **90% of startups fail**, and another **70% of those don't succeed beyond five years**. Hardware startups are a subset that have their own special problems. They are more complex than purely based software startups.

Within this article, we'll concentrate on **hardware startups and explore ways to convert potential failures into success stories**.

Talk to anyone in the entrepreneurial ecosystem and they will tell you hardware is hard! Perhaps they are right. After all, hardware needs significant capital investment, has a longer development cycle, is part of a complex supply chain, and there are loads of challenges with handling and selling the product.

Hardware startups fail mainly due to technical, financial, or organizational challenges.

Let's take a look at the technical challenges:

1. Design-For-Manufacturing (DFM)

Entrepreneurs and product managers often focus on developing a Proof-of-Concept (PoC) or Minimal Viable Product (MVP) as quickly as possible in order to cut costs or raise capital based on that MVP. What they often don't take into consideration is **how they will transition from the PoC stage to mass production**.

While prototyping boards like Arduino or Raspberry Pi may be great tools for fast and easy hardware prototyping, they are not economically viable options for large-scale production, nor are they the best options available from a supply chain perspective.

For Proof-of-Concept prototypes, an off-the-shelf component or an enclosure or even a basic 3D printed enclosure usually works fine. As you progress with the development of your product, you will have to figure out how you can manufacture each component on a large scale. This is called Design-For-Manufacturing (DFM).

Design-for-Manufacturing (DFM) is the process of **designing parts, components, or products for ease of manufacturing with the end goal of making a better product at a lower cost**.

The sooner you begin incorporating DFM practices into your design the easier and less costly it will be when it comes time to scale up your manufacturing process.

The Design-For-Manufacturing (DFM) process should be used in all of the components of the product such as in PCB design, product enclosure, product packaging.

2. Unforeseen Technological Problems

IoT projects – as compared with traditional IT projects – may fail because of the **inability to understand the complexity of the project**.

Complexities arise because a lot of decisions have to be made in the planning phase before starting the development phase.

Complexities might also come from the volatility of the technologies and the reliability of vendors.

The longevity of IoT projects could outlast a number of supply factors, including the sunsetting of some cellular networks 2G and 3G, the acquisition or merging of some network operators and other partners and suppliers, etc.

Surveys show that industrial machines operate for more than 20 years.

Technologies used in an IoT project must be scalable and adaptable to future updates.

3. No clear definition of IoT use case

This is by far the most common reason why startups fail.

Introducing technology for technology's sake is among the most popular sources of IoT adoption-related problems. To put it simply, make sure you are not solving an issue that didn't really exist.

You can start by **defining your target audience** and conducting research to understand your customer base.

This not only keeps you focused on solving real problems but also helps you avoid feature creep.

4. Don't build a product, Build an Experience

Quartz's brilliant article on copycats of Kickstarter products is perhaps the easiest way to understand what the current state is in the manufacturing business.

Most physical products are not difficult to reverse engineer or replicate. Every product is prone to copycat manufacturing. For every innovative hardware idea, there exists a potential partner or competitor that can offer a similar product at a much lower price,

even if the product owner signs “NNN agreements” with potential partners before revealing any intellectual property. These agreements prevent partner factories from using the intellectual property themselves, (“non-use”), sharing it with others (“non-disclosure”), or inking a partnership and then selling extra units on their own (“non-circumvention”).

Even then, there's no guarantee that you can stop others from being a copycat of your product.

Your only competitive advantage then is to create a strong community around your product, build a brand, and offer great customer support so that you are not simply selling a product, but a great end-to-end experience.

How to get your hardware startup off the ground

 [startupguide.com/how-to-get-your-hardware-startup-off-the-ground](https://www.startupguide.com/how-to-get-your-hardware-startup-off-the-ground)

November 23, 2018

The road to creating a successful startup based on a physical product is fraught with challenges, many of them unexpected. Making the decision to produce a hardware product, and then building a company around it, means knowing the many steps between initial inspiration and market success.

GoPro, which is known for its action cameras, is an example of a company that deals with hardware. Photo: Unsplash/Frame Harirak

Starting a company is as challenging as it is exciting and is without a doubt an uphill battle – especially if you’re heading toward the steep climb that is the hardware startup.

Examples of well-known hardware startups which have been very successful include Fitbit, which produces wearable tech devices, and tech company GoPro, which is known for its action cameras.

In the world of entrepreneurship and innovation, we’re generally talking about consumer electronics products, often with layers of software developed for the device in question, when speaking about hardware.

Unlike many digital products, the creation of hardware involves solving a problem with a physical product, prototyping it, figuring out how to make a viable amount of the product for the target market, distributing the said amount to consumers, and many more steps.

Moreover, developing a hardware product is arguably more challenging than starting up with a software solution. Going into it, future failure factors include not getting the customer demand you want, having a high burn rate, and receiving little to no funding, leading to the inability to produce the devices you’ve designed.

It’s also expensive to build physical products and involves many moving parts (pun fully intended), and the pressure is on to make that prototype squeaky clean.

Sounds daunting, right? If you do manage to succeed with your hardware startup, you’ll have no doubt gone through a rewarding process filled with surprises.

We take a look at the basics of what you need to know before getting into the hardware game, from the initial ideation phase to developing the product. We’ll also get to everyone’s favorite part of the climb: financing options.

Prototyping and the MVP

One of the biggest steps in founding a hardware startup is prototyping the product, and creating the MVP (minimum viable product) to test your idea with your potential customers.

In this broader development phase, it's easy to get bogged down in iteration after iteration. In some ways, a product can never be too perfect. That voice at the back of every entrepreneur's head is whispering, "the product isn't ready, no one will want to use it!"

While this is, unfortunately, sometimes true, it's also a good driver to do one of the most important things in this entire process, which is to communicate with your potential customers.

Something important to note in creating your MVP is to have it solve the problem as simply as possible. The market is filled with tons of complex gadgets, so your product should be able to perform its function better than every other option out there. Think about where your product fits into a full customer journey.

Fitbit fitness trackers, for instance, originally only recorded steps and sleep. But as time went on, the company added more and more functions to solve one major problem in a variety of ways.

This is why you may want to release the product before you think it's ready. You're not launching a faulty product. Rather, you're offering up a prototype of your product to test if it has legs.

Take the iPhone as another example. It's now in an astounding number of pockets and bags all over the world. Originally, it was an iPod with a control wheel that iterated and iterated, evolving toward the device we're now all obsessed with.

While the chances are probably slim (no offense) you'll release the next iPod, if you solve your problem creatively with hardware that's excellent to use, improving your product based on market feedback might be better than releasing an overcooked product later in the game.

Getting funding

To add to the challenges faced by brave entrepreneurs and innovators with hardware startups, there is also the question of making enough money to keep the business afloat during the prototyping phase.

There are a number of options to think about, and there's no single right answer, though it's important to remember to hold onto that purpose and passion while researching funding options.

Probably the best funding option for a consumer product is crowdfunding, like with Kickstarter or another similar platform. Crowdfunding your hardware product will not only put you in the position to tell your story and compel people to join in before you even have a unit sold (or built, sometimes), it will also hold you accountable.

When you crowdfund your product, you are fostering direct communication between the startup and the end users and customers. The expectation here is that you will deliver as promised, and that can be as inspiring as it can be stressful. In the end, crowdfunding your product gives you that push to develop your first usable iteration, and an entire community from which to receive useful feedback.

You also have the option to seek investment from a fund to create your product, especially if it's in the field of impact innovation. Once you have an MVP and a clear message, you can make the move to an accelerator or an incubator and receive VC funding advice, or just strike out on your own and raise seed funding after some successful bootstrapping.

The biggest thing to remember when it comes to analyzing costs is that each pivot you make when developing the tech and the team will come with costs. Manufacturing plus distribution will be expensive. So when you eventually price out your product, don't be afraid to charge a bit more for it, because your dedicated customer base may be happy to pay for something of high quality.

Producing the product

Manufacturing the product is one of the most difficult steps. Depending on your product, you will likely have to manufacture a sizable number of units to make the whole enterprise worth it, and you will want products that don't fall apart upon first use.

As you are doing research for your product, make sure to take time to find out the best manufacturers (and designers, engineers, etc.) for the job. Determine whether the manufacturer has experience in your product type.

It's important also to be aware of differences in terms of language and units of measurement between you and the manufacturing country, so you can be as accurate as possible when turning your design into a product.

Most importantly, be warned that this phase usually takes longer than expected, and there will likely be errors. It's critical to budget in the time and resources to account for manufacturing issues.

As said before, don't be afraid to spend a bit more on the first iteration of the product, as you've already decided to price it higher for your loyal customers. You want that first physical object to be absolutely sleek and stellar to behold.

Photo: Unsplash

Telling a story

After all is said and done and you have a physical product you're proud of, you need to find customers beyond those who either funded the project in the beginning or were the initial users.

In short, people have to know your product exists. To make this happen, you have to tell a compelling story, using history and emotion to relate to your audience on a deeper level.

A good example of a product with a compelling story is the smart home water system, [Mitte](#). Not only is the Berlin-based company's product design simple and elegant, its story is also open, honest, and told beautifully.

Mitte lets their customers know the challenges and risks, and passionately explains the simple goal which drives the project. On the one hand, you want a sleek water purifier in your home, and on the other, you want to be contributing toward a global clean water initiative.

Hardware: The Struggling Segment Of The Indian Startup Ecosystem

 inc42.com/resources/indian-startup-ecosystem-for-hardware-startups

Arindam Paul

April 18, 2018

India is one of the hottest startup hubs in the world today. Numerous startups across the country have successfully established themselves as big players in the market. Of late, the Indian Startup Ecosystem has improved significantly. The primary drivers of this unprecedented growth are improved and easy access to capital, the presence of a massive domestic market, and an increase in nurturing mentors and incubators.

According to Somshubro Pal Choudhury, a renowned face of the corporate world, India witnessed tremendous growth in the software front **but has miserably failed on the manufacturing front**. He stated:

"Around 2010-12, we saw the emergence of the system design trend with many multinational corporations (MNCs) and design houses beginning to do design work in India...This was good news for 'Design in India,' but manufacturing was still being done overseas."

The rapidly escalating and maturing startup ecosystem in India is encouraging budding entrepreneurs and accelerating innovation. Government initiatives such as Design in India, Make in India, and Startup India, are empowering startups across the country to boost their innovation process. Such efforts have shifted the focus to the manufacturing sector. This bodes well for the hardware startup ecosystem in India. While most Indian startups primarily focus on e-commerce and software, the hardware ecosystem has so far taken a backseat.

While it is considerably easy for software startups to gain a strong foothold in the market, thanks to the strong backing and bulk of useful information readily available for them, **it is quite on the contrary for hardware startups in the country.**

Funding

The foremost challenge for every hardware startup is to get the financial aspect sorted out. Hardware startups require more funding than software startups as assembling and developing the product from scratch is one that demands a considerable amount of capital. Gaining the support of investors becomes tough as being a new player in the market, not many are ready to trust your product and invest in it. Having a concrete and well-charted business plan is a must to get the attention of VCs and angel communities.

Designing

Developing a prototype of a product is a meticulous task, one that requires a great deal of time and effort. And you cannot just rely on one prototype either. While this process is time-consuming, taking the successful prototype to the level of mass manufacturing is another herculean task for hardware startups. Also, procuring the raw materials for the product at affordable prices can be difficult at times.

Target Market

Identifying the target market for a product is essential for any startup. Unfortunately, this is where most startups lose their way and end up targeting all the wrong segments of the market. Just as researching for developing the prototype is important, so it is pivotal to have a good market knowledge. Hardware startups need to study the market sectors and see in which sector their product could be the most useful. This requires thorough research, but once the target market segment is identified, it becomes so much easier to curate the products accordingly.

Then vs. Now

Previously, most hardware startups used to be clueless about the basic things such as where to look for help, which markets to target, how to go about innovation and manufacturing, etc. However, the situation of hardware startups has significantly improved. Today, the number of hardware-centric accelerators and incubators in the country is rapidly increasing, providing hardware startups the necessary backup during the early stages.

Accelerators such as Intel India Maker Lab and Bosch, play a nurturing role for hardware startups by offering mentoring, funding, infrastructural incubator services, and so on. But this isn't enough. One of the biggest challenges for hardware startups is to find the right market opportunities in the fast progressing industry. It is a known fact that most Indian businesses fail because they cannot keep themselves updated with the latest technological developments. This needs to change immediately if the Indian startups want to make it big nationally as well as on the global platform.

Incentives and government aid can help transform the game for hardware startups. For instance, if prominent manufacturing firms associate with hardware startups, the volume of business for these startups and their market reach would expand. Such large magnates of the industry can help hardware startups by providing them with large contracts against a small percentage of the profit made. Also, government incentives can be a great boost for hardware startups. Singapore government's initiative is a fine example of this. Singapore government offers incentives to firms and organizations that procure products from startups. Similarly, if the Indian government also encouraged such incentive schemes, hardware startups would have more exposure in the market, which would undoubtedly mean increased sales.

So, while there have definitely been remarkable improvements in the hardware startup ecosystem in India, there still remains scope for improvement. Increased participation of the government, large industrial magnates, and incubators can improve the standing of

hardware startups and most importantly, encourage innovation.

Why Do Startups Fail? Because Hardware is Hard

 wired.com/story/why-do-startups-fail-because-hardware-is-hard

Erin Griffith

September 28, 2017

Few venture-capital investors have forgotten the story of Pebble: In 2012, after every VC firm on Sand Hill Road had passed on investing, the smartwatch startup raised more than \$10 million on crowdfunding site Kickstarter. It was an unheard-of amount for a crowdfunding campaign, and the resulting hype made Pebble an internet sensation. Then the VCs, suffering from FOMO, begged Pebble to let them invest. The startup eventually raised a total of \$59 million.

Investors have been loath to repeat the mistake ever since. Venture funding for hardware startups hit an eight-year high in 2016, with investors pouring \$4.4 billion into 624 startups, according to data provider CB Insights.

Likewise, hardware entrepreneurs are eager to use a successful crowdfunding campaign as evidence of customer demand for their product. If tens of thousands of people are willing to donate money or pre-order a product that doesn't yet exist, surely millions will want to buy it in a store, the thinking goes. More than half of gadget startups raised their first funding on a crowdfunding website, according to CB Insights.

But it takes time and a lot of money to bring hardware to market, and in the last year a number of well-funded hardware startups have flamed out spectacularly. Wearable startup Jawbone, backed by \$930 million, sold its assets earlier this year. E-cigarette company Njoy, backed by \$181 million, went bankrupt last year and liquidated its assets. Kitchen appliance maker Juicero, backed by \$100 million, shut down over the summer. And Fuhu, a tablet startup; Zeebo, a gaming console; and Hello, a sleep tracker; which each raised more than \$50 million, have ceased operations.

Amid the failures, it's increasingly clear that crowdfunding success does not automatically equate to widespread consumer demand. A [new study from CB Insights](#) analyzes the failures of 382 hardware startups, finding that the biggest reason they fail is a lack of demand for their products. In other words, a popular crowdfunding project can be deceptive. According to the report:

Startups are likely raising money to get to a limited release stage, and then finding that there is not a large enough market for their product to justify a larger raise and production at scale.

The study cites overspending as the second reason for failure and waning interest after an initial crowdfunding campaign as the third. On the surface, the reasons aren't too different from the reasons all startups fail. A [prior report](#) from CB Insights found that the top reason unsuccessful startup founders believe their companies failed is the lack of a market need for their product.

That may seem obvious, but the cult of entrepreneurship encourages startup founders to ignore signs that their idea won't work. Building the future around one's own vision requires a bit of irrationality. Startup mythology largely ignores failures, in favor of the rarer successes. As Steve Jobs famously said, "A lot of times, people don't know what they want until you show it to them."

It's an inspirational idea, but most startups fail to live up to it. Crowdfunding exacerbates this problem of false hope, making customer demand appear stronger than it actually is. Investors wowed by buzzy crowdfunding campaigns would do well to remember how the Pebble story ended: In December 2016, the startup shut down, selling its assets to competitor Fitbit.

Hardware Startups Have a Secret Strength

 earlyinvesting.com/hardware-startups-have-secret-strength

Andy Gordon

March 3, 2021

Hardware is risky. Making something you can touch and feel usually takes more money and time than developing software products.

Yet five out of the last seven startups I recommended to my *First Stage Investor* members are hardware (or hybrid hardware and software) companies. That's because in each of them something significant is offsetting the risks.

The journey these hardware companies take is complicated, expensive and requires founders to have diverse skill sets. It takes longer to develop hardware. And when founders finally have a product or prototype, they have to spend time reiterating on it to make sure it's ready for market. And that process can be expensive, complicated and time consuming too.

But where other investors look at hardware and see problems and potholes, I see defensibility. The harder it is to make a product, the harder it is for someone to compete with it. This is a huge deal. It's why hardware companies are worth investing in. But it often goes unnoticed.

Here's a basic list of all the tasks that go into bringing a hardware product to market... Design the product. Build a prototype. Experiment in-house. Tweak the prototype. Repeat a few more times. Make more prototypes. Send to customers. Selectively incorporate feedback. Build new prototypes. Send to customers again. Finalize the pre-commercial prototype. Build tooling (in-house or via a contract manufacturer). Develop supply chain. Build in redundancy. Lock in the cheap prices. Hire a logistics specialist or contract one. Develop a spreadsheet to manage cost (for goods and components, manufacture ops, shipping, warehousing, last-mile delivery and dozens more categories).

If you're making a consumer product good, then also figure out packaging, labeling, returns and shelf life. And develop software to collect data that will tell you which products to ship to which stores at what amounts.

This is by no means a comprehensive list. I just wanted to give you a general idea of what's involved. Not any one thing is daunting. It's the totality of what goes into manufacturing a product that makes it challenging.

CB Insights analyzed 400 failed hardware startups and found that one of the top two reasons hardware startups fail is a high burn rate. In other words, the journey is very expensive. The other reason is lack of consumer demand. That could mean a lot of things — bad pricing, bad marketing, etc. It could also mean if the hardware startup gets it wrong the first time with customers, there's no do-over.

So hardware isn't easy. But that high level of difficulty also carries an enormous advantage. Because it's so hard to build an innovative hardware product, it's also much harder to build a better one. That's defensibility.

As an investor, you don't have to know all the gritty details about manufacturing. But apart from defensibility, you do need to know if the company has a firm grasp on these three critical areas...

1. **Operations.** I believe the leaner the better. In particular, shortening product development cycles and iterating as rapidly as possible — while getting feedback to achieve product-market fit — is a boon to a hardware company. Also, contracting out as much as possible. Other people may disagree, but in my book, the more that's farmed out — from engineering to manufacturing to logistics to e-commerce — the better chance startups have of doing more while spending less. But as the next rule suggests, finding that balance isn't easy.
2. **Finances.** The challenge is to deploy best-of-class contractors, partners and hires within a responsible budget. Costs can quickly mount by doing too much in-house. But they can also add up by using top-of-the-line third parties that are expensive. The best founders know where to find bargains. They also master the fine art of determining when it's worth spending money and when it makes sense to go with a cheaper alternative.
3. **Scaling.** This is a whole new ballgame. Has the company developed the software and physical infrastructure, expertise, organization and skill to transition from small-batch production and modest marketing and sales to something much bigger? If done right, the company can reap significant economies of scale, fatten margins and unleash revenue growth. But if not done right, it becomes a big and usually unfixable mess.

Scaling is often years down the road and therefore not an issue of immediate concern for some early investors. But it should be. Even at an early stage, hardware companies should develop *scalable* supply chains and fulfillment infrastructures, *mass scale* contract manufacturing and *multi-year* contracts with third-party logistics, warehousing and marketing partners.

The biggest myth about hardware startups is that they have to settle for slim margins. That's too simplistic. It varies from company to company. But it's certainly not a death sentence for those that do bear slender margins. Vizio has thrived as a high volume and low margin manufacturer of large-screen TV's. Last year it raked in more than \$2 billion in revenue. Its net income was \$102 million — not great but more than sufficient for it to file for an initial public offering this week.

But many hardware companies sport generous margins. I just recommended a hardware company that sold its product for \$5,300 or higher. Its cost of goods was \$1,000. As it scales, it aims to drive down costs to around \$350.

I take the talk of high costs, long runways, extended product iteration cycles with a grain of salt. America has always excelled in manufacturing. And startups are upholding this proud tradition. Their upside can be every bit as enticing as software startups. And because it takes more than a couple of coders on laptops to develop a product, hardware startups provide plenty of defensibility in addition to upside. And that's the recipe for a good investment.

3 Reasons Hardware Startups Fail by BOLT Labs

On citizentekk.co/hardware-startups-by-ben-einstein-of-bolt-labs

April 8, 2013



By Ben Einstein

All startups face a mountain of challenges. When you throw a hardware product into the mix, that mountain inherits sub-zero temperatures and a record-setting blizzard. The path is not insurmountable, but hardware startup founders should carefully plot their course on their way to paying customers.

Founders of early-stage companies typically have two foci: cash and product development. Once founders nail the cash problem (whether through private investors, venture capital, Kickstarter or couch change) companies shift into high gear to make as many copies of their product as fast as possible. Despite their best efforts, first-time hardware developers often wind up with over-priced products of lower-than-expected quality delivered behind schedule. This trifecta of failure is driven by the same three things....

EXPERTISE

Manufacturing is harder than distributing software, but it's not impossible. If you were to ask Apple or Dell what the biggest problem they face with new products is, I guarantee you it won't be manufacturing. Manufacturing won't even make the top 5. But if you were to ask startups the same question, it almost always is . Think about why that is. They hire people that have done it before . It's worth every penny.

PLANNING

Timing is everything. Understanding a few basic facts about how products move through the manufacturing and distribution systems can make the difference between a blockbuster success and dismal failure. Avoid development feature creep like the plague. Anticipate at least one component in your product will go missing/lost/too expensive/long lead time and plan for replacements. Always factor in shipping and customs time + 50%. Know that most retailers lose money every month except December. Test everything.

ECONOMICS

There are really two factors at play here: what I call "microeconomics" and "macroeconomics". Microeconomics are things like your Bill of Materials (BOM) and Cost of Goods Sold (COGS). Own these numbers. Know that every penny counts. Consumer products typically see a 3-4x increase to the shelf cost (ie. a microprocessor that costs you \$1 more means the end price of the product needs to be raised by \$3 – \$4).

Macroeconomics relate to the product/market fit and how many products you need to build/sell to get to your next stage of development. Every single time you approve a product run, you should have very specific metrics of what you want to learn. The oft-used

“make as many possible and sell them all” doesn’t cut it unless you want boxes and boxes of costly leftovers.

These are a subset of some of the pitfalls and how they can be avoided. If you have specific questions regarding product development and/or manufacturing, feel free to contact us at help@bolt.io.

Ben is the Managing Director of Bolt, a Boston-based program that helps promising early-stage hardware companies develop their products and get to market. Bolt provides companies with capital, staff, shop equipment, and extensive expertise with manufacturing and commercialization.

Ben Einstein

Manufacturing challenges for hardware startups

 merudynamics.com/post/manufacturing-challenges-for-hardware-startups

The manufacturing industry is evolving with new manufacturing technology and materials. However, early stage hardware startups face challenges in keeping up with these changes in manufacturing and figuring out which manufacturing technologies and materials are required for a given application.

This article explains three key challenges hardware startups face and how cloud manufacturing as a service can help solve them.

Finding the right manufacturing partner

Looking for a manufacturing partner is like looking for a needle in a haystack. This involves searching for manufacturers, going through loads of quotes, explaining requirements, waiting for design feedback, back and forth communication, and so on. On top of this there is a trust issue if the manufacturer will deliver parts on time or as per expected quality.

Once startups bog down in manufacturing inefficiency, then the product deadline begins to slip and mount additional expenses.

The early days of any startup are constrained by money and resources. The greatest strength of any startup is customer interaction and hyper focus on product development.

MeruDynamics solves these manufacturing inefficiencies with software defined manufacturing. Our customers can go into manufacturing in minutes and not weeks. We save our customers time and resources so they can focus on product development.

Product Quality

There are loads of examples where early-stage hardware startups were in trouble because they worked with manufacturing partners who delayed manufacturing parts because of poor DFM feedback or substandard manufacturing quality. Further companies with bulk orders tend to get more attention from good manufacturers compared to low-volume orders by startups. This has resulted in many startups growing frustrated because their quality expectations are not being met.

The MeruDynamics manufacturing rating system and vetted manufacturing partner network solve quality problems. And low-volume orders can be bundled from multiple startups and sent to top manufacturers.

Manufacturing expertise

Hardware startups have high expertise in terms of product development and innovation, but when it comes down to manufacturing things change. Startups are short-handed in terms of manufacturing expertise as big companies have resources to attract skilled engineers. This means startups have to find solutions themselves or hire external consultants which might complicate things.

Taking advantage of established expertise through a cloud manufacturing service like MeruDynamics can alleviate these skill shortages.

Overcoming the Challenges of Being a Hardware Startup

 knowledge.ulprospector.com/3899/pe-sa-challenges-hardware-startup

March 23, 2016

Paid content by Dassault

In many ways, starting up a new company is easier than ever. Thanks to the Internet, even the smallest of companies can have a global presence. Crowdsourcing platforms can take the funding conundrum out of the equation. In addition, 3D printing enables companies to get prototypes built quickly and at less expense.

Despite all of this good news for entrepreneurs, it's still not an easy endeavor. Taking cues from some hardware startups who have successfully navigated the hurdles, here are some lessons learned from their experiences. While it's not a sure-fire recipe for success, a lot can be learned from these now-seasoned entrepreneurs.

Securing Funding Through Different Sources

Some of the biggest challenges facing any hardware start-up involve locating sources of capital. Many start-ups are initially run through bootstrapping (self-funding), which can get you through the short term, but may leave you with mountains of debt. In some cases, hardware start-ups are formed out of extensions of collegiate projects or research. In these cases, universities can often provide some initial research seed funding to carry the project for a little while. However, good entrepreneurs plan their funding route long before they run out of money.

Funding can come from many sources and will depend on the stage of your company. Many high-tech hardware start-ups look to local colleges and universities for innovation challenges and competitions. In addition, some large tech accelerators run contests with winners at the local level advancing to regional levels and beyond to compete on the national stage.

Many high-tech hardware companies take advantage of government grants. Many states offer grants to fledgling start-ups in an effort to not only help them grow, but to keep their employment in-state. Be aware, however, that applying for government grants is time-consuming and can take up a lot of resources.

Crowdfunding is another source of funding that has become popular over the last few years. Online crowdfunding companies like Kickstarter and Indiegogo offer platforms for companies seeking capital to raise money through donations. In essence, a company can get hundreds or thousands of smaller donations amounting to millions of dollars. At the same time, crowdfunding allows the start-up's founders to maintain a greater share of the company's equity and control. Many companies choose this route early on when they need to prove market demand to angel investors or venture capitalists (VCs).

Another interesting aspect of raising funds in the hardware space is how it is often tied to having a demonstrable prototype. In many cases, especially in high tech, investors want to see how things look, feel, and work before they invest. Entrepreneurs in this space will benefit from building a working prototype as early as possible; otherwise, they risk being unable to secure funding at required times.

What Type of Prototypes Work Best?

The ability to quickly and efficiently design and build a prototype can be a key success factor for many hardware technology start-ups. In many cases, additional capital hinges on the company's ability to have a working prototype as early in the process as possible.

Creating physical prototypes can be expensive. Start-ups trying to conserve cash may need to create multiple versions of the product as they progress through the early stages. Wearables, for example, which incorporate both hardware and software components, require more physical prototypes than other products. Some wearables are considered safety equipment, which must be certified to meet government safety standards.

In many instances, hardware companies can more effectively perform part and system stress-testing through simulation. This enables cost-effective testing prior to parts going to the factory for production, avoiding the problem of finding out later they may not work correctly under load. These mistakes can be costly for any company, but are more magnified for start-ups that do not have extra capital to waste. Many hardware startups use computer-based analysis tools, such as SOLIDWORKS Simulation solutions, to help them cost-effectively test and validate their designs.

Protecting Intellectual Property (IP)

In the hardware world, patents create a sustainable advantage for technology companies. Protecting your original designs and technology not only builds a competitive barrier to entry, but can also put small companies in a position of strength.

IP can come in many forms. At its simplest form, entrepreneurs think about IP as design and technology developments, however, it can also include employees, partners, suppliers, and contractors. Creating and using proper documentation can make a huge difference down the road.

Many startups are also unaware that in the legal world, there is a concept called enabling public disclosure (EPD), which means you have publicly shared enough about your product to allow someone with the same level of knowledge as another in the industry to copy your product. Common examples are exhibiting the product at a trade show or within an article in a publication. One year following an EPD, you cannot patent that product or invention; therefore, it is important to keep your technology out of the public eye until you are confident it is legally protected.

The Bottom Line: It's Not Easy

Starting a hardware company is a daunting task. Entrepreneurs face a lot of hurdles. It can be a lonely journey, fraught with many uncertain times. Understanding how other entrepreneurs have successfully navigated these hurdles can improve your odds of success. Read the white paper, "[Navigating the Hurdles of Hardware Startups](#)" to hear their real-life success stories.

How to Tackle Product Manufacturing Challenges as a New Hardware Startup

 onaplatterofgold.com/new-hardware-startup

Anthony Williams

29th August 2019

how to overcome new startup product manufacturing challenges

Are you a new hardware startup looking for the best ways to tackle product manufacturing challenges? Hardware startups are on the rise. Thanks to new technologies, the big push towards smarter devices and **Internet of Things (IoT)**.

Nowadays, more startups are founded based on hardware innovations in an attempt to solve problems that require hardware-based solutions.

Of course, starting a hardware startup or **launching a new startup**, is not without its challenges. Similar to the way software startups must manage their development process, hardware startups often face challenges in manufacturing products.

These challenges make entering the hardware landscape exciting. And, more importantly, the manufacturing challenges you may (and will) face as a new startup are easier to solve than you think with these tips and tricks we are about to discuss in this article.

#1]. It Starts with Good Design

Product design is a process that requires a lot of attention to detail for one particular reason: a well-designed product is easy to manufacture.

When you get the design of your board, case, and other components right, transitioning from the design phase to manufacture phase becomes easy.

A lot of design tools available today are positioned to solve this challenge. Rather than requiring you to develop multiple prototypes, the available design tools come equipped with robust 3D environments and testing tools.

You can even start sourcing components as you design your next product. Tools like Octopart let you **gain access to everything from small screws to supplies** made by Aviditi. The whole process becomes part of manufacturing planning.

#2]. Plan for Problems

Thinking about manufacturing challenges as you design your product helps eliminate some of the more common issues. Rather than waiting until you face difficulties in trying to bring your product to the market, it is better to anticipate those difficulties during the planning stage.

With an **optimized product design** in hand, you can utilize rapid prototyping to develop several models and prototypes. Don't just focus on producing a working prototype either.

Experiment with the different ways your product can be manufactured. There will be times when minute changes are the most substantial ones to make.

Moving the position of a screw by a couple of millimeters or altering the corner shape of your product case are the kind of changes that can help you avoid problems altogether.

#3]. Be Flexible with Your Process

You don't have to establish your own manufacturing line to bring your brilliant product idea to life. There are third-party providers that rent out their manufacturing lines so you can make your product faster and cheaper.

Working with third-party manufacturing companies, however, requires some degree of flexibility. You must be willing to take input from those who will be handling the manufacturing process, mainly because they have more experience in the field.

The input you get is actually invaluable to the **success of your product**. When your manufacturing partner suggests ways to simplify the production process, they are basically suggesting ways to make your process more efficient.

At the end of the day, an efficient process, along with good product design and problem-free manufacturing, is the kind of competitive advantage you want in today's market. You can bring your product to a suitable market segment faster and cheaper this way.

Hardware Startup from Home: Early Challenges and How to Overcome Them

 mystartupland.com/hardware-startup-from-home-early-challenges-and-how-to-overcome-them

September 11, 2019

If you have been following our posts about home business ideas, you know that there are a lot of possibilities waiting to be explored. Starting a hardware company, however, is becoming increasingly popular as the landscape becomes more accessible.

You, too, can turn your ideas into tangible products that customers can buy. You don't need an engineering degree or a large team of engineers to create hardware that solves real-world problems. There are, however, some challenges to overcome before you can begin manufacturing your product.

Market Fit

Having a product idea is only the beginning. You also have to think about whether that product idea fits the market. Ideally, you want a product that solves real market problems, but even this type of idea needs to be validated.

An easy way to validate your product idea is by measuring its market size. Start with a problem that you want to solve. Think about the market segment in which your solution will be appreciated the most. You can then measure the value of that market segment.

You can also validate your product idea by speaking to potential customers directly. Make sure you are careful when sharing your ideas, and only discuss the product idea with those you fully trust. You can gain plenty of insights while keeping your product development process in check.

Hardware Design

Hardware design is the biggest obstacle of them all. Simply having a mature product idea is not enough. You have to work on the schematics for your product, design boards based on those schematics, and think about how to best package your product.

Fortunately, there are many resources to help you complete those tasks. For example, you can design a round PCB that works efficiently and can be manufactured easily with the help of Altium Designer. The PCB design software can also be used to handle essential details like making sure that the components you use fit together well.

Hardware design is also made easier thanks to rapid prototyping. You no longer have to spend months developing mechanisms and cases to take your product idea into its mature stage. Rapid prototyping allows you to print 3D models in hours or even minutes.

The Perfect Product

There is a reason why engineers now adopt minimum viable product, or MVP, as an element of engineering projects. Instead of working to create the perfect product from the start, it is a lot easier to set milestones and start the development project with an MVP.

Once you have reached that MVP, you can begin finding things to improve. Continuous improvement becomes part of the development process. The approach will not only reduce the time needed to complete a product development but also make the final product better.

These three challenges always come early in the development process. Now that you know how to anticipate and overcome them, you can plan your development process better, get cracking on your product idea development, and bring your product to the market sooner.

The three biggest challenges facing startups in the Middle East

 zdnet.com/article/the-three-biggest-challenges-facing-startups-in-the-middle-east

Damian Radcliffe

The Middle East's startup landscape has changed significantly in recent years. Initiatives such as Abu Dhabi's [twofour54](#) and [Flat6Labs](#) in Cairo have provided the means for entrepreneurs to develop their skills and businesses, alongside increasing investment opportunities from global funders like [500 Startups](#) and regionally focused efforts such as the Amman-based [Oasis500](#).

But despite this progress, a number of infrastructure, financial, and people-orientated challenges remain. Two separate reports published in the last month -- [one](#) by Wamda Research Lab and the [other](#) by Dubai Silicon Oasis -- highlighted some of these issues, and the need to address them if the full potential of tech entrepreneurs in the Middle East and North Africa (MENA) is to be realised.

Funding

As with most regions, issues related to investment and cashflow can be key challenges for MENA startups. For Middle East-based entrepreneurs, particular obstacles exist in terms of the lack of larger funding levels and follow-on investment.

The authors of Wamda's report noted that "funding gaps are particularly acute for sizes of \$500,000 and above," while Dubai Silicon Oasis's study stated that "the top two predominant financial challenges are access to capital and lack of financial support from banks".

Although there is generally an acknowledgement that these situations have begun to improve, both documents highlight that many banks and investors in the region fail to understand the startup business model and the need for long-term investment. As a result, 72 percent of Oasis's respondents stated that they found it difficult to fund their business, and just 12 percent of the 220 participants in Wamda's research said they had received access to loans.

"Financing and de-blocking funds is a long process," one Syrian entrepreneur said. "Even after approval it took a good four months for the funds to go into the bank account."

As a solution, 70 percent of entrepreneurs claim to self-fund; and many startups -- especially in the [Gulf Cooperation Council \(GCC\)](#) -- admit to often relying on financial support from family and friends.

That said, Wamda's analysis does highlight the emergence of "business accelerators, venture capital funds, angel investment networks, and even a small cohort of crowdfunding platforms" across the region in recent years. However, for many startups these sources are often insufficient for their needs.

Red tape

Interlinked with the challenge of attracting funding, many Middle Eastern entrepreneurs find their efforts further hampered by legal and logistical roadblocks.

Issues clearly identified in Oasis's report include high fees for business registration and licensing, ownership structures, and unclear legal frameworks. Eighty-one percent of their survey respondents said they found it hard to understand governmental and legal regulation, whilst 62 percent acknowledged bureaucracy and red tape as a major barrier to progressing their ideas.

William Fellows, of the advisory and investment company Lixia Capsia, is not surprised by the findings. "With some important exceptions like Morocco, regulation and legal frameworks make SME lending very difficult," he says.

The authors of Wamda's study were even more explicit in this area, stating that "tax and business laws in many countries are subject to spontaneous revisions or else enforcement of these laws is subjective".

As a result, the experience described by one Lebanon-based entrepreneur in Oasis's study remains all too common: "Everything [is] in Arabic and for people who are not proficient with the language, it's really hard to [go] through the process alone. Moreover no proper information is available online. If you need answers, you need to go down to the institutions who ping pong you from one person to another."

Skills and talent

Although more funding and less red tape would help Middle Eastern startups, both entrepreneurs and investors have recognised additional areas which -- if addressed -- could potentially aid the development of this nascent sector.

Of particular note was the fact that over half of the 65 investors interviewed for Wamda's study felt that MENA's entrepreneurs lacked strategic planning and decision-making skills. Forty-four percent also conveyed concern at the lack of financial literacy skills among entrepreneurs, and 29 percent of funders "feel that entrepreneurs lack the ability to pitch their ideas effectively". (Given these misgivings, sometimes it's a wonder that so many of MENA's startups get funding in the first place.)

For entrepreneurs, 30 percent of those interviewed by Wamda expressed the view that they would like to see investors offer value "beyond cash". Oasis' study meanwhile highlighted more logistical complications, such as securing visa and work permits (65 percent), the availability of technical staff (66 percent), and the cost of acquiring qualified personnel (76 percent).

"Convincing talented developers to leave corporate jobs and join a startup" is a major problem, said one Egyptian entrepreneur, nevermind "retaining the talents with the low salary budget we have".

The future

Many of the issues faced by MENA's startups are not unique to the region, although local markets do have distinctive characteristics, which means that no two environments are ever exactly the same. Subsequently, solutions to their problems often need to be localised too, even when there is consensus about the founding principles on which to move forward.

The World Economic Forum captured ten of these solutions in a [2011 paper](#) titled, *Accelerating Entrepreneurship in the Arab World*. Although MENA's startup environment has clearly matured since then, their conclusions remain highly pertinent. Their suggestions included: a multi-stakeholder approach to develop a culture of entrepreneurship, bringing these values into the classroom and the office, embracing the Arabic diaspora, and encouraging VCs "to go beyond funding and provide a support structure for entrepreneurs".

Elements of this are already in place, but clearly more can be done. Perhaps most importantly, as Emile Cubeisy - managing partner of Silicon Badia in Jordan - has identified: "There is a huge need for success stories to enlighten the ecosystem."

After all, nothing breeds success like success.

Hardware Startups: The Way Ahead

 electronicsforu.com/career/hardware-startups-way-ahead

3 January 2018

The boom in demand of electronics device/gizmo has triggered growth of hardware startups around the world. According to a joint study brought out by Assocham and NEC Technologies in the year 2014, India's total electronics hardware production estimates for 2014-15 stood at \$32.46 billion which is about 1.5% of world electronic hardware production. The domestic consumption of electronic hardware in 2014-15 was \$63.6 billion and 58% of this demand was fulfilled with imports. This opens up a huge opportunity for hardware based technology startups.

India has been traditionally very strong in software and tech-enabled services startup area. However, hardware startups face a very different set of problems in comparison to these companies. These challenges are related to longer innovation cycle, technology infrastructure requirement for manufacturing and fulfilment, competition from low cost devices from other countries, to name a few. This makes building a hardware company a much more involved process than software or Internet related models.

The Government, realizing these challenges, has taken significant steps to support hardware startups ranging from setting up hardware oriented Incubation Centres such as Incubation Centre IIT Patna to incentivizing companies in the sector by various policy reforms. This is expected to enable the ecosystem where hardware startups can survive and thrive.

Basic Challenges for hardware startups

Accessibility to relevant technology:

Skills and infrastructure are two key requirements for hardware companies. For startups in ESDM and related sectors such as IoT-enabled devices, it will be critical to have access to infrastructure for prototyping and to skilled PCB designers and manufacturers with the right technology for production.

Longer innovation Cycle:

Hardware prototyping iterations are longer and complex. Unlike software, each iteration of product development leads to larger lead time and investment. Lack of right prototyping infrastructure and expert guidance can jeopardize a startup's attempts to be early to a very competitive market while remaining cost effective and viable. Labs that will enable rapid prototyping and involvement of seasoned mentors are critical to work around this challenge.

Competition from global players:

Increasing competition from cheaper hardware products from other countries is a major threat. Since India is a price sensitive country, buyers often prefer low cost products over good quality. Beating competitors in the price game may be some time away for Indian startups. However, the differentiation Indian startups should rather be in the innovation/intellectual property component, thus pushing their product up the value chain.

The Way Forward

Government has been consistently working to create basic elements for the ecosystem to thrive. Electronics Development Fund (EDF) has been created to help generate an ecosystem of R&D in electronics in India to promote IP generation and large-scale manufacturing.

One of the major steps has been the initiative to fund and set up Incubators focused on hardware oriented startups. Incubation Centre IIT Patna (IC IIT Patna), the leading technology incubator by IIT Patna is one among them.

ESDM(electronics system design and manufacturing) incubators such as IC IIT Patna help startups by eliminating some of the major challenges they face. Having set up world class prototyping labs, tools for prototyping and fabrication have become more accessible to startups through the incubator. Trained staff adds some of the essential skills required for initial stages of prototyping which is a boost for the startups.

The expert guidance of both technology and business mentors and the access to state of the art infrastructure helps startups to manage the issue of longer innovation cycle. The startups are guided at these incubators to study the market, optimize product features and encourage them to a fail-fast approach so as to shorten their time to market. This not only reduces the overall costs involved, but also makes the product fit to the market.

The incubators very often offer seed funding to incubated startups. IC IIT Patna offers seed fund of upto Rs 10 Lakhs and connects the startup with various government agencies and departments like BIRAC for additional funding if needed. Bionic Hope Pvt Ltd, a hardware startup incubated at IC IITP has received additional funds of 43 lakhs from BIRAC for its product prototyping.

IC IITP has been playing a major role in ecosystem development by reaching out to colleges in Bihar and neighboring states to conduct awareness sessions for technology students on hardware based entrepreneurship. In the recently concluded national level Medtech Hackathon, it sought solutions to predefined problems from the participating teams. IC IITP provides a unique platform for the aspiring entrepreneurs and startups. Startups or startup aspirants can apply for Incubation by sending their business plans to iciitp@iitp.ac.in.

Why hardware startups fail or struggle

 vator.tv/news/2017-11-07-why-hardware-startups-fail-or-struggle

November 7, 2017

Hardware founders share their advice on how to scale a hardware startup

In November 2016, I wrote a piece about the top 10 biggest deals in the healthcare wearables space, listing the companies that had raised funding up until that point. They included companies selling direct to consumer products, as well some that were developing sensors to be fitted into other devices, but all had been fairly successful in getting investors interested.

Not even a year later and already two of the companies on that list have been forced to shut down.

Last week, wearables technology company Doppler Labs announced in a blog post that it would be closing operations. That followed a similar announcement from the company with the largest funding round of 2016: Jawbone, which shut its doors in July.

"This is not because our vision of the future is not going to happen. We are actually more confident than ever that it will. Amazing hearing aids will be available at lower prices, and you will be able to tune them yourself. Tens of millions of people will be interacting with audio-based smart assistants, translating hundreds of languages instantaneously, and even going without their phones because smart earbuds will give them access to the people they love and the data they need," Doppler wrote.

"We wish we could have been the company to establish this future, but we know others will build on what we started, and we'll be rooting them on."

So what happened? In an extensive interview with Wired, Doppler Labs founder Noah Kraft explained some of the reasons his company was forced to shut down, including running into a situation where the company did not have enough money to get its second product into production, but had raised too much to ask for more. Founded in Doppler had raised a \$24 million Series B round of funding in July of last year, bringing its total funding to \$50.5 million.

Stuck in no man's land, it tried to sell itself, but the deals all fell through. With no other options, it had to shut down.

If companies like Doppler and Jawbone, which itself had raised nearly \$1 billion before its own downfall, couldn't make it work, what does that mean for companies still looking to raise money for their own companies? What are the challenges and problems that companies face that make it difficult to succeed in hardware?

I reached out to a slew of hardware founders and CEOs to ask them about some of the problems that they've experienced in trying to get their hardware companies off the ground.

Hardware is hard

Surely you've, at some point, heard someone utter the phrase, 'Hardware is hard.' It's almost a cliche at this point, a mantra that's repeated over and over to explain away the difficulties of an entire space. But what does it actually mean? Why is it so difficult to start and maintain a company that actually makes something?

Some of the issues that affect hardware startups simply come with the territory: these companies are actually making a physical product, not just lines of code, and that means additional manufacturing costs and time.

"In my experience, when building a disruptive hardware product, it always takes longer and costs more than expected. There are many unknowns that you can't always plan for," said Michael Garel, Founder and CEO of eyeQ, an in-store brand management platform.

"Many components, especially the more complex, and typically critical, components usually have long lead times - meaning it could take weeks or months after placing the order with a component manufacturer, before the component arrives. When building a new product, you may not have the bill-of-materials finalized until you are nearly ready to ship the product. As a small, lean, startup - you need to carefully balance the risk of ordering components early, always knowing that you might not actually use that part, or need to order a completely different one. Especially if you are expecting significant volume at launch. In our experience, however, some of the component distributors may be willing to work with you to help secure the supply with limited risk. But, it's hit or miss depending on the component, vendor, and distributor. So, in the design process, make sure to take into account lead times when selecting components."

One problem that founders may not anticipate, for example, is having to deal with foreign countries to get parts made, Ned Sahin PhD, founder of Brain Power, told me. The company makes wearable artificial-intelligence systems to aid people with brain-related challenges.

"Pretty much, if you are making some kind of gizmo or anything with plastic shell or a circuit board inside, you are probably doing to have to deal with China for manufacturing. That could be directly or indirectly, via a contract manufacturer, but nonetheless you are dealing with some major issues you may not have anticipated," he said.

"What do you think are the chances of something NOT going a bit wrong in translation when dealing with a country and culture and language so far from your own? How do you think you are going to get into queue with a manufacturer there who is shooting off a million parts for one client and 10 million for another - before breakfast? Do they really

care to listen to some millennial flaming them out because their 2000-unit low-production-volume mold yielded parts 1 millimeter too short in one dimension? Why should they care?"

As a result, the iteration process for a hardware company takes much longer, and therefore costs a lot more, than a company doing software, where, if there's a problem, someone can just go into the code and fix what's wrong. With hardware, going back and fixing a potential problem means having to redo all of your work, something that can be a costly, and potentially fatal, problem.

"My father taught me to measure twice and cut once," said David J. Whelan, Managing Director of Bespoke Business Strategy, a company building businesses and inspiring entrepreneurs at the intersection of technology, health, and wellness. "That rule of thumb is especially important in the world of hardware. With software, you can roll out a buggy beta and keep updating the product, sometimes daily, until you get it right. If you make a mistake, you can fix it. The product gets better over time. With hardware, you have to get it right the first time. You have to plan ahead, test ahead, and make sure you are getting it right. Your second chance is not a software update but a second version of the product, months or even years later. But if the first version doesn't work, you might not get a chance to make a second version."

Kraft may have summed it up best in his Wired interview, when asked what the biggest mistake he made with Doppler.

"We fucking started a hardware business! There's nothing else to talk about. We shouldn't have done that," he said.

Going up against Apple and Google

As if the time and cost didn't hinder hardware companies enough, then there's the fact that a small hardware company is also going up against extremely formidable opponents, including the most valuable company in the history of the world. In his Wired interview, Kraft noted that Doppler once wasn't able to beat Apple's AirPods to market, the company was likely doomed to always be in second place.

It's incredibly difficult to go compete with companies with almost unlimited resources, who can bounce back from a bad product or mistake much quicker than a company that needs to raise its next round of funding, said Dr. Steven LeBoeuf, Co-founder and President at Valencell, a developer and manufacturer of biometric sensors for electronics.

"Say you want to make a wearable device, it has to compete against one of the big guys, and you really are spreading yourself thin because there's so much that goes into a wearable device that you can't control and you know nothing about other than the core technology you bring to it."

In fact, he said, that is one of the reasons that his company decided to create the sensors that power the technology, rather than its own devices.

"We decided to focus on what the big guys couldn't compete with, the core sensor technology, because that's thing we could own, we could wrap our hands around it and be the best at it, because they're focused on so many different things with the product, not that core thing. I think for a lot of startups, it's good to think about where do you really add value?" he said.

"It may be better to collaborate with those folks than to compete with them."

While everyone agrees that the big companies are formidable, not everyone sees them as being unbeatable, given how difficult it can be for them to innovate, compared to the young and nimble upstarts.

"Start-ups can always compete where they are innovating and/or thinking ahead of corporations. Decision making happens slowly in bigger companies and plans tend to be set years in advance. Innovation is hard to make its way into corporations and this is to a start-ups advantage. Innovation typically comes from the people who see the world differently," Rose Haft, CEO of augmented reality platform Lumenora, said.

"It is unusual for corporations to hire innovative people to do one thing or another. Innovators tend to be called 'chaotic' or not fit into company culture or are seen as a threat because of their intelligence or not a good fit because of diverse skills. Tile and Tesla are good examples of this. Microsoft or Apple could have made Tile but they didn't and many car companies could have made the leap or purchased the rights to use the tech that Tesla started with but they didn't. It is hard for corporations to pivot quickly or they don't have the capacity and resources allocated to make it happen."

Rather than going head to head with big companies, smaller companies should innovate in a way that makes the larger companies more likely to acquire them than to compete with them, said Alan Levy, CEO of Chrono Therapeutics, a developer of a digital smoking-cessation system.

"On the med tech side, most of the innovation has come from small companies that were willing to take risks, and then that technology was eventually acquired by one of the larger companies. There are obviously advantages to the big companies, but there are advantages to the small companies as well and I think to be successful you have to identify an opportunity where not going head to head with a company right in their sweet spot, in their core area, where they're going to defend that tenaciously. You want to be able to innovate quickly, take risks, move quickly; large companies, in general, can't move as quickly, particularly if it's not part of their core business and core revenue source," he said.

"Even if they're in that same space, if there are opportunities where you can get there quicker, if you can get there with a better product, it's often, from the large company's point of view, better to acquire you than to develop a competitive product on their own. That's happened again and again in the med tech space."

Impatient investors

With all of the above challenges, perhaps it's not very surprising that investors aren't exactly jumping up and down to fund hardware companies. This may ultimately be the most difficult aspect of getting a company off the ground.

According to [data from CB Insights](#), less than a quarter of hardware companies that raised an initial round in 2012 or 2013 have since gone on to raise a second round; for comparison's sake, 46 percent of all tech companies get a second round. Even more alarmingly, 97 percent of the consumer hardware companies that the firm tracked "died or became zombie companies."

It's no wonder that more than half of consumer hardware startups had to turn to crowdfunding to get money.

"Hardware companies typically have more difficulty receiving investment," said Haft, listing a number of reasons for that, including how many iterations it takes to get a product right.

"It typically takes several iterations of product as well as manufacturing set-up and tooling and coordination with manufacturing teams in order to bring a full product to customers, and one slight overlook can cost the company a lot of money. Palm Pilot and Samsung have both seen this with their batteries and charging circuits for the batteries that caused a great deal of issues, even after having well developed teams. Investors really need to love a product and believe in a team in order to see it come into life."

Investors may have certain expectations for when a company is going to go to market, or when they will be profitable, and that may take longer than anticipated, Levy noted.

"Where investors may have had one set of assumptions that made it an attractive opportunity, a year or two later, things may have changed. The competitive situation may have changed, they have needed more money and, therefore, it affected the return," he said.

"In general, med tech has become less attractive to healthcare investors than pharma, for a variety of reasons. One is the fact that there are fewer potential acquirers, and, generally, the potential upside is not as great for a med tech company as it is for a pharma company. So you've seen over the last several years much more money going into pharma biotech than med tech primarily for those two reasons. Med tech is not getting the same returns, often it's taken longer than people had anticipated, and you can see some very attractive returns in biotech and pharma side."

In the end, it may come down to hardware companies getting the right investors, those who will understand the difficulties of hardware and who have the patience to see it through, said David Utley, President and CEO of Carrot, a developer of a digital health and wearable technology to help people quit smoking.

"In the tech world, technology investors are not as used to the longer haul of a medical device march that's trying to help a chronic disease that kills a lot of people. The tech investor community, I'm just learning because I never had tech investors on my board

before, are used to quicker development. We don't go that fast and that's okay. You can be very successful by having a diligent strategy that helps save millions of lives over and I just have to prove that to my investors over time," he said.

"I'm very happy with my investors, but, in general, tech investors are used to much quicker milestones."

Lessons learned from hardware founders

I asked all of the founders and CEOs I spoke to share their lessons learned, and to tell me what advice would they give to upcoming hardware founders. Here are some of the answers they gave:

Utley: "If you're talking about a medical device, they need to have some really veteran regulatory and medical device engineering teams. It is really hard. Our FDA submission was over 2,000 pages long. It's not like creating a consumer device that can help you count your steps or your elevation change. It's complicated. So if you're talking about something that's regulated as a medical device, you better have a really awesome team that's got a lot of experience. You want to get on a plane, you want a veteran, grey haired pilot, you want people who really understand how this is done and they do it well.

If it's not a medical device, there's a lot more competition out there and all sorts of other types of things, like fitness. You've got to see, see how am I different and do I have people on my team who can make this thing into a business? Is selling a \$150 step counter three million times every quarter, is that a business? How long until I saturate the market with the competition pressure at that price point? It only took Fitbit a few years. They're an awesome company, but everybody's got one. So the question is, how special is your thing that you're trying to create?"

Haft: "My top pieces of advice are: Build for your customers... and please build something that makes the world a better place. Build, build, build. Put off fundraising (if you can) and just build a good prototype. Try your best to have something that shows what you're talking about. MVPs can be a demonstration of how it will work, it doesn't have to function. Ask customers and/or make sure you have tested your thesis before trying to fundraise. Make sure you have a business plan. Many technical founders don't understand the ins and outs of starting a business and having a plan and being able to communicate it to investors and customers is critical to fundraising and building a company. Help everyone who is willing to be a cheerleader and champion for you to see and know your vision. Ask for help when you need it. Build a support network to keep you up and going in the hard times. Don't lie or always try your best to be honest. Build things people want. This will challenge everything you know about yourself. It is just as rewarding for the founders as it is for the world when a successful product, that makes the world a better place, makes it out into the world," said Haft.

Levy: "What is the market? How is that market currently being met? What is the unmet need you're fulfilling and how large is that opportunity? Then you get all of the issues related to, what's the regulatory path? What is your intellectual property position? What

is the development path? What is the reimbursement? Those are all key questions that you would ask for any medical device startup. Those are the initial questions, and then after that questions like: how are you going to manufacture it? What are the cost of goods? What is your selling price? What makes you think you can get that price? Also management team, and importantly, how do you plan to distribute this product? That's where large companies have advantages, their greatest strength is their distribution capability in the med tech space and the brand as well."

LeBoeuf: "The first thing I'd do is ask them a question: what do ya'll do extremely well? And, if they focused in on a particular thing, I'd say, 'Focus all your efforts on that first.' What is the best thing you can provide the marketplace, focus on what you do really well without adding any of the things that force you to dilute yourself or to compete with other folks that can outstrip you in that area. What is it that you do extremely well, and focus on that, is the first thing I would say because with hardware it's so easy to dilute yourself and make an irreversible mistake."

Sahin: "I wouldn't say no startup should do hardware. That would be absurd, and we need innovation. However, do consider if you can meet your goals by making software and capitalizing on an installed base of highly refine and powerful hardware that is already out there.

Then I would say: remember the hardware development and debug cycles are very long and frustrating, and remember that customers will expect magic. Also, they have zero idea how hard hardware is, so you may want to educate them and let them in on the frustrations early so they are rooting for you. You have that ability as a startup.

Finally, i would close by invoking Hofstadter's Law: Hofstadters Law states that all major projects take much longer than you think, even if you already took into account Hofstadter's Law!"

Adam Greenberg, CEO and Co-Founder of iUNU, an AI greenhouse startup:
"We had our fair share of challenges with hardware when we were focused on lighting. We built an intelligent computer vision system into the lights and have since licensed out the lighting business to another company and are solely focused on the industrial computer vision solution. Some big learnings for us in the hardware realm include: never have single source supply; always expect shipping delays; something will always go awry you won't expect; cost rises dramatically if you want speed to market."

Jaya Rao, COO of Molekule, an air purifier that captures and actively destroys harmful pollutants: "When founding the company, we took conscious, measured steps to ensure Molekule could be referenced as an example of "hardware done right" -- it certainly wasn't by accident. This was a journey that we were very personally invested in seeing all the way through.

A couple of things in particular: we took the time to do in field beta testing -- a lot of it. We used early (and unattractive) versions of the product, that still had our core air purification technology in it, to give to people test. We kept our beta testing program

going up until we started shipping, to be confident we were delivering the best version of Molekule possible. We used this feedback to ensure that we were constantly improving the experience. That's what allowed for us to go from a literal black box (with our air purification technology in it) to the device that is shipping today. We're still taking feedback from customers and on a constant journey to make the experience better and better."

Why your hardware startup might have stalled: a systems-thinking perspective

 ktn-uk.org/perspectives/why-your-hardware-startup-might-have-stalled-a-systems-thinking-perspective

Posted on: 09.06.2020

Applying a systems approach can enable complex, uncertain and challenging projects to be undertaken with progressively less risk.

Success in the world of hardware startups can be illusive. 97% of hardware startups fail (compared with 70% of tech startups). Great ideas can sink in unsuccessful funding rounds, rejected grant applications and stonewalled emails. Frustrations build and, in the worst of cases, once inspiring ideas become phycological burdens and the system that's there to support you becomes the target of blame for failure.

We are here to light this tricky and challenging innovation path: pointing out what could trip you up; challenging your thinking when you're going off in the wrong direction; providing insights and connections to accelerate your progress.

One of the biggest challenges we observe relates to sequential decision making and lack of a holistic plan. There is a tendency to quickly skip past understanding the market, user journey and customer requirements; focus on design then to think about manufacturing and; planning finances and cash flow in a reactive rather than proactive manner.

I am increasingly convinced that the antidote to this is Systems Thinking.

Systems Thinking

Systems thinking is a employing a mindset that focuses on the relationships between elements (components, decisions, activities, perspectives) rather than focusing on the individual things themselves. Applying a systems approach can enable complex, uncertain and challenging projects to be undertaken with progressively less risk.

Each area of consideration interconnects and influences the others. It is pointless, for example, to have a polished product render and technically beautiful engineering drawings (full maturity, in the innovators mind) without clarity about the volumes required, the manufacturing processes needed, the cost to manufacture and refined engineering detail to optimise manufacturing (correct radii for inflection mould flow, for example).

The relationships between all the component decisions (market, volumes, design, manufacturing processes etc.) needs to be considered from the outset. Information should be incrementally matured across the whole piece (each of the components of the design process) rather than fully matured at each point before moving on to the next. Awareness of this concept and a mental model of product development that accommodates Systems Thinking is half the battle.

I've yet to meet anyone who can complete this journey alone. Why would you? Diversity of skills and experience is not only opportunity, it's an absolute necessity when it comes to hardware development. Building a team of complementary skills is key. This is critical for raising investment and securing grant funding. Get them on board at the start to truly benefit from their experience. Share your ideas – get feedback and input from customers, peers and trusted advisors. Seek out criticism and be open to it. All too often, innovators can't make progress because they are so concerned about IP. Don't be precious about it or spend a fortune on an underdeveloped idea. Make IP work for you. Be clear about why you are investing.

Applying a systems approach can enable complex, uncertain and challenging projects to be undertaken with progressively less risk. Basically, it means think holistically and incrementally mature information for richer and better-informed decision making.

Navigating the Design to Manufacture Journey Webinars

We've been running a series of weekly webinars – Navigating the Design to Manufacture Journey – during #lockdown, where we engaged with a number of industry experts exploring all aspects of systems thinking from funding and investment to scaling up manufacturing. If you managed to join us for some or all of these webinars, great. If not, you can catch up on recordings from the series [here](#).

Over the next 12 weeks we'll be releasing a series of articles covering the webinar topics in more depth. Watch this space.

Hardware Startups Have Options, But It's a Mistake to Explore Them All

 tenorpr.com/2018/10/hardware-startups-have-options-but-its-a-mistake-to-explore-them-all

By Matthew Stotts

October 16, 2018

Few things are as difficult as launching and scaling your own business. For every success we read about

in TechCrunch, there are dozens of companies that flame out before we get the chance to read about them.

Seventy percent of startup companies fail within 20 months of raising their first funding round, a

detailed post-mortem by CB Insights said. But those numbers are far more dire in the world of

consumer hardware, where 97% of seed or crowdfunded companies eventually turn into “zombies” or

go out of business altogether.

Hardware startups face their own unique challenges, and according to researchers, these companies are

most likely to fail over a lack of consumer demand, a high burn rate, decreased enthusiasm and product strategy mistakes.

There is one product strategy mistake that hardware companies frequently make as they scramble to

build out products and services to appeal to as many consumers as possible, and the mistake is putting

too much value on “optionality.”

The Danger of Optionality

In a bid to be all things to all people, consumer hardware CEOs keep a range of options open on the

company’s roadmap, in case the business needs to pivot to tap a new base of customers. Flexibility is

good in theory, but this kind of optionality can easily turn into a lack of focus or commitment.

Keeping every option on the table can mean the failure to do one thing well, and in hardware, this is a death knell.

The CEOs at the helm of startup hardware companies are doing business in a subscription-based

economy that is increasingly defined by software and driven by brand experience. Many want to build

one product after another and one feature after another to win consumer mindshare and keep

a competitive advantage. This makes these CEOs vulnerable to the pitfall of overvaluing optionality.

Creativity and flexibility are admirable, but in consumer hardware, a company can't keep "iterating"

forever. It's prohibitively expensive. What works far better is setting clear goals and boundaries in the

beginning, and then executing on those before embarking on a new adventure.

While it might be feasible to create new features or services to keep up with consumer demand, tapping

whole new markets or customer segments can mean remaking the product from the ground up.

A Costly Failure

One-time consumer hardware leader Jawbone was once worth more than \$3 billion, but is now in the

process of being liquidated. A failure this massive can't be attributed to a single factor, but optionality

looks like a top culprit in the company's demise.

The company began as a developer of military-grade audio equipment, which turned into Bluetooth

earpieces that consumers loved. The company later pivoted into fitness tracking and health-data

products, raising more than \$900 million from investors along the way.

Jawbone's health-tracking rival FitBit—which now trades on the New York Stock Exchange—does one

thing well, and went from launch to IPO on a fraction of what Jawbone raised.

Things have changed since the height of the Jawbone-FitBit rivalry, and the kind of focus shown by a

company like FitBit is more important now than it's ever been.

The Gauntlet

Now isn't the time for a hardware startup to try to be all things to all people, or to constantly move

the goalposts to reach multiple customer segments.

Hardware companies today are trying to square off with tech giants like Samsung, Google, Apple and

Amazon, who are rolling out a series of interconnected products for the office and the home. At the

same time, Chinese companies are bringing similar products to market at lightning speed, and for a

fraction of the cost.

This means a hardware company starting up today is running a gauntlet, competing with the scale of

established tech companies and the speed and prices of Chinese firms. And running this gauntlet takes focus.

To succeed, hardware companies need to take options off the table, not constantly add them. A

company starting today should have a very specific customer segment in mind, and design a product to solve a specific problem.

Solve that problem, and get those customers. If you make it more complicated than that, optionality could be your undoing.

One Laptop per Child

W en.wikipedia.org/wiki/One_Laptop_per_Child

One Laptop per Child (OLPC) was a non-profit initiative established with the goal of transforming education for children around the world; this goal was to be achieved by creating and distributing educational devices for the developing world, and by creating software and content for those devices.

The goal was to transform education, by enabling children in low-income countries to have access to content, media and computer-programming environments. When the program launched, the typical retail price for a laptop was considerably in excess of \$1,000 (US), so achieving this objective required bringing a low-cost machine to production. This became the OLPC XO Laptop, a low-cost and low-power laptop computer designed by Yves Béhar^[3] with Design Continuum.^[4] The project was originally funded by member organizations such as AMD, eBay, Google, Marvell Technology Group, News Corporation, Nortel, Chi Mei Corporation, Red Hat, and Quanta provided in-kind support.

The OLPC project was the subject of much discussion. It was praised for pioneering low-cost, low-power laptops and inspiring later variants such as Eee PCs and Chromebooks; for assuring consensus at ministerial level in many countries that computer literacy is a mainstream part of education; for creating interfaces that worked without literacy in any language, and particularly without literacy in English. It was criticized from many sides regarding its US-centric focus ignoring bigger problems, high total costs, low focus on maintainability and training and its limited success. In 2014, after disappointing sales, the Foundation shut down.^[5]

The OLPC project is critically reviewed in a 2019 MIT Press book titled *The Charisma Machine: The Life, Death, and Legacy of One Laptop per Child*.^[6]

History

Play media

A short video covering OLPC's main mission principles

Play media

Thank You from the Children of OLPC

The OLPC program has its roots in the pedagogy of Seymour Papert, an approach known as constructionism, which espoused providing computers for children at early ages to enable full digital literacy. Papert, along with Nicholas Negroponte, were at the MIT Media Lab from its inception. Papert compared the old practice of putting computers in a computer lab to books chained to the walls in old libraries. Negroponte likened shared

computers to shared pencils. However, this pattern seemed to be inevitable, given the then-high prices of computers (over \$1,500 apiece for a typical laptop or small desktop by 2004).

In 2005, Negroponte spoke at the [World Economic Forum](#), in Davos. In this talk he urged industry to solve the problem, to enable a \$100 laptop, which would enable constructionist learning, would revolutionize education, and would bring the world's knowledge to all children. He brought a mock-up and was described as prowling the halls and corridors of Davos to whip up support.^[7] Despite the reported skepticism of [Bill Gates](#) and others, Negroponte left Davos with committed interest from AMD, News Corp, and with strong indications of support from many other firms. From the outset, it was clear that Negroponte thought that the key to reducing the cost of the laptop was to reduce the cost of the display. Thus, when, upon return from Davos, he met [Mary Lou Jepsen](#), the display pioneer who was in early 2005 joining the MIT Media Lab faculty, the discussions turned quickly to display innovation to enable a low-cost laptop. Convinced that the project was now possible, Negroponte led the creation of the first corporation for this: the Hundred Dollar Laptop Corp.

At the [2006 Wikimania](#), [Jimmy Wales](#) announced that the One Laptop Per Child Project would be including [Wikipedia](#) as the first element in their content repository. Wales explained, "I think it is in my rational self interest to care about what happens to kids in Africa,"^[8] elaborating in his fundraising appeal:^{[9][10][11]}

I'm doing this for the child in Africa who is going to use free textbooks and reference works produced by our community and find a solution to the crushing poverty that surrounds him. But for this child, a website on the Internet is not enough; we need to find ways to get our work to people in a form they can actually use. And I'm doing this for my own daughter, who I hope will grow up in a world where culture is free, not proprietary, where control of knowledge is in the hands of people everywhere, with basic works they can adopt, modify, and share freely without asking permission from anyone. We're already taking back the Internet. With your help, we can take back the world.

At the [2006 World Economic Forum in Davos, Switzerland](#), the [United Nations Development Program](#) (UNDP) announced it would back the laptop. UNDP released a statement saying they would work with OLPC to deliver "technology and resources to targeted schools in the least developed countries".^[12]

Starting in 2007, the Association managed development and logistics, and the Foundation managed fundraising such as the Give One Get One campaign ("G1G1").^[13]

[Intel](#) was a member of the association for a brief period in 2007. Shortly after OLPC's founder, Nicholas Negroponte, accused Intel of trying to destroy the non-profit, Intel joined the board with a mutual non-disparagement agreement between them and OLPC. Intel resigned its membership on January 3, 2008, citing disagreements with requests from Negroponte for Intel to stop dumping their [Classmate PCs](#).^{[14][15]}

In 2008, Negroponte showed some doubt about the exclusive use of open-source software for the project,^[16] and made suggestions supporting a move towards adding Windows XP, which Microsoft was in the process of porting over to the XO hardware.^[17]

Microsoft's Windows XP, however, is not seen by some as a sustainable operating system.^[18] Microsoft announced that they would sell them Windows XP for \$3 per XO.^[19] It would be offered as an option on XO-1 laptops and possibly be able to dual boot alongside Linux.^[20] In response, Walter Bender, who was the former President of Software and Content for the OLPC project, left OLPC^{[21][22]} and founded Sugar Labs to continue development of the open source Sugar software which had been developed within OLPC. No significant deployments elected to purchase Windows licenses.

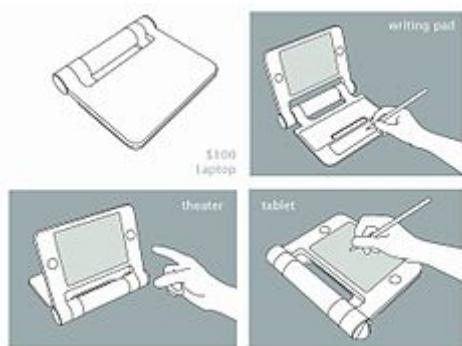
Charles Kane became the new President and Chief Operating Officer of the OLPC Association on May 2, 2008.^{[23][24]} In late 2008, the NYC Department of Education purchased some XO computers for use by New York schoolchildren.^[25]

Advertisements for OLPC began streaming on the video streaming website Hulu and others in 2008. One such ad has John Lennon advertising for OLPC, with an unknown voice actor redubbing over Lennon's voice.^[26]

In 2008, OLPC lost significant funding. Their annual budget was slashed from \$12 million to \$5 million which resulted in a restructuring on January 7, 2009. Development of the Sugar operating environment was moved entirely into the community, the Latin America support organization was spun out and staff reductions, including Jim Gettys, affected approximately 50% of the paid employees. The remaining 32 staff members also saw salary reductions.^{[27][28]} Despite the downsizing, OLPC continued development of the XO-1.5 laptops.

In 2010, OLPC moved its headquarters to Miami. The Miami office oversaw sales and support for the XO-1.5 laptop and its successors, including the XO Laptop version 4.0 and the OLPC Laptop. Funding from Marvell, finalized in May 2010, revitalized the foundation and enabled the 1Q 2012 completion of the ARM-based XO-1.75 laptops and initial prototypes of the XO-3 tablets. OLPC took orders for mass production of the XO 4.0, and shipped over 3 million XO Laptops to children around the world.

Criticism



OLPC XO-1 original design proposal



OLPC XO-1 laptop in e-book mode

- ⚠ This article's *Criticism* or *Controversy* section **may compromise the article's neutral point of view of the subject**. Please integrate the section's contents into the article as a whole, or rewrite the material. (August 2021)

At the World Summit on the Information Society held by the United Nations in Tunisia from November 16–18, 2005, several African representatives, most notably Marthe Dansokho (a missionary of United Methodist Church), voiced suspicions towards the motives of the OLPC project and claimed that the project was using an overly "U.S. mindset", pointing out that the presented solutions were not applicable to specifically "African problems". Dansokho said the project demonstrated misplaced priorities, stating that African women would not have enough time to research new crops to grow. She added that clean water and schools were more important. Mohammed Diop specifically criticized the project as an attempt to exploit the governments of poor nations by making them pay for hundreds of millions of machines and the need of further investments into internet infrastructure.^[29] Others have similarly criticized laptop deployments in very low income countries, regarding them as cost-ineffective when compared to far simpler measures such as deworming and other expenses on basic child health.^[30]

Lee Felsenstein, a computer engineer who played a central role in the development of the personal computer, criticized the centralized, top-down design and distribution of the OLPC.^[31]

Already by September 2009, Alanna Shaikh offered a eulogy for the project at *UN Dispatch*, stating "It's time to call a spade a spade. OLPC was a failure."^[32]

Cost

The project originally aimed for a price of 100 US dollars. In May 2006, Negroponte told the Red Hat's annual user summit: "It is a floating price. We are a nonprofit organization. We have a target of \$100 by 2008, but probably it will be \$135, maybe \$140."^[33] A BBC news article in April 2010 indicated the price still remained above \$200.^[34]

In April 2011, the price remained above \$209.^[35] In 2013, more than 10% of the world population lived on less than US\$2 per day.^[36] The latter income segment would have to spend more than a quarter of its annual income to purchase a single laptop, while the global average of ICT spending is 3% of income.^[37] Empirical studies show that the borderline between ICT as a necessity good and ICT as a luxury good is roughly around the "magical number" of US\$10 per person per month, or US\$120 per year.^[37]

John Wood, founder of Room to Read (an NPO which builds schools and libraries), emphasizes affordability and scalability over high-tech solutions. While in favor of the One Laptop per Child initiative for providing education to children in the developing world at a cheaper rate, he has pointed out that a \$2,000 library can serve 400 children, costing just \$5 a child to bring access to a wide range of books in the local languages (such as Khmer or Nepali) and English; also, a \$10,000 school can serve 400–500 children (\$20–\$25 a child). According to Wood, these are more appropriate solutions for education in the dense forests of Vietnam or rural Cambodia.^[38]

The Scandinavian aid organization FAIR proposed setting up computer labs with recycled second-hand computers as a cheaper initial investment. Negroponte argued against this proposition, stating the expensive running cost of conventional laptops.^[39] Computer Aid International doubted the OLPC sales strategy would succeed, citing the "untested" nature of its technology. CAI refurbishes computers and printers and sells them to developing countries for £42 a piece (compare it to £50 a piece for the OLPC laptops).^[40]

Teacher training and ongoing support

The OLPC project has been criticized for allegedly adopting a "one-shot" deployment approach with little or no technical support or teacher training, and for neglecting pilot programs and formal assessment of outcomes in favor of quick deployment. Some authors attribute this unconventional approach to the promoters' alleged focus on constructivist education and digital utopianism.^[30] Mark Warschauer, a Professor of University of California at Irvine and Morgan Ames, at the time of writing, a PhD candidate at Stanford University, pointed out that the laptop by itself does not completely fill the need of students in underprivileged countries. The "children's machines", as they have been called, have been deployed to several countries, for example Uruguay, Peru, and in the US, Alabama, but after a relatively short time, their usage declined considerably, sometimes because of hardware problems or breakage, in some cases, as high as 27% to 59% within the first two years, and sometimes due to a lack of knowledge on the part of the users on how to take full advantage of the machine.

However, another factor has recently been acknowledged: a lack of a direct relation to the pedagogy needed in the local context to be truly effective. Uruguay reports that only 21.5% of teachers use the laptop in the classroom on a daily basis, and 25% report using it less than once a week. In Alabama, 80.3% of students say they never or seldom use the computer for class work, and Peru, teachers report that in the first few months, 68.9% use the laptop three times per week, but after two months, only 40% report such usage. Those of a low socio-economic level tend to not be able to effectively use the laptop for educational purposes on their own, but with scaffolding and mentoring from teachers, the machine can become more useful. According to one of the returning OLPC executives, Walter Bender, the approach needs to be more holistic, combining technology with a prolonged community effort, teacher training and local educational efforts and insights.^[41]

The organization has been accused of simply giving underprivileged children laptops and "walking away". Some critics claim this "drive-by" implementation model was the official strategy of the project. While the organisation has learning teams dedicated to support and working with teachers, Negroponte has said in response to this criticism that "You actually can" give children a connected laptop and walk away, noting experiences with self-guided learning.^[42]

Other explanations of failure included a high minimum order, low reliability and maintainability, unsuitability to local conditions and culture, and encouragement of children to learn new ways of thinking instead of remaining loyal to old ways.^[43]

Technology

Main article: [OLPC XO](#)

See also: [Sugar \(software\)](#), [OLPC XO-3](#), and [OLPC XS](#)

The XO, previously known as the "\$100 Laptop" or "Children's Machine", is an inexpensive [laptop computer](#) designed to be distributed to children in developing countries around the world,^[44] to provide them with [access to knowledge](#), and opportunities to "explore, experiment and express themselves" ([constructionist learning](#)).^[45] The laptop was designed by [Yves Béhar](#) with [[Design Continuum]], and manufactured by the [Taiwanese](#) computer company [Quanta Computer](#).

The [rugged](#), [low-power](#) computers use [flash memory](#) instead of a [hard drive](#), run a [Fedora](#)-based operating system and use the [SugarLabs Sugar user interface](#).^[46] [Mobile ad hoc networking](#) based on the [802.11s wireless mesh network](#) protocol allows students to collaborate on activities and to share Internet access from one connection. The wireless networking has much greater range than typical consumer laptops. The XO-1 was designed for lower cost and much longer life than typical laptops.



[OLPC XO-1 laptop](#)



[XO-3 concept](#)

In 2009, OLPC announced an updated XO (dubbed *XO-1.5*) to take advantage of the latest component technologies. The XO-1.5 includes a new [VIA C7-M](#) processor and a new chipset providing a 3D graphics engine and an HD video decoder. It has 1GB of [RAM](#) and built-in storage of 4 GB, with an option for 8 GB. The XO-1.5 uses the same display, and a network wireless interface with half the power dissipation.^[47]

Early prototype versions of the hardware were available in June 2009, and they were available for software development and testing available for free through a [developer's program](#).^[48]

An XO-1.75 model was developed that used a Marvell [ARM processor](#), targeting a price below \$150 and date in 2011.^[49]

The XO-2 two sheet design concept was canceled in favor of the one sheet XO-3.^[50]

An [XO-3](#) concept resembled a [tablet computer](#) and was planned to have the inner workings of the XO 1.75.^[51] Price goal was below \$100 and date was 2012.^[52]

As of May 2010, OLPC was working with [Marvell](#) on other unspecified future tablet designs.^[53] In October 2010, both OLPC and Marvell signed an agreement granting OLPC \$5.6 million to fund development of its XO-3 next generation tablet computer. The tablet

was to use an ARM chip from Marvell.^[54]^[55]

At [CES](#) 2012, OLPC showcased the XO-3 model, which featured a touchscreen and a modified form of [SugarLabs "Sugar"](#).^[56] In early December 2012, however, it was announced that the XO-3 would not be seeing actual production, and focus had shifted to the XO-4.^[57]

The XO-4 was launched at [International CES](#) 2013 in Las Vegas^[58] The XO Laptop version 4 is available in two models: XO 4 and XO 4 Touch, with the latter providing multi-touch input on the display. The XO Laptop version 4 uses an ARM processor to provide high performance with low power consumption, while keeping the industrial design of the traditional XO Laptop.



XO-3 production model

Software

The laptops include an anti-theft system which can, optionally, require each laptop to periodically make contact with a server to renew its cryptographic lease token. If the cryptographic lease expires before the server is contacted, the laptop will be locked until a new token is provided. The contact may be to a country-specific server over a network or to a local, school-level server that has been manually loaded with cryptographic "lease" tokens that enable a laptop to run for days or even months between contacts.

Cryptographic lease tokens can be supplied on a [USB flash drive](#) for non-networked schools.^[59] The mass production laptops are also tivoized, disallowing installation of additional software or replacement of the operating system. Users interested in development need to obtain the unlocking key separately (most developer laptops for Western users already come unlocked). It is claimed that locking prevents unintentional bricking and is part of the anti-theft system.^[60]

In 2006, the OLPC project was heavily criticised over [Red Hat's non-disclosure agreement](#) (NDA) with Marvell concerning the wireless device in OLPC, especially in light of the OLPC project being positioned as an open-source friendly initiative. An open letter for documentation was inked by [Theo de Raadt](#) (a recipient of the [2004 Award for the Advancement of Free Software](#)), and the initiative for open documentation has been supported by [Richard Stallman](#), the President of the Free Software Foundation.^[61] De Raadt later clarified that he finds an issue with OLPC having proprietary firmware files that are not allowed to be independently re-distributed (even in the binary form) by third-party operating systems like [OpenBSD](#), as well as receiving no documentation to write the necessary drivers for the operating system.^[62]^[63] De Raadt has pointed out that the [OpenBSD](#) project requires no firmware source code, and no low-level documentation to work on firmware, only requiring the binary distribution rights and documentation to interface with the said binary firmware that runs outside of the main CPU, a quite simple request that is generally honoured by many other wireless device vendors like [Ralink](#).^[64] Stallman fully agreed with de Raadt's request to open up the documentation,^[61] since Stallman is known to hold an even stronger and more idealistic position in regards to the

proprietary components, and requires that even the firmware that runs outside of the main CPU must be provided in its source code form, something de Raadt does not require. De Raadt later has had to point out that such more idealistic and less realistic position has instead been misattributed to OpenBSD's more practical approach to make it look unreasonable, and stood on record that OpenBSD's position is much easier to satisfy, yet it nonetheless remained unresolved.^[62]

OLPC's dedication to "Free and open source" was questioned with their May 15, 2008, announcement that large-scale purchasers would be offered the choice to add an extra cost, special version of the proprietary Windows XP OS developed by Microsoft alongside the regular, free and open Linux-based operating system with the SugarLabs "Sugar OS" GUI. Microsoft developed a modified version of Windows XP and announced in May 2008 that Windows XP would be available for an additional cost of 10 dollars per laptop.^[65] James Utzschneider, from Microsoft, said that initially only one operating system could be chosen.^{[66][67]} OLPC, however, said that future OLPC work would enable XO-1 laptops to dual boot either the free and open Linux/Sugar OS or the proprietary Microsoft Windows XP. Negroponte further said that "OLPC will sell Linux-only and dual-boot, and will not sell Windows-only [XO-1 laptops]". OLPC released the first test firmware enabling XO-1 dual-boot on July 3, 2008.^{[66][68][69][70][71]} This option did not prove popular. As of 2011, a few pilots had received a few thousand total dual-boot machines, and the new ARM-based machines do not support Windows XP. No significant deployment purchased Windows licenses.^[72] Negroponte stated that the dispute had "become a distraction" for the project, and that its end goal was enabling children to learn, while constructionism and the open source ethos was more of a means to that end.^[23] Charles Kane concurred, stating that anything which detracted from the ultimate goal of widespread distribution and use was counterproductive.^[23]

Bugs

The organization has been criticized for its lack of troubleshooting support. Teachers in Peru are told to handle problems in one of two ways. If the problem is a software issue, they are to flash the computer, and if it is a hardware problem, they are to report it. In the classroom environment this black-boxing approach is being criticized for causing the teachers and students to feel disconnected with, and confused by the laptop, which results, in many cases, in the laptops eventually going unused.^[73] Several defects in OLPC XO-1 hardware have emerged in the field, and laptop repair is often neglected by students or their families (who are responsible for maintenance) due to the relatively high cost of some components (such as displays).^[30]

On the software side, the Bitfrost security system has been known to deactivate improperly, rendering the laptop unusable until it is unlocked by support technicians with the proper keys. (This is a time-consuming process, and the problem often affects large numbers of laptops at the same time). The Sugar interface has been difficult for teachers to learn, and the mesh networking feature in the OLPC XO-1 was buggy and went mostly unused in the field.^[30]

The OLPC XO-1 hardware lacks connectivity to external monitors or projectors, and teachers are not provided with software for remote assessment. As a result, students are unable to present their work to the whole class, and teachers must also assess students' work from the individual laptops. Teachers often find it difficult to use the keyboard and screen, which were designed with student use in mind.^[30]

Environmental impact

In 2005 and prior to the final design of the XO-1 hardware, OLPC received criticism because of concerns over the environmental and health impacts of hazardous materials found in most computers.^[74] The OLPC asserted that it aimed to use as many environmentally friendly materials as it could; that the laptop and all OLPC-supplied accessories would be fully compliant with the EU's Restriction of Hazardous Substances Directive (RoHS); and that the laptop would use an order of magnitude less power than the typical consumer netbooks available as of 2007 thus minimizing the environmental burden of power generation.^[75]

The XO-1 delivered (starting in 2007) uses environmental friendly materials, complies with the EU's RoHS and uses between 0.25 and 6.5 watts^[76] in operation. According to the Green Electronics Council's Electronic Product Environmental Assessment Tool, whose sole purpose is assessing and measuring the impact laptops have on the environment, the XO is not only non-toxic and fully recyclable, but it lasts longer, costs less, and is more energy efficient. The XO-1 is the first laptop to have been awarded an EPEAT Gold level rating.^{[77][78]}

Anonymity

Other discussions question whether OLPC laptops should be designed to promote anonymity or to facilitate government tracking of stolen laptops. A June 2008 New Scientist article critiqued Bitfrost's P_THEFT security option, which allows each laptop to be configured to transmit an individualized, non-repudiable digital signature to a central server at most once each day to remain functioning.^[79]

Distribution

The laptops are sold to governments,^[80] to be distributed through the ministries of education with the goal of distributing "one laptop per child". The laptops are given to students, similar to school uniforms and ultimately remain the property of the child. The operating system and software is localized to the languages of the participating countries.

OLPC later worked directly with program sponsors from the public and private sectors to implement its educational program in entire schools and



At a primary school in Kigali, Rwanda in 2009, running Scratch

communities. As a non-profit organization, OLPC did require a source of funding for its program so that the laptops are given to students at no cost to child or to his/her family.

Early distributions

Approximately 500 developer boards (Alpha-1) were distributed in mid-2006; 875 working prototypes (Beta 1) were delivered in late 2006; 2400 Beta-2 machines were distributed at the end of February 2007;^[81] full-scale production started November 6, 2007.^[82] Around one million units were manufactured in 2008.

Give 1 Get 1 program

OLPC initially stated that no consumer version of the XO laptop was planned.^[83] The project, however, later established the laptopgiving.org website to accept direct donations and ran a "Give 1 Get 1" (G1G1) offer starting on November 12, 2007. The offer was initially scheduled to run for only two weeks, but was extended until December 31, 2007 to meet demand. With a donation of \$399 (plus US\$25 shipping cost) to the OLPC "Give 1 Get 1" program, donors received an XO-1 laptop of their own and OLPC sent another on their behalf to a child in a developing country. Shipments of "Get 1" laptops sent to donors were restricted to addresses within the United States, its territories, and Canada.

Some 83,500 people participated in the program. Delivery of all of the G1G1 laptops was completed by April 19, 2008.^[84] Delays were blamed on order fulfillment and shipment issues both within OLPC and with the outside contractors hired to manage those aspects of the G1G1 program.^[85]

Between November 17 and December 31, 2008, a second G1G1 program^[86] was run through Amazon.com and Amazon.co.uk.^[87] This partnership was chosen specifically to solve the distribution issues of the G1G1 2007 program. The price to consumers was the same as in 2007, at US\$399.

The program aimed to be available worldwide. Laptops could be delivered in the US, in Canada and in more than 30 European countries, as well as in some Central and South American countries (Colombia, Haiti, Peru, Uruguay, Paraguay), African countries (Ethiopia, Ghana, Nigeria, Madagascar, Rwanda) and Asian countries (Afghanistan, Georgia, Kazakhstan, Mongolia, Nepal).^[88] Despite this, the program sold only about 12,500 laptops and generated a mere \$2.5 million, a 93 percent decline from the year before.^[89]

OLPC no longer advertises direct to consumers, focusing instead on fundraising efforts. In 2011, they launched a new website designed by Pentagram^[90] and Upstatement.^[91]



OLE Nepal, One Laptop Per Child
image from Nepal

Laptop shipments

As of 2015, OLPC reports 'more than 3 million laptops' have been shipped.^[92]



The first of shipment OLPC machines
in Cambridge, MA



Children in a remote Cambodian
school where a pilot laptop program
has been in place since 2001



An OLPC class in Ulaanbaatar,
Mongolia

Regional responses

Uruguay

Main article: [Ceibal project](#)

In October 2007, Uruguay placed an order for 100,000 laptops, making Uruguay the first country to purchase a full order of laptops. The first real, non-pilot deployment of the OLPC technology happened in Uruguay in December 2007.^[93] Since then, 200,000 more laptops have been ordered to cover all public school children between 6 and 12 years old.

President Tabaré Vázquez of Uruguay presented the final laptop at a school in Montevideo on October 13, 2009.^[94] Over the last two years 362,000 pupils and 18,000 teachers have been involved, and has cost the state \$260 (£159) per child, including maintenance costs, equipment repairs, training for the teachers and internet connection.^[95] The annual cost of maintaining the programme, including an information portal for pupils and teachers, will be US\$21 (£13) per child.^[95]

The country reportedly became the first in the world where every primary school child received a free laptop on October 13, 2009 as part of the Plan Ceibal (Education Connect).^{[95][96]}

Unfortunately, even though roughly 35% of all OLPC computers went to Uruguay, a 2013 study by the Economics Institute (University of the Republic, Uruguay) of the Ceibal plan concluded that use of the laptops did not improve literacy and that the use of the laptops was mostly recreational, with only 4.1% of the laptops being used "all" or "most" days in 2012. The main conclusion was that the results showed no impact of the OLPC program on the test scores in reading and math.^[97]

United States

Originally, OLPC announced the United States would not be part of the first-year effort. In 2008, Nicholas Negroponte said "OLPC America already has a director and a chairman and will likely be based in Washington, D.C.",^[98] however such an organization was not set up. As of 2010, Birmingham, Alabama is the largest deployment in the US. Some said the changing economic landscape forced OLPC to adjust their distribution strategy. Negroponte cited patriotism, "building critical mass", and providing a means for children all over the world to communicate.

Artsakh

On January 26, 2012, prime minister Ara Harutyunyan and entrepreneur Eduardo Eurnekian signed a memorandum of understanding launching an OLPC program in Artsakh. The program is geared towards elementary schools throughout Artsakh. Eurnekian hopes to decrease the gap by giving the war-zoned region an opportunity to engage in a more solid education. The New York-based nonprofit, Armenian General Benevolent Union, is helping to undertake the responsibility by providing on-the-ground support. The government of Artsakh is enthusiastic and is working with OLPC to bring the program to fruition.^[99]

Nigeria

Lagos Analysis Corp., also called Lancor, a Lagos, US-based Nigerian-owned company, sued OLPC in the end of 2007 for \$20 million, claiming that the computer's keyboard design was stolen from a Lancor patented device.^[100] OLPC responded by claiming that they had not sold any multi-lingual keyboards in the design claimed by Lancor,^[101] and that Lancor had misrepresented and concealed material facts before the court.^[102] In January 2008, the Nigerian Federal Court rejected OLPC motion to dismiss LANCOR's lawsuit and extended its injunction against OLPC distributing its XO Laptops in Nigeria.

OLPC appealed the Court's decision, the Appeal is still pending in the Nigerian Federal Court of Appeals. In March 2008, OLPC filed a lawsuit in Massachusetts to stop LANCOR from suing it in the United States.^[103] In October 2008, MIT News magazine erroneously reported that the Middlesex Superior Court granted OLPC's motions to dismiss all of LANCOR's claims against OLPC, Nicholas Negroponte, and Quanta.^[104] On October 22, 2010 OLPC voluntarily moved the Massachusetts Court to dismiss its own lawsuit against LANCOR.

In 2007, XO laptops in Nigeria were reported to contain pornographic material belonging to children participating in the OLPC Program.^[105] In response, OLPC Nigeria announced they would start equipping the machines with filters.^{[105][106]}

India

India's [Ministry of Human Resource Development](#), in June 2006, rejected the initiative, saying "it would be impossible to justify an expenditure of this scale on a debatable scheme when public funds continue to be in inadequate supply for well-established needs listed in different policy documents".^{[107][108]} Later they stated plans to make laptops at \$10 each for schoolchildren. Two designs submitted to the Ministry from a final year engineering student of [Vellore Institute of Technology](#) and a researcher from the [Indian Institute of Science](#), Bangalore in May 2007 reportedly describe a laptop that could be produced for "\$47 per laptop" for even small volumes.^[109] The Ministry announced in July 2008 that the cost of their proposed "\$10 laptop" would in fact be \$100 by the time the laptop became available.^[110] In 2010, a related \$35 [Sakshat Tablet](#) was unveiled in India, released the next year as the "Aakash".^{[111][112]} In 2011, each Aakash sold for approximately \$44 by an Indian company, [DataWind](#). DataWind plans to launch similar projects in Brazil, Egypt, Panama, Thailand and Turkey.^[113] OLPC later expressed support for the initiative.^[114]

In 2009, a number of states announced plans to order OLPCs. However, as of 2010, only the state of Manipur had deployed 1000 laptops.

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Further reading

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External links

[Official website](#) ↗

11 Common Mistakes of Hardware Startups and How to Avoid Them

 admitad.pro/en/blog/11-Common-Mistakes-of-Hardware-Startups-and-How-to-Avoid-Them

June 29, 2021

What a hardware startup is and what defines it. Examples of such startups in Russia and worldwide. Common mistakes of innovative hardware companies. What you can do to avoid making such mistakes.

A hardware startup is a company that creates, develops, and manufactures electronic devices.

Hardware startups are somewhat opposed to software ones: while the latter produce computer programs, the former build actual physical objects.

General features of hardware startups often lead their founders to make the same mistakes. In this article, we list key gaps in hardware startup management and ways to avoid incorrect decisions.

Hardware startup characteristics

There is a rule for hardware companies: only a scalable project can be transformed into a successful business. It means that the difference between **a project** and **a product** is the difference between **creating one piece of hardware** and **producing a whole batch**.

However, “producing a batch” is traditionally associated with higher costs, limited access to the materials, and other difficulties. In order to grow and evolve, a company must find a way to keep its production costs as low as possible.

Luckily, over the past few years, a trend towards simpler manufacturing processes has emerged. It has affected the hardware industry, too.

Hardware manufacturing specificities

Building a company that makes proper physical objects may be complicated by a couple of specific industry characteristics.

1. **Lengthy and labor-intensive development process.** Generally, hardware startups require more time and work to create their very first products. Preparations for the launch include steps that are simply unnecessary for software development.
2. **Involvement of third parties and contractors.** Hardware startups tend to involve external actors in their business processes. Such actors may include consultants, design agencies, manufacturers, distributors, and so on. Building relationships with partners is a difficult strategic process that requires constant attention.

3. **Complicated organizational structure.** Differences between hardware and software development are manifested in companies' internal structures as well. As a general rule, hardware startups have more complex multi-level business models since they also need a packing department, a production management department, and so forth.
4. **Butterfly effect.** Tiny mistakes at earlier stages of hardware development lead to disproportionately destructive consequences in the long term.

Examples of hardware startups in Russia and worldwide

Russian hardware startups

Dauria is an ambitious startup that specializes in space exploration and satellite manufacturing. It's one of the first Russian corporations to launch private satellites into Earth orbit. *Dauria* has worked with *Roscosmos*. In 2015, it received \$70 million from *Cybernaut*, a Chinese investment fund. *Dauria* was founded in 2012 by Mikhail Kokorich.

RoboCV is a manufacturer of smart autopilots for warehouse transportation vehicles. It has created X-MOTION NG, the world's first fully automated mobile robotics system designed to operate indoors. Industrial robots made by *RoboCV* can move objects along all of the three axes. They are controlled through a cloud solution. Founded in 2012 by Sergey Maltsev.

DRD Biotech is a startup from the Republic of Buryatia that works on creating in vitro rapid response tests for diagnosing brain damage based on biotechnology and IT. The company products are used to detect ischemic strokes, epilepsy, and cranial injuries. In 2020, the company started to develop a rapid test for coronavirus. Founded by Anzhei Zhimbiev in 2014.

Global hardware manufacturers

Graphcore is a British company that makes chips and processors for artificial intelligence and machine learning. Graphcore's production is used in many areas, such as medicine, robotics, and automated vehicles. The startup intends to make its IPU technology a world standard in AI. *Graphcore* was founded in 2012 by Nigel Toon and Simon Knowles.

Fitbit is an American manufacturer of wireless devices for physical activity tracking. *Fitbit*'s gadgets can measure the number of steps you walk during the day, your sleep quality, and many more health indicators. In 2015, the company conducted an IPO on the New York Stock Exchange which brought it \$358 million. Founded in 2007 by James Park and Eric Friedman.

GoPro is a startup that manufactures cameras for action video shooting. Its first product was a film camera that brought only \$150 000 to the company. However, in 2007, a shift to digital cameras allowed the startup to receive \$3.4 million in revenue. In 2014, *GoPro* launched an IPO hoping to raise \$2.95 billion from the sale. But the stocks sold like hotcakes on the NASDAQ. Their aggregate market value increased four times over several months reaching \$11.8 billion. The company was founded by Nick Woodman in 2002.

Common mistakes of hardware startup founders

1. Trying to create the next *Apple* or *Tesla*

The easiest way to instantly drain a startup's money is to imitate tech giants. New companies just don't have enough capital to do things the way industry moguls do.

When *Apple* began manufacturing aluminum cases for Macbook Air, it had to purchase 10 000 CNC machines to be able to ship one million units per year. Obviously, no startup can replicate that move. A newly established company that needs to manufacture similar cases is more likely to change the design so that it can function just as well while requiring simpler production.

Solution: build the manufacturing system on the lean startup methodology right from the start. Keep the processes simple. Don't try to make another *Tesla* in your favorite industry or niche market; work on your own unique offer instead.

2. Blind trust in customer opinions

You might probably want to ask, "What do you mean? Shouldn't businesses always listen to customers?" Our answer would be: not necessarily. Or at least not without critical thinking.

When founders are obsessed with their projects, sometimes they become tempted to promise clients everything they demand. While paying attention to customers is a must for every startup, it's equally important to take into account actual financial limitations. **An aspiring project cannot make everyone happy** as it lacks sufficient resources, experience, and key team members.

Solution: focus on one particular need of your client and find a way to address it better than anyone else on the market. The more functions your product has, the pricier its production gets, and yet more things can go wrong.

Every wrong move is costly in the hardware industry. Big companies can afford mistakes, but a startup must avoid them by all means. Therefore, it's best to keep products simple, designing them with fewer functions and thereby fewer errors.

3. Product design that ignores technological limitations

Building a functional prototype is just half the battle. The real challenge lies in scaling the project to organize its mass production.

The most important things to design at this point are the printed circuit board and the exterior of the product. The latter is especially tricky: no matter how many prototypes a startup builds, at least half of them will never make it to the production phase.

Things get complicated when founders underestimate how crucial it is for a product design to comply with technological requirements. Reckless development practices, especially when critical errors get detected in the middle of a large batch production, lead to enormous expenses and delays.

Solution: as a rule, first prototypes get 3D-printed or made of materials at hand, such as wood, paper, or cardboard. As startup evolves and moves forward, it can afford professional product design services. This solution allows combining looks, usability, and functionality, all while abiding by manufacturing restrictions and other technical characteristics.

4. Obsession with an idea

A good idea is not enough: it also needs a sales market. But some founders become so obsessed with their concepts that they cannot accept the current economic situation and respond to it. They can't evaluate the demand level objectively or simply listen to constructive criticism from users, investors, friends, and family members.

Solution: improve your projects by conducting CustDev interviews, gathering data from end-users, and adjusting the product accordingly. This way it has more chances to find its target audience and remain on the market for a while.

5. Underestimating development and production costs

Prices on electronic components and prototype building tools continue to decline. However, when a production line reaches an output level of thousands of units per month, expenses may increase at an exponential rate while remaining unnoticed.

That is often a result of underestimation of certain expenditure objects like certification, assembling, packing, and shipping. Founders' disregard for sudden delays, changes in the instruments used, or discovered defects might be involved, too.

For example, *Coolest Cooler* became the second most supported startup on *Kickstarter* in 2014: the company raised almost \$13 million. That seemed like enough money to start a production process, but all of the investments could not save *Coolest Cooler* from a complete failure. It underestimated the development expenses, resulting in shipping delays of several years. Thousands of disillusioned customers were awaiting the arrival of goods they purchased.

Solution: analyze your expenses well beforehand. Ask manufacturers or founders of other startups how much the development process may cost. The more opinions you gather, the better. Finally, be sure to calculate your budget thoroughly and with due attention so that you do not spend your entire capital on production alone.

6. Inaccurate planning or scheduling

Many manufacturers from Western countries prefer to launch their products during the Christmas season, expecting to monetize the holiday surge in sales. However, no company is safe from unexpected disruptions in the production schedule.

They might be caused by

- delays in the supply chain,
- inaccessible components,
- poor production quality,
- sudden changes in the manufacturing process,
- correction of discovered errors.

Solution: try to predict all possible delays and include them in the production schedule, leaving out a considerable amount of extra time to cover any emergencies.

It may also be wise to bear in mind all important events and holidays in your partners' countries. For example, if your manufacturer is from China, make sure to exclude the Chinese New Year weekend from your working schedule.

7. Lack of proper testing

Say, founders create an excellent smartphone prototype. Its waterproof case was tested at sea level and worked perfectly well in every test.

But the waterproof material may start deforming at higher altitudes. This points to the lack of testing during the design phase: the product designers didn't account for pressure differences and therefore ignored the necessity to try the smartphone out in various environments or use cases.

Solution: you should spend a lot of time and effort to test your product before shipping using only appropriate methodologies and product testing standards.

8. Insufficient market research

Ignorance of customers' needs, desires, and problems is another trap for hardware startups. Many founders start working on their projects in a complete information vacuum. As a result, their products do not solve any real problems and lack an actual market or business model.

Solution: feedback is everything in the earlier stages of development. Start gathering client reviews by identifying your target audience and conducting an extensive market study. [Find out more about CustDev](#).

A preliminary study helps you understand what the target audience looks for, so you'll be able to abandon ideas without potential. It allows you to focus on actual problems and avoid spawning useless product features.

Pro tip: crowdfunding schemes are useful for testing the actual demand for the concept of your startup. If people are ready to pay for your product when it's merely an idea, then it must really be valuable. Moreover, a successful crowdfunding campaign is a good argument for potential investors.

9. Wrong choice of a manufacturer

Numerous startups have had to stop production because of totally incompetent manufacturing partners. In most cases that happens when a factory of inadequate scale gets chosen.

For instance, an order for 20 000 parts would simply go unnoticed by a big manufacturer that ships more than a million parts every month. But a smaller factory would be able to pay attention to the developer's needs and complete the order more thoughtfully.

Solution: you should request relevant documentation and reference materials to ensure the partner will actually be able to deliver your order in the required quality.

Communication is key to managing every relationship. That is why you might want to avoid working with middlemen and spend more time on the ground with the producing team instead. It will help you get into corporate culture, understand the processes, and form expectations for quality standards.

10. Lack of competitive advantage

We live in a world where every innovative idea will be copied by some Chinese company and made into a much cheaper knock-off. The majority of hardware projects are particularly vulnerable to reverse engineering and reproduction.

A patent may be used to protect business concepts, but obtaining one is a rather costly procedure. And besides, in case of legal proceedings, a patent violator almost always has more money to cover legal costs than a startup. That explains why patents are generally not used by founders nowadays.

Solution: if a hardware project has no objective and uncopyable competitive advantages, you should focus on creating a loyal brand community. Exceptional customer service and splendid user experience will help your startup stand out from the crowd of even the most accurate fakes.

11. Inadequate traction

Remember those hypothetical founders with their waterproof smartphones? Let's say the team of the startup spends months refining every part of the prototype. Then the product launches, and it turns out customers are not exactly interested in waterproof phones.

That happens all the time: sometimes startups fail to become successful despite having an excellent conception. Such failures are attributed to the fact that a startup couldn't secure enough initial support as a result of a weak marketing strategy.

Solution: start your advertising campaign early on to hype up customers and create a big client base. When the startup is ready to present shiny new prototypes, enough people will be interested in the product, and the company will be able to convert that interest into its first shipments.

Brief summary

Hardware startups develop actual physical gadgets with innovative features. The industry specificity makes hardware startup founders make similar mistakes. Basically, all of them are caused by problems which can be divided into three main categories.

1. A startup lacks

1. information about its target audience,
2. a marketing strategy for product promoting,
3. sufficient testing and quality control,
4. a unique competitive advantage.

2. A startup has unrealistic expectations for

1. its own possibilities and resources,
2. customers' opinions and genuine needs,
3. the value of an idea the startup is based on.

3. A startup has made mistakes in

1. the product design itself,
2. calculating costs and expenses,
3. establishing a work schedule,
4. choosing a manufacturer.

Each of these problems is capable of setting a project back for a couple of steps, canceling out all of the achieved progress, and resulting in thousands, if not millions in losses. That is why we recommend you carefully plan the strategy, test your hypotheses repeatedly, and hold a finger on the market's pulse, whatever venture business you're building.



Dayana Bol'shakova

Marketing Manager at Admitad Projects



11 Reasons Why Hardware Startups Fail and What You Can Do to Avoid it

o. outdesign.co/single-post/11-reasons-why-hardware-startups-fail-and-what-you-can-do-to-avoid-it

September 7, 2017

You've probably heard "Hardware is Hard!" several times before already. Hardware *indeed* is hard and hardware startups fail hard!

But why so? What makes hardware startups different?

Below we have listed 11 reasons why hardware startups fail and how you can avoid those failures.

This article will be useful for those of you who may be planning to start a hardware startup or may be in the process of developing a new hardware product, by giving you an overview of the things to avoid while you try to bring your hardware product to market.

1) Trying to build the next Apple/Tesla of 'X'

As a startup, an easy way to run out of all your cash is to emulate tech giants like Apple and Tesla. You simply don't have the capital to do things the way big companies do.

According to Ben Einstein (*previously founder of BoltVC*), when Apple had to manufacture the aluminium uni-body casing for the Macbook air, they bought 10,000 CNC machines to make a million of those per year.

CNC machining is expensive and as a startup you should avoid CNC machined parts in high volume products.

Instead, look for ways to alter the design of parts in such a way that they perform the same function but use a different manufacturing process like metal die-casting or sheet metal processes. These are much more cost-effective at higher volumes.

It's best to keep things simple and lean initially, and instead of being the Apple/Tesla of 'X', sell your own unique value proposition that differentiates you.

2) Not considering DFM (Design for Manufacturability)

Getting to a functional prototype is only half the battle won, the real challenge is to scale from prototype to mass production.

While prototyping boards like Arduino or Raspberry Pi may be great tools for hardware prototyping, they are not economically viable options at large scale production.

A custom PCB, designed according to your product's core functionality using easily available components is the logical step when scaling.

For the enclosure design, we come across too many designs that are either not suited for manufacturing at high volume or sometimes are just not practical to manufacture at all.

For proof-of-concept prototypes, an off-the-shelf enclosure or a basic 3D printed enclosure usually works fine. As you progress further with the development of your product, you will eventually need a professionally designed enclosure for your product.

A professionally designed enclosure provides the right combination of aesthetics, usability and functionality, while being considerate of the manufacturing constraints and other technicalities.

The importance of **DFM** (Design for Manufacturability) is often under-estimated by many founders and this can result in significant additional costs, delays and frustration down the line.

At Outdesign, we not only consider DFM when designing products, but also place huge emphasis on **DFA** (Design for Assembly) of products to further streamline the assembly process.

3) Underestimating Development Costs

The costs of electronic components and prototyping tools have come down in recent years and this trend continues. But these costs can add up quickly when manufacturing in thousands.

It is not uncommon to see hardware startups raising \$1m+ and still not being able to ship their products.

Often, it's a result of underestimating the overall development costs including certifications, assembly, packaging, warehousing and shipping, and not factoring in unexpected delays, tooling changes or defects.

Coolest Cooler launched in 2014 was the second highest funded project on Kickstarter, raising nearly \$13 million. One would think that they raised an enormous amount of funding for their project. Of course, \$13m is a lot of money, but it could not save Coolest Cooler from almost shutting down.

The underestimation of development costs has resulted in several years of delay and thousands of unhappy customers who are still waiting for their products to arrive. The company has also been on the lookout for additional external investment. Here is one of our article about [Crowdfunding on Kickstarter- Hits, Misses and Lessons Learnt](#).

4) Lack of Research and Validation

Not knowing enough about your end-users' needs, desires and problems is another major pitfall that hardware startups (and every entrepreneur who wants to succeed) must be wary of.

Yet, we see too many startups creating products in a vacuum, only to realize later that they address no real problems, have no real market or a feasible business model.

Define your target audience and conduct extensive research to understand your customer base. Getting early user feedback is crucial to understanding what your target audience is actually looking for, instead of pushing down features which they don't really need.

This not only keeps you focused on solving real problems, but also helps you avoid 'feature creep'. And as a result of giving users what they ask for, the sales and marketing process also becomes more effective.

You also need a way to validate that your idea has a real market (Yes, even if your mom thinks that you have a great idea!) Crowdfunding is a great way to validate your idea.

When people are willing to pay for what you are building, it's an actual validation that your product has a market.

A successfully funded campaign also puts you in a strong position to seek funding from angel investors.

*"If I had asked people what they wanted, they would have said faster horses."**

(*quote famously attributed to Henry Ford, though without any evidence)

Unless your product is as ground-breaking as the Model T, **do ask people what they need!**

5) Listening to your Customers! (Wait...What?!)

Being passionate about your product, you might be tempted to give your customers all the features they could ask for. And while it's important to listen to your customers, you also need to work within your financial constraints as a startup and realize that you cannot make everyone happy.

Focus on a very specific need and try to address it better than anyone else. As described in the book *Universal Principles of Design* by William Lidwell, it's a Flexibility-Usability tradeoff.

Flexible designs can perform more functions than specialized designs, but they perform those functions less efficiently.

For example, "a Swiss army knife offers flexibility in the functions it can perform but is less efficient in performing the same functions when compared to the corresponding specialized tools."

More the features, higher the complexity and production costs, and higher is the number of things that could go wrong.

Mistakes in hardware startups are costly, so it's best to keep things simple when starting out. While bigger companies can afford to make mistakes, the same mistakes by a new business could mean pack-up before starting up!

6) Falling in Love with your Idea

Some founders are so obsessed with their ideas, that they are unable to accept the market realities, data or constructive criticism from their users, investors, family and friends.

A good idea alone is not enough, you need to have a market for it too. It is therefore important to keep iterating and improving your ideas as you collect more and more data from user research.

This will ensure that your product is a better fit for the market and loved by your users. We love to work with clients who are open to criticism of their idea. Mostly it leads to an end product that is much better than what they had initially set out to create, which is a win-win for everybody involved.

7) Lack of Proper Planning and Timelines

Many consumer product launches are scheduled before Christmas to capitalize on the increased sales during the holiday season. The annual Consumer Electronics Show soon follows.

If you are on a similar schedule, factor in delays caused by unexpected disruptions in your planned production schedule and add a generous buffer.

Delays can be due to multiple factors - supply chain, unavailability of certain components, quality issues, a last minute change or some flaw discovered in the product. You must also factor in important events and holidays in the country you are manufacturing in.

For example, if manufacturing in China, you must plan for the Chinese New Year much ahead of time. Here's a great article from Dragon Innovation on [how the Chinese New Year affects your manufacturing plans.](#)

8) Wrong Manufacturing Partner

Unfortunately, there are numerous stories about how a startup had to halt manufacturing or reschedule due to lack of competence, commitment or timely communication from the manufacturing partners.

It therefore becomes paramount that enough diligence is carried out before engaging with a manufacturing partner.

Look for proper documentation and referrals to ensure that the manufacturer can actually do what they say they can do.

Communication is key to managing any relationship, therefore, avoid engaging with middlemen and spend as much time as possible with manufacturing company's teams on the ground.

This will not just help you gain an understanding of their local culture, processes and constraints, but will also help set expectations and define quality standards.

Choosing the right sized factory is equally important. Your 'large' order of 10,000 parts just won't get the necessary attention from a manufacturer who makes millions of parts every month. A smaller but competent manufacturer will be more willing to take your order and accommodate your requests.

9) Lack of Proper Testing

What should you do when you have a *great looking prototype* that works exactly as intended? You should spend enough time (and money) to test your products before you ship them out.

Understand and apply proper product testing methodologies and standards. Test rigorously for different environments and for multiple use-cases.

For example, you may have a waterproof (IPx6) product that is assembled and tested at near sea level, and is working as expected.

If the same product is shipped at a higher altitude area, the waterproofing seals might fail if the pressure difference was not accounted for while designing.

Temperature, Altitude, Moisture levels vary across regions and it is therefore important to design and test your product according to the conditions it has to operate in.

Remember, no business - big or small - wants its customers to send back products because they were faulty. And a lot more is at stake for fledgling startups - credibility, customers and costs.

10) No Competitive Advantage

Most physical products are not difficult to reverse engineer or replicate, every product is prone to copycat manufacturing. For every innovative hardware idea, there is most likely some company in China that can offer a similar product at a much lower price.

If you have a highly successful product, it will most likely get copied, sometimes even before your Kickstarter campaign ends, as we saw in case of *STIKBOX*.

Patents can help to a certain extent depending on your product idea, but they are expensive to begin with. The litigation costs in case of infringement by someone in another country with deeper pockets than you are usually not worth the hassle. And if your product is relatively easy to manufacture, it won't be just one factory that you will have to go after.

Your only competitive advantage then is to create a strong community around your product, build a brand and offer great customer support so that you are not simply selling a product, but a great end to end experience.

11) Not Enough Traction

You spend months on end perfecting little details of your product prototypes, but without giving any importance to generating interest around your idea. When you are finally done (if ever) you realize that there aren't enough users to buy (or atleast appreciate) what you have built.

You are not alone. There are so many startups that despite having a great product, are not able to take off just because they don't get that initial traction. This is because they didn't plan and implement a strong marketing strategy right from the beginning.

Start your marketing campaign early on to generate interest and build a strong fan base, so that by the time you are ready to unveil your polished prototypes, you already have a good number of people who are interested in your product. Having a marketing person as a co-founder is helpful if you are the tech guy as it complements your skillset.

Pebble pulled this off brilliantly. When they launched their first Kickstarter campaign in 2012, they had already built a list of 6000 subscribers who were interested in their product, apart from exclusive media tie-ups. As a result, Pebble got the initial traction they needed and went on to become the most funded KS project of that time.

The Top 12 Reasons Startups Fail By CB Insights 2021

12. Burned out/lacked passion

Work-life balance is not something that startup founders often get, so the risk of burning out is high. Burnout was given as a reason for failure 5% of the time. The ability to cut your losses where necessary and redirect your efforts when you see a dead end — or lack passion for a domain — was deemed important to succeeding and avoiding burnout, as was having a solid, diverse, and driven team so that responsibilities can be shared. What can make conversations about burnout difficult, especially in Silicon Valley, is the widespread belief that building a successful company will always involve some degree of possibly hazardous overwork. As former Uber board member and CEO of Thrive Global Arianna Huffington puts it:

11. Pivot gone bad

Pivots like Burbn to Instagram or ThePoint to Groupon can go extraordinarily well. Or they can start you down the wrong road. For Frances Dewing, the founder of Rubica, a last-ditch attempt to save her cybersecurity startup from failure amid Covid-19 led her to pivot from focusing on consumers and small businesses to larger companies.

10. Disharmony among team/investors

Discord with a co-founder was a fatal issue for startup post-mortem companies. But acrimony isn't limited to the founding team, and when things go bad with a board or investor, it can get ugly pretty quickly, as evidenced in the case of Hubba.

9. Poor product

Bad things also happen when you ignore what users want and need, whether consciously or accidentally.

8. Product mistimed

If you release your product too early, users may write it off as not good enough, and getting them back may be difficult if their first impression of you is negative. And if you release your product too late, you may have missed your window of opportunity in the market.

7. Not the right team

A diverse team with different skill sets was often cited as being critical to the success of a company.

6. Pricing/cost issues

Pricing is a dark art when it comes to startup success, and startup post-mortems highlight the difficulty in pricing a product high enough to eventually cover costs but low enough to bring in customers.

5. Regulatory/legal challenges

Sometimes a startup can evolve from a simple idea and enter a world of legal complexities that can ultimately shut it down.

4. Flawed business model

Most failed founders agree that a business model is important — staying wedded to a single channel or failing to find ways to make money at scale left investors hesitant and founders unable to capitalize on any traction gained

Various music startup post-mortems also pointed to the difficulty of finding a viable business model in the industry as a reason for startup failure.

3. Got outcompeted

Despite the platitudes that startups shouldn't pay attention to the competition, the reality is that once an idea gets hot or gets market validation, others may try to capitalize on the opportunity. And while obsessing over the competition is not healthy, ignoring it was also a recipe for failure in 20% of the startup failures.

2. No market need

Tackling problems that are interesting to solve rather than those that serve a market need was cited as the No. 2 reason for failure, noted in 35% of cases. Mobile-focused streaming service Quibi, which shut down in October 2020 just 6 months after launching and raising a mammoth \$1.8B, found itself in this position.

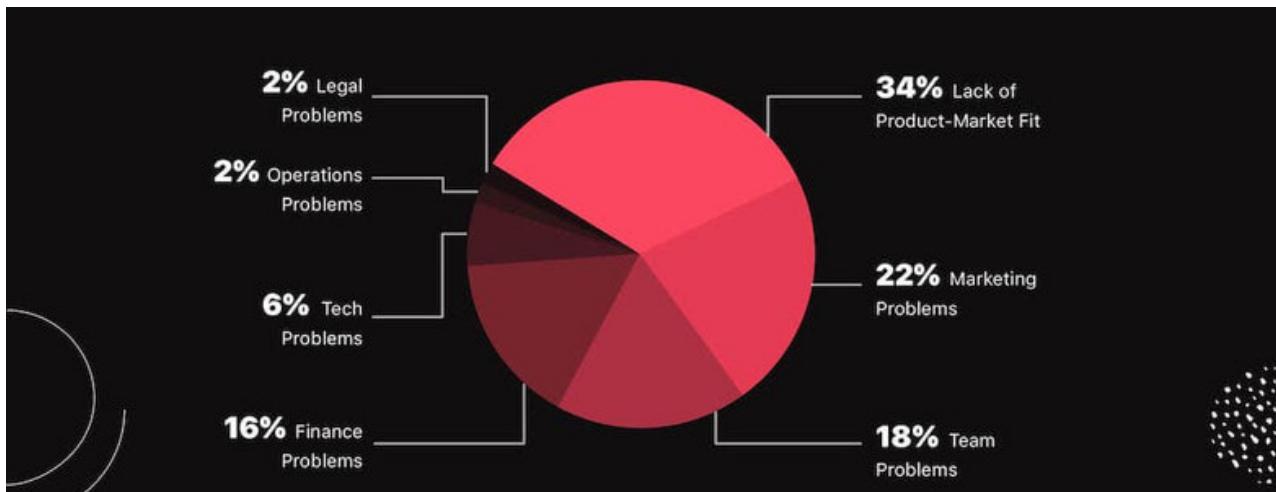
1. Ran out of cash/failed to raise new capital

Money and time are finite and need to be allocated judiciously. For the startups on our list, running out of cash — tied with the inability to secure financing/investor interest — was the top reason startups cited for their failure.

13 Reasons Why Hardware Startups Fail?

 industry.com/blog/reasons-why-hardware-startups-fail

November 9, 2020



We are human beings, and we learn from our mistakes. But how it sounds that you learn from others' mistakes? We study the reasons for the failure of others so we can prevent ourselves from making those mistakes. If we talk about hardware startups, many people, CEO, team members make the wrong decisions and make some mistakes. There are some solid reasons behind these mistakes because hardware startups founded are hard to manage. The purpose of this content is to make you aware of some common mistakes most people make so that you can avoid these mistakes to save your investments.

There are several reasons for the failure of hardware startups. These reasons fall into three main categories: technical, financial, and marketing. Here is a list of all the reasons for the failure of a hardware startup.

Technical Reasons Why Hardware Startups Fail

During the manufacturing and development process, many technical issues occur.

It depends on how complicated the hardware is. The more complicated device means the more challenging task to avoid mistakes.

IoT devices need a lot of time in the estimation of cost due to its latest technology. The latest technology used in IoT is in great demand as it includes simple home devices to room door locks to make our lives convenient.

If any single thing goes wrong, the whole investments are at risk.

Miscalculating Product Development

Product development is a complicated, expensive, and time-taking process in hardware and software plans.

Even big tech companies also invest their time to estimate cost and time to develop a new idea.

Hardware companies have to face challenges to get real-time product and design.

Some rare cases go well beyond our expectations. Engineers always have to work hard to meet unexpected challenges.

It is not easy to bring a new product with innovation in the market. The investors put in their investments to complete your mission.

Underestimating the complexity of mass-manufacturing

Entrepreneurs make a mistake by underestimating the complexity, time, and cost of the product from prototypes to mass manufacturing — the most important and perhaps the most forgotten step in launching a new product in the market.

Companies should focus on the development from an early stage and consider how to design a product.

Then it will be easy to manufacture a product.

This method is called Design-For-Manufacturing (DFM). It is advisable to practice DFM at the early stages so that your design will be more comfortable and less costly during scale manufacturing.

Poor Quality Testing / Bad Product

A company invests a lot of money and time to bring its products to the market.

Investors invest money in a hardware startup to get the products to the people.

All this hard work will waste if you deliver defective products to the customers. The popularity of your products will go down if you provide a product with broken parts.

Therefore, it is necessary to conduct quality testing off and on to control default products shipping.

Many businesses ruin just because of shipping the wrong products.

Requirements Creep

The most common mistakes that a company or entrepreneur does while designing their product are requirements creep. They want to make their product perfect, but they forget to put all possible features in the product.

The investors or venture capital invests money in your startup ideas and provides funding, but you must meet all the requirements.

It is necessary to estimate the financial limit for startup and then add features according to the budget.

Over Promising to Customers

Do not be over predictable to your customers until you have the product in your hands.

When you get to know that product is ready, don't rush to advertise on social media.

First, do high-quality testing and then give ad to social media and other sources like on your company's website. If you make big promises and fail to deliver quality on time, you will lose users' trust.

It is also good to promote your device before it launches as many companies are doing through their websites' promotion. Keep your customers up-to-date about the shipping schedule and ship them high-quality devices.

Financial Reasons Why Hardware Startup Fails

Many entrepreneurs give up on startups by thinking that they do not have enough funding to invest in.

Funding is indeed a huge obstacle, and many entrepreneurs find investors to fund their startups. But sometimes, it is a blessing not to have much money.

Are you amazed at how?

Less funding will force you to make smart choices without the need of any funding from investors. It does not mean that you will not need money at all.

It means that you will need money in the initial stages of the development of hardware startups. These funding needs will lessen with smart decisions and real-time plannings.

Here are some common reasons why hardware startups fail.

Ran out of money

The most common thing in a startup is financial resources, but what if you face a financial crisis during the device. Companies have to face a financial crisis because they underestimate the development cost. In this case, the problem does not have the capital for project development but a low estimate of development cost.

Sometimes companies develop the wrong device that no one wants to buy, and when they do not have enough finance to make a new device.

So the problem is not a financial crisis but a wrong understanding of users' needs.

Here it would help if you had a reasonable estimate of development cost, not the investors.

Small Profit margins

Many entrepreneurs lose hope at the start of startups because the profit margin is small.

When there is a small number of devices, you will get a small profit margin.

As the demand increases, the manufacturing volume increases and cost per unit decreases. That means it takes time to get a considerable profit margin.

Even the companies experience low-profit margins at the start because of the small volume of manufacturing. Sometimes it becomes challenging for companies to survive in this condition, but companies use different technologies to promote the mission of the hardware startup.

Underestimated Production Cost

For hardware startups, the manufacturing cost is a crucial element to determine choosing a reliable partner manufacture is a crucial point.

It directly affects the margin of the startups. If there is any mistake in estimating production costs, your margins could decrease. If your margins are low, there are specific reasons for this.

Either you have underestimated the cost of production or overestimated how many people are willing to buy or both.

Another major disadvantage of underestimating production costs is an increase in inventory cost. Once companies set up manufacturing units, inventory costs constitute a significant disadvantage and decrease the profit margin.

Wrong Estimate Sale Price

Hardware companies may also face financial issues if they have the wrong estimate about the sale price.

It would be best if you reduced your manufacturing costs to level your profit margins. Most hardware startups fail due to a lack of sufficient profit margin.

It is necessary to collect all the information and data about hardware startup before starting it. Companies with low margins are difficult to move further towards sustainability.

Cash Flow

Cash flow is the biggest problem for hardware startups and the main reason for the failure of a hardware startup. Many manufacturers ask for some advance payment upfront with the remaining amount due before shipping.

It depends on how you work. If you directly sell your goods to the consumers through your website, you need to pay for those units to keep goods in inventory.

It depends on how fast you sell your goods, but it takes months to sell your goods.

If you are planning to sell your goods in retail stores, then you can wait for 30 to 90 days to get paid. In both situations, cash flow seems the biggest obstacle.

It means you must have sufficient funding for a hardware startup to keep your feet firm in the business world.

Marketing Reasons Why Hardware Startup Fails

Most hardware startup fails because companies spend a lot of finance on production and manufacturing, but they neglect the advertisement for the startup.

The marketing of hardware devices matters and companies can survive without its promotion. What other things will matter the most if companies do not get enough sales?

For a successful startup, it is necessary to get marketing services to experience more sales and substantial profit margins. Run a strong ads campaign through different software and double the margins.

Unaware of customer's needs

A simple reason why hardware startup fails is that they are unaware of the customer's needs.

Just because customers say that they will buy the product does not mean they will buy it.

This is the point where hardware startup faces difficulties. Sales feedback is necessary to get an idea about the demand of people. The most beneficial way for this is crowdfunding because people vote for the product by using actual money.

[A simple reason why hardware startup fails is that they are unaware of the customer's needs.](#)

[Click to tweet](#)

Neglect Building an Online Community

This is something you need to do as a first priority. As technology advances, we have many online platforms to build an online community.

We can increase our sales by sending an email to the relevant retailers and consumers.

You can work on social media apps to post stories about your goods. Online platforms grow your online community throughout the world. You can earn a considerable profit margin through the online community.

Delayed Sales Marketing

Communication is a great way to connect with people and increase sales.

Some entrepreneurs focus on the production of goods but neglect sales marketing. The sales will increase if the founders will focus on marketing techniques.

You can hire a co-founder with marketing experience to boost your sales. The combination of technical founder and marketing founder will work great with hardware startup.

Conclusion

I would highly recommend going through the content to prevent yourself from these mistakes.

Before startup, collect all the necessary information about do's and don'ts to succeed in this field.

We need to look at all the reasons why startups fail and then avoid these mistakes.

An investor invests his funding to make a project successful, and we should not waste his funding by doing silly things. Innovation is the key to access international markets.

A leader with co-founders is the best combination to run a successful business. Co-founders also view success stories, future aspects, device innovation, funding, venture capital, and employees to lead a business towards the new height of innovation.

Don't forget to share this article!

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#SBChat: Overcoming the Challenges of Running a Hardware Start-up in Ghana with Isaac Sesi.



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James Erskine

@SBIIncubatorGH : What has been your top three challenges starting a hardware company in Africa?

@IsaacSesi : Scaling to mass manufacturing: It is very difficult to scale to mass manufacturing in Africa. Setting up manufacturing processes, getting the right equipment, finding enclosure for your products, etc are some of the challenges you will face when trying to scale your manufacturing. Funding: Unlike software where all you need to develop an MVP is a laptop and #internet, developing hardware is expensive. You need money to develop a prototype. You need equipment to refine your prototype. All of this cost money. U need a larger skillset to successfully develop a hardware prototype. You need a maker (the engineer who designs and prototypes the product.) then you need the software guy who will develop supporting mobile applications. These come cheap. So you need cash. Technical Knowhow: Developing hardware requires a lot of specialised skills. Unfortunately, it is difficult to find people with that skillset in Africa. Either they are already working somewhere or they are so expensive that you cannot afford them initially if you don't have cash.

@SBIIncubatorGH : How did you manage the risk during the development stage?

@IsaacSesi : We had a lot of support. We had support from our partners at USAID to get us set up nicely. We had access to 3 years of research that had been done on our product to refer to. We also had access to experts in industry, research, who guided us to get started with our production facility. And we had a contract already waiting for us before we finished developing so i guess i would say, we were blessed.

@SBIIncubatorGH: What are the top four factors to consider when starting a hardware company?

@IsaacSesi :

The problem/missed opportunity : Your hardware product should solve a unique, clearly identified problem in a way which other solutions are failing to solve.

The Market Potential: You should be able to clearly identify who is going to use your hardware and that there is a large enough market to justify bringing your product to market. People should also be willing to pay for it.

Technical complexity: The more complex your product is, the harder it will be to design, the longer it will take to get to market, the more expensive it will be to develop, the more cash you will need and the more challenges you will face. so you have to look at that.

The competition: If your hardware product is so common that you have to compete with the similar, probably, better-designed products from China, then already you are setting yourself up for failure.because china has more resources and can afford to produce at a lower cost than you.

@SBIncubatorGH : In what market segments do you see significant growth in hardware consumption ?

@IsaacSesi : There's the guy who developed the glove that translates sign language into audio. Then there is energy and education. DEXT is doing something awesome with the science set. If you're looking for promising hardware innovations by Africans, you can check out [@ASMEishow](#)

I see significant growth of hardware from Africa in the food/AgriTech space. A lot of guys such as [@ujuzikilimo](#) are already doing some pretty good stuff in that field. Then there's health too. People are developing affordable assistive technologies and it's exciting.

@SBIncubatorGH : What limitations do you see as barriers in scaling your hardware startup in the near future?

@IsaacSesi : I would rather say I see many of the present barriers gradually being overcome.I see; more access to funding by African startups in the coming years, more africans building skills in hardware, outsourcing of manufacturing becoming easier and more policies for hardware entrepreneurs.

@SBIncubatorGH : Starting a hardware business is capital intensive. What should potential hardware startups look out for in their very early stages of fundraising?

@IsaacSesi : Well, even though a lot of money has been raised by African startups in recent years, raising money is still difficult. First, you really have to have a good idea how much it will cost you to develop your product and get it to the market.

You can bootstrap to grants and competitions to help you develop a proof of concept that you can test. After, you can develop several iterations and do very low volume production all to test the product and business model and try getting some traction, then you can go look for investors.

Remember, you should identify a clear problem or missed opportunity that hasn't been taken advantage of yet and at least, show that there exists a big enough market for it and you should be able to clearly articulate your business model to anyone.

@SBIncubatorGH : What three top skills are in demand in the hardware manufacturing industry ?

@IsaacSesi:CAD/Industrial design skills(the guy who designs casing/enclosures and packaging with mad solid works skills). And of course, for every business, you need the guy with the mad sales/marketing skills who goes to sell the product.

Electronics design and embedded systems skills(the guys who design and build the actual hardware), software development skills(the guys who write the software/firmware that communicates with or works on the hardware)

#SBChat: Overcoming the challenges of running a hardware start-up in Ghana with Isaac Sesi.

@IsaacSesi: Provide funding opportunities, get experts to provide technical support to these entrepreneurs, a campaign to support and create appeal for locally manufactured hardware products, boosting the engineering capacities of institutions to better equip students with hardware skills, providing scholarships to students who want to major in hardware, low/zero import duty on parts imported for production to reduce the cost of production, these are all ways that will help.

14 Common Mistakes Hardware Startups Should Avoid

 startupblink.com/blog/14-common-mistakes-hardware-startups-avoid

By StartupBlink

May 3, 2018

Everyone loves a success story, but failures tend to be shoved under the carpet. However, we can learn much more from failure than from success. In this way, failure is a stepping stone to success. In the hardware startup world, there have been many failures, and we can learn from the mistakes these startups have made that ultimately led to their demise.

Here are some of the most common mistakes that hardware startups make and advice on how to avoid them:

1. Not building a prototype that works in different conditions

This is the first step in your hardware startup journey and can greatly impact your progress. Let's say you've built a great prototype that works well near sea level. What happens when the same product is taken to a higher altitude?

Questions such as these need to be answered before you start shipping out faulty products to customers. If you're building a hardware product in an industry such as healthcare, automotive, or aerospace, testing the product for various different scenarios becomes even more critical.

It's imperative for hardware startups to test their product for different scenarios and environments. This will ensure that you don't end up shipping defective units to your customers. After all, your credibility and your customer's trust are at stake.

You may think it's practically impossible to test a product for multiple different scenarios. If you're thinking of physical prototypes, yes it is. But there is another way you can test your product in a low-cost, low-risk environment: engineering simulation. Engineering simulation software helps you test your ideas virtually in any number of real-world scenarios. Startups can look at programs such as the [ANSYS Startup Program](#) that offer simulation solutions to startups.

2. Failing to take manufacturability into account

So, you've created a fully functional prototype. Congratulations! But wait, now you now have to face the hurdle that most hardware startups have trouble with once their prototype is ready: manufacturing their product at scale. This is also known as "Design for Manufacturability".

You could've used prototyping boards such as Raspberry Pi or Arduino for building your prototype, but bear in mind that these are not viable options to manufacture your product at scale. Another challenge that hardware startups face is designing their product enclosure.

While enclosures for prototypes can be built using 3D printing, production units use injection molding to build at scale. It's important to take into consideration all the modifications your enclosure will go through when using this method since it has several design rules that you must follow.

3. Skipping market research

Let's face it: every founder is in love with their idea. But do you know what the success of your hardware product depends on? The answer is how much your target audience loves your idea (and the product you finally build).

Try as you might avoid the marketing side of starting a business, this is where you should begin research for your hardware startup.

Begin by asking yourself 'who am I building this product for?' This is your target audience. Next, think of what problem your product is solving for these people. Is this a real problem your audience is facing or something you've cooked up to sell a product? If you are creating a simple B2C product, the best way to find out is to speak to your target audience face-to-face or online (community forums, social media). In some cases, if you are creating a groundbreaking technology, you will also have to identify the few experts in your field who might be able to help out with valuable insights.

Another aspect of market research is finding out who your competitors are and how you will differentiate your product from theirs. If your research is solid, you'll know which core features of your product matter most to customers. If not, you'll end up with a product that nobody needs, packed with too many features that nobody uses.

4. Underestimating development costs

It's important to take into account how much you'll be spending on development in order to have a healthy profit margin.

We are not referring to prototyping costs. Thanks to modern software simulation tools, prototyping can be made substantially cheaper in comparison to building a costly physical prototype by trial and error. But the cost of manufacturing your product at scale is what you really need to consider: assembly, warehousing, certifications, packaging, and shipping. And let's not forget delays and defects that you may have to deal with.

It's crucial to take these into account while setting your sales price or you'll end up with no profit margin, as well as delays in product manufacturing.

5. Developing “too many” features

This is not necessarily exclusive to hardware startups, but many of them are guilty of committing this mistake.

Developing too many features can be very expensive and time-consuming, and at launch, you may end up with a generic product that nobody really wants. Instead, focus your energy on developing one single feature that your target audience needs and doing it

better than anyone else in the market.

Remember that a product that performs one function in a superior way is better than a product that performs 10 functions in an average way. The more features you try to add, the more chances of things going wrong, wasting your time and resources.

Hardware startups should first develop an MVP with one core feature. Take that to potential customers, get their feedback, and then work on developing a better version. Don't try to develop your final product on the first attempt.

6. Choosing the wrong manufacturing partner

Your manufacturer carries the success of your product on his shoulders. Why? Because no matter how good your prototype is, it only matters how well you can develop the product at scale.

It is vital to choose a manufacturing partner that is both competent and can meet deadlines. Before you zero in your manufacturer, be sure to speak to as many candidates as possible, and put proper documentation in place, to avoid delays and roadblocks.

Spend as much time as possible with your manufacturing partner to build a strong relationship. Set expectations in the beginning, from a quality of production to production schedules. It's also important to choose the optimal factory size. If the factory manufactures millions of parts every month, they may not be willing to give the necessary attention to your order.

7. Lack of a differentiating factor

Why do people buy iPhones when other cheaper phones are available on the market? Some of these phones have even managed to copy the features that Apple offers, such as interface and style. Why is iPhone still the leader in the market?

Because consumers know that Apple is an innovator. While every product can be copied, you need to have the ability to innovate and lead the market by being the first to offer unique ways to solve problems that set you aside from the pack. Patents can be an expensive, especially if you don't have institutional investment.

In order to differentiate your product, you need to build a strong brand, offer great customer support, and build a community around your company.

8. Keeping insufficient profit margins

Your profit margin depends on two things: the cost of manufacturing your product and the sale price of your product. If you underestimate your cost of production or overestimate the price people are willing to pay for your product, you'll end up with a low-profit-margin.

In the beginning, it's common to see a low-profit-margin, as you don't have the benefit of economies of scale. Once you start manufacturing large batches, you need to find a way to lower your cost of production so your profit margin can go higher.

Profit margins are essential to keeping your company afloat. Lower profit margins will also mean fewer resources to invest back into your business.

At launch, a low-profit-margin may be acceptable. But you have to eventually make a profit to be able to sustain your company, yourself, and your family. Even in the beginning, having low-profit margins will make growing your startup much more challenging because you won't have any significant profit to invest back into your company.

9. Not working out cash flow needs

Many startups struggle with this, and it happens to be the second most important glitch after manufacturing.

First of all, there is the cost of developing a prototype. Depending on the complexity of your product, this can be an expensive affair. Luckily, hardware startups have the option of developing multiple virtual prototypes to see if their idea is feasible in the real-world through engineering simulation. Programs such as the [ANSYS Startup Program](#) offer multiple simulation options to startups.

After prototyping, startups need steady cash flow for manufacturing. Manufacturers generally require 50% upfront payment for production.

On the other hand, when you sell your inventory, it is likely that your clients will pay you after 30 to 90 days. So, you're looking at financing a good part of the inventory yourself, until you get paid.

In the early days, it is often essential to have an initial investment, ensuring your cash flow needs are met on time.

10. Failing to invest in marketing

Hardware startup founders are often solely focused on building the product, and ignoring marketing altogether. "Build it and they will come" is surely a recipe for failure.

If marketing is not your strong suit, then it helps to have a co-founder with valuable marketing experience. You can also hire an independent sales representative so they can set up distribution channels and start acquiring customers. Most of the time, sales representatives get paid on a commission basis, so you only pay once the sale has been made.

It's important to figure out a sales strategy early on. Don't just focus on hiring engineering talent. Also, look at adding valuable marketing and sales hires to your team, and identifying who can focus on customer acquisition.

11. Focusing on ‘beauty’ over ‘value’

While there's nothing wrong with beautiful products, they should also work properly.

While the design is one of the plus points of the iPhone, let's not forget that the product is superior too. Many startups try to simply design a beautiful product and don't invest too much in core functionality. The thing is customers don't care as much about how your product looks, as much as they care about how well it works. So it doesn't make sense spending precious dollars on an aesthetic designer.

In the beginning, it's okay to ship not-so-good-looking products to early adopters, so you can get feedback from them. The design is something you can always work on later.

12. Choosing the wrong cofounder

This is where a lot of startups falter in general, not just hardware startups. A co-founder should ideally bring complementary skill sets to the table, and essentially complete you.

This means if you're a technical founder, you need someone with business acumen and marketing know-how. On the other hand, if you're a salesperson, and have zero knowledge about building hardware, you obviously need someone to bring your ideas to life. Avoid choosing someone with the exact same skill set.

Another important factor among co-founders is the presence of trust and mutual understanding. If you don't believe in each other's vision and skills, you're probably not a good fit for each other.

13. Mismanagement of inventory

It's important to have a handle on inventory if you don't want things to spin out of control. If you manufacture too many units, you will have to wait until all of them are sold. On the other hand, if there's a lot of demand and no product, you'll lose customers.

Also, keep in mind that it costs money to store and ensure inventory. To avoid losses and lost opportunities, have a dedicated inventory management system in place for your startup.

14. Going to investors too soon, or too late

As a B2B hardware startup, you're likely to need a good amount of initial investment to start manufacturing your product. If you need money from investors, by all means, go to them. Do not wait until your idea can no longer be salvaged, or has already been copied.

On the other hand, if you think you can sustain your company without outside investment, hold off on seeking investors. Spend some time doing research on which investors would be interested in your product, and have experience in your industry. Once you've done some research, approach them cautiously.

Conclusion

We hope you can learn a thing or two from the most common mistakes that hardware startups make. Are you guilty of making any of these mistakes? How did you rectify them and save your startup? Share your story in the comments below!

The Top 9 Reasons Hardware Startups Fail by CB Insights 2017

Here are more details on the top reasons for failure.

#9 – Regulatory uncertainty

Regulation can help turn the tide of favor in either direction for a startup, and with a lot of consumer hardware products focused towards health/leisure, they can be caught on the wrong side of regulatory changes.

#8 – Investor/founder misalignment

Discord between co-founders or between founders and investors was a fatal issue for multiple consumer hardware startups.

#7 – Consumer adoption barriers

Consumer hardware startups often launch a product equipped with cutting-edge technology, flawless design, and awe-inspiring marketing. A common issue we found with failed consumer hardware products was the lack of a “Why?” Access to funding avenues like crowdfunding have made it easier for an idea to become a product, but there is often a lack of product vision to attract and retain customers, differentiate from competition, or to update the product in the future. Sweden-based Narrative launched a one-of-its-kind wearable camera in hopes of sparking a trend of “life-logging.” Narrative created buzz having raised over \$500K in a 2012 crowdfunding campaign and they went on to secure over \$11M in additional equity funding. But life-logging never became mainstream. Late last year Narrative ceased sales and sold its assets, raising questions about the underlying utility of it’s product.

#6 – Too much competition

The consumer hardware space has historically been one in which first-mover advantage is soon wiped away by tech giants following suit with the launch of a similar competing product. Startups looking to gain market share usually struggle against established brand names.

#5 – Manufacturing setbacks

Overestimating production capacity and expecting to scale sooner than supply chains or manufacturing bandwidth will allow was a common reason for failure. Manufacturing problems rooted in issues with materials, technology, or intellectual property were all identified as a factor for failure.

#4 – Product strategy mistakes

Some consumer hardware failures we evaluated made smartphone accessories and for that reason it was crucial for their products to align with the reference smartphone/tablet. In such cases, updates to both major smartphone platforms, iPhone and Android, might create unexpected challenges for the product. iPhone accessory company Popslate faced issues when it discovered that the design for its e-ink display iPhone case meant the product was not working as expected, and they would need major product change before they could ship. Increased R&D expenses coupled with a high burn rate proved it unsustainable for Popslate to continue operations.

#3 – Lack of interest after initial crowdfunding

Crowdfunding platforms like Kickstarter and Indiegogo have been a blessing for consumer hardware startups, and have enabled firms to acquire funds on thin evidence of real capacity to produce a polished product. The project’s promise is often based on prototypes or pictures so it’s not surprising that many startups fail to deliver, with some failing to even offer a refund to backers

#2 – High burn rate

Money and time are finite and need to be allocated judiciously. In our research of failed consumer hardware startups, spending available funds too quickly was identified as a frequent problem. In

this space, unexpected expenses can be triggered by factors like change in market dynamics or hurdles in product development.

#1 – Lack of consumer demand

Creating products that are interesting but do not serve a clear market need was identified as the number one reason for failure of consumer hardware startups, given that it was a problem identified in a notable 39% of cases.

Related blog posts

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6 Reasons Why Your Startup Fails

We know it might sound harsh but let's face it, **most startups fail**. According to CBInsights (2019), it was estimated that almost 90% of startups fail.

Surprisingly 97% of those startups were seed or crowdfunded consumer hardware startups, yikes! In terms of upstart tech companies, the failure rate is around 70%, which is still quite high.

Now, we don't want your startup to fail so we have curated a list of ways you can avoid failure.

Don't crash and burn, read and learn.

1. There is no market for your product.

“We’re the next Facebook!” Are you? Are you sure? Really? We love enthusiasm but you need to be realistic. What is your unique selling point (USP)? What makes you different? Know your chosen market like the back of your hand. If you can get online, you can do your research. You’ll need to come up with a brilliant marketing strategy and a customer acquisition strategy to prove that you know what you’re doing. Can you answer the following questions?:

- Have you learned from early versions of your product?
- Have you learned from your competitor’s mistakes?
- Are there any key features you want to add to make your product different from the rest?
- Why should anyone care about your product?
- Are your product milestones in place?
- How often do you intend to update your product?

Top Tip: There's no excuse for laziness. If you really don't know where to start, hire someone who does. Market researchers are always looking for exciting new challenges.

2. Your bank account is empty.

Approximately 29% of startups run out of money. Also, if you can't afford to hire people, don't. **Pricing and cost issues result in 18% of all disasters**. Make sure you have two founders. Two heads are better than one by significantly increasing your odds of

success. Based on relevant data (2019), companies with two founders raise 30% more than those with one, they are 19% less likely to prematurely scale and they have around three times the amount of user growth. If you know what the market looks like, you can implement strategies to make a profit! Even breaking even for a while is OK as long as you have a plan in place to improve. Funding might be available, search for it, apply for it, try to get yourself an investor! There are so many options available such as:

- Angel investor
- Online lender
- Venture capital (VC)
- Crowdfunding ([Kickstarter](#), [Indiegogo](#))
- Personal funds
- Bank loan
- Borrowing from family or friends
- Other funding
- Donations from family or friends

Top Tip: Investors aren't interested in good ideas, good ideas are everywhere. Actions speak louder than words. Being able to grow a little bit on your own before seeking investment can go a long way, investors like to see evidence of traction. This evidence can be found in press visibility, sales metrics, website traffic, app downloads etc. The more traction, the better.

3. The team doesn't work.

You've got funding and now you need to build up a team of people to help your business grow. This is quite tricky because hiring the wrong people, or hiring people for the wrong reasons is probably a mistake. Remember that even though your family member or best friend knows X, Y and Z, they might not make a good employee. **Not hiring the right team members accounts for 23% of all startup failures.** Proactive individuals are able to organise themselves and deal with issues which may escalate quickly. The more self-motivated your teams are, the faster the success rate. We've written more about hiring the right people [here](#) and [here](#). It's worth noting that hiring a lot of managers all fighting for attention is a bad idea, you need people willing to step up and do the work, leaving their egos at the door. If you hear the phrase "that's not my job" uttered at any point, then that's probably not a good sign. Most managers in startups do a lot of different tasks, before more employees are hired to help, without complaining.

4. Your business model doesn't exist.

Imagine starting a business without a plan. Why would anyone do that? The sad fact is that it happens, a lot. That's might be the reason **why your startup fails**. **Products without a business model equal 17% of failures**. There are so many business models to choose from such as the Ecosystem Model, On-Demand Model, Freemium Model, Experience Model, Subscription Model, "Free" Model, Access-Over-Ownership Model etc. If you need advice, there are venture builders and consultants out there who would be willing to help you. If you don't know what you're doing, it's crucial that you find people who do! Nobody wants to read your boring 50 page business plan either. Be aware of your competitors and think outside the box, the startup world and the corporate world are very different environments. One is a jungle, the other is a zoo. If you have written a really long winded business plan, that's OK, keep it for internal use, it won't go to waste and it's likely a lot of work was put into it. However, it means nothing if you can't sum up your ideas in a concise manner. Choose a business model, make sure you have a solid executive summary (three pages maximum) and that your pitch deck is on point (15 pages maximum). No spelling mistakes, no grammatical errors, no low quality images, etc.

5. The users don't like it.

Products with no user experience (UX) testing tend not to work, **un-friendly products cause 17% of failures, ignoring customers and not listening to their feedback leads to 14% of failures and poor marketing also leads to 14% of failures**. Did you survey the competition? Every business has competitors. Investors (and venture builders know that you're not ready if you think your startup has no competition. Analyse your competition, write down why you're better and know your market. Caring more about press releases than your customers is a definite no-no. Marketing teams should always work with the product or development team so as to avoid any miscommunication too.

Vanity metrics are OK to get a company started but they're useless if you're relying on them to keep the company afloat, unless you're an influencer who gets work based on vanity metrics (followers mainly), social media accounts should exist solely to communicate with potential partners, clients, investors, team members and leads etc., to show them what you're doing and to share relevant content. Identify metrics that mean more and you'll be able to target your product to the right people. Never underestimate and always know your audience.

6. Someone else did it better.

When startups get outcompeted, they account for 19% of failures and simply mistiming your product accounts for 13%. If you don't stay on top of trends, you're unlikely to know when to launch. If you release a product, especially a digital product, in the right place at the right time, you'll be so much better off. If you don't release it at all, or if you wait until the trend has blown over, or if you're too ahead of your time, you might not see the results you want.

Top Tip: Thinking “we’re not ready yet” isn’t good enough, consider this: launch first, fix later. We wrote about this in our blog post '[Brace Yourself: Competitors Are Coming](#)'.

If you’ve founded a successful business in the past, your chance of success is 30% in terms of the next venture. When founders fail to make their previous business work, they have a 20% success rate and for first timers looking to become successful entrepreneurs, it’s 18%.

Supply Chain Management For Hardware Startups

 hardwaremassive.com/resources/videos/supply-chain-management-for-hardware-startups-taipei

Ray Tai has more than 10 years of experience as a sales and product manager in the field of EMS. His experience includes everything from digital cameras to IoT modules to 3D printers. Currently, he's the CEO of Mighty Net and has worked with many recognizable companies, like Acer and Hitachi. In his talk during this Hardware Massive Taipei event, he covers how startup founders should deal with suppliers, and teaches us best practices for managing your supply chain.

Key Takeaways

1. Most Startups are Delayed

Most startups are delayed when it comes to shipment, and those delays often occur at the supply stage. In fact, only 1 in 5 projects are delivered on time, and 81% of venture dollars can go to late projects, with 65% of crowd dollars going to late projects. Broken down, that's more than \$50 million crowd dollars and more than \$411 million venture dollars.

2. Manufacturing is Easy

Even though you may not think so, manufacturing is easy! So why do hardware startups fail so much? First, integration can get in the way. Then, scale can become a problem. In fact, some startups, when rushing to get to production and get to scale, can actually cause problems for themselves in the long run, by rushing to production before they have the perfect functional product, all in order to catch a deadline. You can probably guess, though, that it's better to be late than have a product that doesn't work.

3. Design Does Not Equal Manufacturing

Just because you have a good design, does not mean you know everything about manufacturing. There's so much that changes when you get to the manufacturing stage. You'll want to take advantage of the various skills that your manufacturer offers, rather than assume you already know what's needed and best.

4. Sometimes You Just Can't Afford Your Supply Chain

It's not uncommon for startup founders to get to the manufacturing stage and realize that they've underestimated their costs and now they can't quite afford their manufacturing. This is something you'll want to take into consideration from the beginning, and accurately predict.

5. Most Startups Have No Experience

Most startups simply have no experience in the realm of hardware supply chains. When you start a hardware project, how many sectors of the supply chain will you have to deal with? There are often about six units of the supply chain that you'll have to work alongside. These include the design house, certification lab, EMS/ODM, forwarder, chip solution and chip agent.

6. Software is Solo, Hardware is Symphony

Software can almost seem easy in comparison to hardware. When you're working on and developing software, you can be a one-man operation in some cases and fix issues yourself. When you're dealing with physical products and hardware, though, you're working as a team and you have to know how to deal with a hardware supply chain. Just because you're good at software, don't assume you're great at hardware.

7. The Factory is Your First Customer

You may think that the factory is merely your supplier. However, you should be thinking of your factory as your customer. You have to sell your startup to your factory and treat them as a partner. After all, you're probably dealing with a risky project that's low-volume, right? So why should they deal with you? Why wouldn't they go with another project that will ensure more money for them in the long run? You also need to choose your factory in terms of your next project. Can they handle it? Do they have the capabilities to make your next project, whatever it may be?

The Complete Guide to Hardware Product Development

 mistywest.com/complete-guide-to-hardware-product-development

A step-by-step guide to building a hardware startup. MistyWest has seen many companies succeed and many fail; here's what we've learned.

Written by Leigh Christie, cofounder of MistyWest; and Dan Millar, Business Developer. Edited by Madison Reid, Content Creator.

You found a problem people care about and/or you've got a brilliant idea for an innovative, potentially world-changing, industry-disrupting, breakthrough technology. This idea could change the path of intelligent connected devices, edge computing and AI for future generations. It could impact the likelihood of humankind achieving the UN's Sustainable Development Goals mission for 2030!

Now what?

MistyWest's years of experience as an engineering consultancy in new product development have given us unique insights into building hardware startups. We've helped see through hundreds of projects at various stages of development – ideation to research, prototypes to Minimum Viable Products (MVPs), and mass productization and product launches.

We've seen products go to market, we've seen clients go bankrupt, and we've seen a lot of mistakes that could have been avoided.

Our guide is broken down into the following parts:

Part 1: Identifying Your Market Position

Part 2: Hardware Product Development Mistakes To Avoid

Part 3: Product Engineering & Prototyping

Part 4: How long does it take to launch a hardware product? (your Speed-to-Market)

Part 5: Hardware Product Fundraising

Why did we write this guide to product development?

While based in Vancouver, BC, MistyWest has worked with every type of client, from scrappy startups, to small and medium-sized enterprises (*SMEs*), to Fortune 500 companies. Not only have we gained knowledge through research, design and engineering, we've also amassed partnerships with vendors, suppliers, entrepreneurs, accelerators and VC firms, whom MistyWest works with to meet our clients' needs.

We want to share our insights so you can bring that intelligent and connected invention from concept to consumer.

One big takeaway that MistyWest has learned from working with so many hardware startups is that launching a new hardware product requires tremendous dedication, tenacity and patience; but if you are *truly* passionate about solving a specific problem, it won't matter how many setbacks (and subsequent pivots) you encounter.

Who is this guide for?

We wrote this guide to product development for:

- Entrepreneurs and intrapreneurs who are solving hard problems that require a custom hardware solution and some firmware and/or software.
- Entrepreneurs who are either raising capital or bootstrapping their hardware startup's product development
- Intrapreneurs who are the driving force behind a new product at a medium-to-large corporation.
- Anyone that is interested in creating a hardware product where there are intelligent and connected (IoT) devices involved.

While this guide to product development is not exclusive to Canadian hardware startups, some information (such as *Part 5: Hardware Product Fundraising*) may be of most value to a Canadian business. That said, we encourage you to read on, regardless of your geographic location.

At the onset of your product development journey, **ask yourself the following questions:**

- What problem will you solve with your new hardware product?
- Why do you want to solve this problem?
- If the problem takes 10 years to solve, do you still want to try to solve it?

These questions are trying to ensure you care enough about the business you're creating to see it through. It's about understanding your own personal mission in life and making sure this business aligns with it. If, after answering these questions you look at your plan and can still give it an undisputed *HELL YES*, then we hope this series will help you make the necessary smart decisions on your journey.

Part 1: Identifying Your Market Position

The frameworks to identifying your market position are your:

- Problem Statement
- Positioning Statement
- Value Proposition
- Business Model
- Pitch

1. Problem Statement

Sometimes you have an intelligent connected technology that can solve many problems, but you don't know which problem to start with first. Even if you find the solution *before* you find the problem, it's still crucially important that you have an intimate understanding of your customers' needs.

Solving a clear problem will be your primary motivation for why you are developing a product. Your early customer discovery activities will help you iterate the problem statement over and over again as new information becomes available to you. You can learn more about this in Simon Sinek's book *Start with Why*.

2. Positioning Statement

Now that you have your problem statement, use it to help create your positioning statement. Think of this as the basis for your 20-second elevator pitch; taking the core problem you are trying to solve and putting it into very easy to understand terms from the perspective of your customers and investors.

Your positioning statement is your *customer profile, customer need, product solution, and product differentiation strategy* all rolled into one short paragraph. All of the above may change as you gain a deeper understanding of your customers and the technologies you are developing and implementing, **so iterate as needed**.

Our **MistyWest Positioning Statement Worksheet** will help you create a clear positioning statement.

3. Value Proposition

The purpose of your value proposition is to make it obvious *why* a client would give you money for what you provide. This is related to your Positioning Statement but not identical, as **the value proposition focuses on your product**, where the positioning statement focuses on your company as a whole.

We've made a **MistyWest Value Proposition template** to help you get started.

4. Business Model Canvas

The **Business Model Canvas**, popularized by Steve Blank, serves as an excellent 1-page business plan. MistyWest has created a **Business Model Canvas spreadsheet** that also includes the problem statement, which is crucial for helping you identify your minimum viable product.

The *business model canvas* should be viewed as a living document with hypotheses in each section that are constantly updated, and serve as a *business analysis guide on feasibility and market share*.

5. The Pitch

The reason to have a good pitch is to land that next meeting – whether this is with customers, investors, or when you finally meet your significant other's parents.

Your *audience* determines your pitch, and you should be ready to deliver **three levels of pitches** for each type of audience you expect to encounter:

- 20 second elevator pitch (*your positioning statement*)
- 3 minute pitch (the answer to ‘*tell me more*’)
- 20 minute pitch (for presenting during a 1 hour meeting, leaving plenty of time for introductions and questions)

It's important to note that the *20 minute pitch* only happens if the *20 second* and the *3 minute* pitches are successful. Some great resources for structuring pitches include Simon Sinek's [now famous TED talk](#), and examples from [VC-funded companies](#), [Launch Academy](#), and [Innovate Calgary](#).

Part 2: Common Hardware Product Development Mistakes To Avoid

There is no smooth paved road through product development; you will make mistakes along the way. Each hardware journey is unique, and you will inevitably run into roadblocks, technological headwinds, or pandemics that your previous experience could not have prepared you for.

MistyWest's engineers and business developers have diligently tracked common product development mistakes that could have been avoided, and broken it down to the following 5 most frequently occurring.

Mistake To Avoid #1: Not prioritizing product-market fit

No matter how much you love your intelligent connected hardware product, it doesn't mean you'll be able to find customers. If you fail to conduct sufficient user testing, or fail to demonstrate the product to the ideal customer early enough in the design process, you'll be making crucial product decisions with insufficient product and market research, leading to an MVP that does not align with your value proposition.

Hardware prototyping enables you to get feedback from your customers long before they are able to buy the product so you can make better decisions on what the minimum feature set should be for your MVP (see *Part 3: Product Engineering & Prototyping*). **If your prototype doesn't meet your target customer's expectations**, you either need to **keep testing and re-engineer your product**, or **change your value proposition and target customer** to match your product. Otherwise, you're going to be left with a lot of boxes of unsold MVPs.

Eric Reis said it best in his book *The Lean Startup*:

“If you are building the wrong thing, optimizing the product or its marketing will not yield significant results.”

Mistake To Avoid #2: Underestimating the product development timeline

The **three most common sources of delays** in intelligent connected hardware product development are:

- Long lead times for parts and sub-assemblies
- Fundamental technological breakthroughs needed
- Issues with manufacturability

The hard truth is that building a functional prototype takes about ten to a hundred times as much engineering time and resources as it takes to get through the early product development stages. If your hardware product is complex and requires certifications and validation testing (such as medical devices), that can double (or triple) your timelines to get to a production prototype. And it can take the same amount of time again to work out all the bugs during manufacturing.

The time it will take to go from concept to pilot production is extremely variable – it can be anywhere from *6 months to 2 years* for “low certification” products, and *2 to 5 years* for hardware products that require extensive certifications. For products that require technology breakthroughs—such as fuel cells—it can take *30 years or longer!*

Mistake To Avoid #3: Not asking for engineering consulting help early enough

Your non-recurring engineering (NRE) cost is the one-time cost to research, design, develop and test a new product or product enhancement. NRE includes all phases from concept/ideation until the start of commercial production, and continues to include the costs of fixing bugs and Engineering Change Orders (ECOs) after production has already started. NRE does not, however, include the cost of manufacturing, marketing or sales.

Some examples of NRE include:

- R&D for very immature technologies
- Industrial Design
- User Experience (UX) Design
- Mechanical Engineering
- Electrical Engineering
- Embedded Firmware Development
- Software Development
- Design for Manufacturing (DFM)

MistyWest has heard many of the same stories from our clients: they hired a collection of freelance or inexperienced engineers and designers in an attempt to save money, but it ultimately led to poor quality assurance, a lack of accountability when things went haywire, leaking of information to competitors, or intellectual property (IP) theft.

Many clients also come to us after having worked with *Original Design Manufacturers (ODMs)* for their engineering assistance, who offer affordable services but may also lead to a loss of control over your IP, your bill-of-materials (BOM), your supply chain, your design files, your tooling, and your negotiating power.

It can be tempting, but hiring inexperienced engineering talent, especially for novel technologies, will inevitably increase your NRE cost and delay your product development. Hiring an engineering consultancy enables founders to set their own terms for budget, quality and timeline. Believe us; MistyWest has been called in to rescue *many* projects where the client could have saved a fortune if they had involved us much sooner.

Mistake To Avoid #4: Not being focused enough

You're a brilliant entrepreneur who has a great idea – and way too many *other* ideas.

Once you've made sure you're building the right thing (see *Mistake 1*), **ignore your other product ideas**, no matter how great, and focus on your MVP feature set.

Focusing on too many intelligent connected features or products can eat up your resources, such as funding and engineering talent, and lead to wasted efforts.

This same advice goes for entrepreneurs who have two or more businesses on the go at the same time: **cut these other side projects out of your life and focus on a single product**. Focusing your hardware product development efforts will dramatically increase your chances of success.

Mistake To Avoid #5: Not raising enough funds

You may want to spend the bulk of your time on strategy, recruiting, designing and selling. In comparison, fundraising can feel like an unwanted chore. However, a lack of monetary investment will lead to a slower speed-to-market and can cause the loss of your First Mover Advantage, leaving a competitor to reap the rewards of your new technology.

In the early days of your hardware startup, you may end up spending more time raising money for your product development than on *any other activity*. If you hate fundraising, consider finding a partner who can work with you to help you raise the capital you need to execute (see *Part 5: Hardware Product Fundraising*).

Part 3: Product Engineering & Prototyping

The MistyWest *Product Development Process* is broken down into 3 Stages: **Ideation, Prototyping and Productization**, where we make use of an agile product development approach.

Our **Ideation** stage yields a Proof-of-Concept (PoC) to determine that our client's goal is technically feasible. The **Prototyping** stage determines *how* the device will work, and relies on many iterations, including *user experience (looks-like)* prototypes, *functional (works-like)* prototypes, and eventually the *MVP*. MVPs are subjected to beta (field)

testing for feedback, and the core features of the prototype are implemented. The **Productization** stage takes the MVP and determines what fun (and perhaps superfluous) features are of interest to the test audience, and finally, on to mass production.

Why Hardware Prototype?

The purpose of hardware prototyping during product engineering is to answer those hard questions, ranging from technical unknowns to getting a better understanding of your end-users and/or market. This enables our engineers to learn about technical challenges while our clients learn more about their users.

A compelling intelligent connected physical prototype can make or break a new hardware product initiative by giving you credibility when you start advertising—especially for novel products that have never existed before—and can answer questions around consumer demand.

Remember that prototyping is an iterative process that can take years; you will need to create many prototypes and test often to learn as much as possible before you lock down the feature set for your MVP.

The following are useful questions you should **ask yourself during the prototyping process:**

Consumer or User Demand

- What are the minimum set of features for our MVP that solves the problem and meets the users needs.
- How high will consumer demand be for this MVP?
- What does our speed-to-market need to be?

Strategy and Investment

- What aspects of our designs are novel and can be patented?
- How can we gain a long term sustainable competitive advantage?
- How large is the Total Addressable Market for our business plan?
- How much money do we need to raise, and what should we be spending our product development money on?

Performance and Cost

- What materials should be used?
- If needed, will the product pass certification?
- What is the trajectory of progress for product development, performance and cost? Or how much better can future prototypes be?
- How well does the prototype function relative to consumer expectations?
- What is the BOM cost for the prototype (*assuming production ready materials, components, and manufacturing methods are used*)?

- Can a BOM cost-down be done?
- Does the alpha prototype meet the specification during alpha testing?
- How will the product be serviced and maintained? (*design for serviceability*)
- If needed, how will the firmware and software be updated?
- How will the product be assembled (*design for assembly*)
- How will the product be manufactured (*design for manufacturing*)

Part 4: How long does it take to launch a hardware product? (your Speed-to-Market)

What is Speed-to-market?

Speed-to-market is the amount of time it takes to get from concept to delivery of the first revenue generating units delivered for a given product. Whether it's B2B or B2C or B2B2C, when we're talking about speed-to-market, there is always a trade-off between cost, performance and speed.

If your product requires novel technologies but you have inexperienced engineers and a modest budget, your speed-to-market will be very slow. If you reduce features and performance targets, or cut corners on engineering and your NRE, your product's quality will suffer or will be vulnerable to competition.

Why does speed-to-market matter?

To understand why speed-to-market is important, you need to understand the concept of *First Mover Advantage*, which is *the benefits accrued to the company who develops and commercially launches a new product before their competitors are able to do so*.

With the First Mover Advantage you get all the benefits that come with being the market leader, **which can include:**

- Capturing the majority of the Press/PR
- Capturing the public's imagination
- Developing a strong brand loyalty
- Being considered as the "original" or "most innovative"
- Being first to patent, and learning what IP is/is not important
- Exclusive deals with vendors/partners/IP-licenses to prevent fast followers from catching up

What are the downsides to being first to market?

A downside to being first to market is that if your product is easy to copy, you have now shown your competitors which way to go if they reverse engineer your product. You've spent a lot of money on NRE costs that competitors might not have to spend if they can avoid it, and if your novel product proves there is a market, then your competitors no longer need to weigh that risk or do that research.

What determines speed-to-market?

Speed-to-market is determined by many factors, and the time it will take to go from concept to pilot production is extremely variable. **You will need to consider:**

- The problem trying to solve (your value proposition)
- The complexity of your product's hardware, firmware and software features
- The amount of NRE required, and the level of engineering expertise and experience on your team
- Your budget and required funding
- Product safety and required certifications
- Product manufacturing complexity (number of parts, size, number of interacting subsystems, and ease of assembly)
- Off-the-shelf technology and supply chain readiness

Part 5: Hardware Product Fundraising

| “*Some people got to have it, Some people really need it*” – The O’Jays

Hardware technologies and physical devices have the ability to capture the imagination of future generations like nothing else – just look at the first iPhone. There is something about “tangible” technologies that we can interact with that help inspire great change in the world.

That said, it’s very hard to raise capital for hardware startups (the old cliche “*hardware is hard*” rings true) and it can be the single hardest part for entrepreneurs to grapple with – but the value of these types of startups to the regional economies who support them are enormous.

Funding can generally be broken into two types: *Dilutive* and *Non-dilutive*. *Dilutive funding* is what you see on *Shark Tank* or *Dragon’s Den*, where a company gives up a portion of ownership for some level of investment. *Non-dilutive funding* doesn’t have slick TV shows about it, but it’s typically much nicer than dealing with Kevin O’leary.

Dilutive Funding

Unless you’re independently wealthy, it’s likely you will want outside money to accelerate product development and sales growth, and depending on your business and your current financial situation, *how* and *when* you raise dilutive funding will vary greatly. Below are things to consider when seeking outside funding in your startup.

Capitalization Table 101

At the highest level, a *capitalization table* is a list of your company’s securities, such as *A Shares*, *B Shares*, *Options*, and *Warrants*. Use a spreadsheet that tracks who your shareholders are, how many of each class of shares they have, what they paid and what

percentage of the company they own. You can even try online platforms like [captable.io](#) for managing your startup equity.

Friends and Family

I hope you were always polite when passing the gravy to Aunt Mildred at Thanksgiving, because now's the time to give her a call and see if she's willing to take a bet on you.

This round of funding is exactly what it sounds like: you go out and ask your friends and family with disposable income if they'd like to invest. If your idea is not yet ready for angel investors (as is most often the case), it's crucial to find early supporters for getting your idea off the ground and moving towards a refined prototype, so you can demonstrate real value to angel or venture capital investors. A typical 'Friends and Family' round of fundraising is \$20K to \$500K in size.

Angels

Angel investors are likely much more sophisticated investors than the ones you were dealing with in the friends and family round. At this stage, you will be looking to raise between \$100K and \$2M.

Globally, there are many Angel networks, and some **networks in British Columbia include:**

Venture Capitalists

Venture Capitalist (VC) firms are a huge part of what made the Bay Area boom, and can be critical for making the leap to commercialization or development of products with high technical risk. If you want to pitch a VC, you'll need to polish your value proposition, have a large total addressable market, and project extreme growth in order to get a meeting with one.

Some British Columbia based VC firms are:

VC fundraising rounds are classified by letter, as *Series A, B, etc.* and typically start between \$1M and \$5M for a Series A and go up 2 to 10 times per round. A funding success story includes our client [VodaSafe securing Series A financing with VanEdge Capital](#) for their [life-saving underwater scanning device the AquaEye](#) in 2020.

Non-Dilutive Funding

The money's just as useful as dilutive sources, but your cap table stays empty. Hurray!

Crowdfunding

If you're fundraising for a consumer product that a backer can personally own or benefit from, Kickstarter or IndieGoGo are a reasonable option. While it's unlikely that you'll be financing your *entire* business via crowdfunding, it can provide valuable working capital and, even more critically, market validation to raise additional capital against.

Crowdfunding campaigns are only as successful as the work you put into them, so if this is your first time, consider bringing on a professional to help and do your research ahead of time. After more than a year of dedication to their product's development, MistyWest's client TZOA successfully ran an IndieGoGo crowdfunding campaign in 2015 for their first wearable indoor air quality monitor.

Industrial Research Assistance Program

Canada's National Research Council Industrial Research Assistance Program (IRAP) is an excellent option for non-dilutive grant funding for research and development projects. While it requires you to find additional funding sources that IRAP will match, it can offer your early investors confidence that their money will be well leveraged. IRAP also offers the YEP program for hiring recent graduates.

SR&ED

Similar to IRAP, SR&ED (Scientific Research & Experimental Development) offers support for technically risky research projects through a retroactive tax credit. Up to 62% of salaries, 42% of materials and 32% of sub-contractor expenditures can be recovered through SR&ED. It's recommended to work with a local company that specializes in SR&ED claims.

To be eligible for SR&ED, **your project must involve:**

- Technological advancement (what you are building must not be readily available in standard practice)
- Technological uncertainty (there is some risk of failure and the outcome can not be perfectly predicted)
- Technical content (work was performed systematically and included documentation)

Other Government Funding

There are new programs all the time to help spark innovation in Canada and BC. The government of Canada has created a concierge program to help navigate this.

Debt Financing

First thing's first: **we don't recommend maxing out your personal credit cards to fund your hardware startup.**

There are a number of options for debt financing (i.e. *taking out a loan*), and as your hardware startup increases its assets and revenue, additional options from traditional lending institutions will become available. Several funds and venture capitalist firms specialize in debt financing, including Espresso Capital and Vistara Capital.

Options for debt financing in Canada include:

- Futurpreneur and BDC: A collateral-free loan—up to \$15,000 from Futurpreneur and \$30,000 from BDC—with preferred rates and mentoring for people ages 18 to 39.
- Genome BC: A \$1 million loan with a 4 year grace period for the principle, and repayment of interest based on royalties. This loan is available for reasonably well established startups in healthcare or industrial applications of genomics or proteomics. Their due diligence is very thorough.
- BDC business loans: Likely the most common way that Canadian companies get loans greater than \$50K. BDC has several funding options that range from general debt financing, to financing specific, to capital purchases or working capital.

Accelerators and Incubators

Surrounding yourself with peers going through the same struggles, and mentors that have been there before, is a critical component in making a hardware startup fly.

The major incubators, accelerators, and similar **programs to investigate in the lower mainland include:**

Conclusion to our guide

We hope this *Complete Guide to Product Development* has gotten the wheels turning and empowered you to do some research and start putting your plan into action. If you’re worried about making some mistakes along the way, don’t worry – that’s part of the journey, and MistyWest is here to help you through it.

MistyWest has supported hardware startup clients by making introductions and offering them exceptional engineering to build better products. We have dozens of product development case studies and have achieved extraordinary customer experiences that win awards.

If you’re looking for more guidance on your hardware startup’s journey, reach out to a MistyWest business developer at contact@mistywest.com and share the problem you’re solving.

You can also download a **MistyWest capabilities statement** to learn more about our expertise in idea generation, product design and productization.

Entrepreneurship

Overcoming the Challenges of Running a Hardware Start-up in Ghana

March 23, 2019

By Isaac Sesi

<https://isaacsesi.com/overcoming-the-challenges-of-running-a-hardware-start-up-in-ghana/>

Last Month, I was a guest on Stanbic Bank Incubator's #SBChat Twitter Chat, where I shared my thoughts on the topic "Overcoming the Challenges of Running a Hardware Start-up in Ghana". Running a hardware startup in Africa is no joke. Just the mere fact that you want to run a hardware startup in Africa brings up a myriad of challenges such as:

The difficulty of finding and paying highly skilled local engineering talent

The lack of necessary equipment for electronics manufacturing.

Unstable currency leading to fluctuating costs of raw materials

Difficulty in accessing enough funding for your hardware startup

Difficulty in scaling to mass manufacturing.

Lack of trust for locally made electronic products.

In this post, I answer some questions about some of these challenges and how my startup, Sesi Technologies is overcoming them.

Funding: Unlike software where all you need to develop an MVP is a laptop and internet, developing hardware is expensive. You need money to develop a prototype. You need equipment to refine your prototype. All of this cost money. You need a larger skillset to successfully develop a hardware prototype. You need a maker (the engineer who designs and prototypes the product.) then you need the software guy who will develop supporting mobile applications. These do not come cheap. So you need to have the cash to prototype

Technical Knowhow: Developing hardware requires a lot of specialized skills. Unfortunately, it is difficult to find people with that skill set in Africa. Either they are already working somewhere or they are so expensive that you cannot afford them initially if you don't have funding.

Scaling to mass manufacturing: It is very difficult to scale to mass manufacturing in Africa. Setting up manufacturing processes, getting the right equipment, finding casing/enclosure for your products, etc are some of the challenges you will face when trying to scale your manufacturing.

We had a lot of support. We had support from our partners at USAID to get us set up nicely. We had access to 3 years of research that had been done on our product to refer to. We also had access to experts in industry, research, who guided us to get started with our production facility. And we had a contract already waiting for us before we finished developing so I guess I would say, we were blessed.

The problem/missed opportunity. Your hardware product should solve a unique, clearly identified problem in a way which other solutions are failing to solve.

The Market Potential: You should be able to clearly identify who is going to use your hardware and that there is a large enough market to justify bringing your product to market. People should also be willing to pay for it(you should be able to come up with a reasonable business model from the product)

Technical complexity: The more complex your product is, the harder it will be to design, the longer it will take to get to market, the more expensive it will be to develop, the more cash you will need and the more challenges you will face. so you have to look at that.

The competition: If your hardware product is so common that you have to compete with the similar, probably, better-designed products from China, then already you are setting yourself up for failure because China has more resources and can afford to produce good quality products at a cost you may never be able to.

if you are looking at going into hardware, your hardware product should solve a unique, clearly identified problem in a way which other solutions are failing to solve.[CLICK TO TWEET](#)

I see significant growth of hardware from Africa in the food/agritech space. A lot of guys such as @ujuzilikilimo are already doing some pretty good stuff in that field. Then there's health too. People are developing affordable assistive technologies and it's exciting. There's the guy who developed the glove that

translates sign language into audio. Then there is energy and education. Dext Technology is doing something awesome with the science set. If you're looking for promising hardware innovations by Africans, you can check out iSHOW.

I'd rather say I see many of the present barriers gradually being overcome. I see more access to funding by African startups in the coming years, I see more Africans building skills in hardware, I see outsourcing of manufacturing becoming easier, I see more policies being put in place to support hardware entrepreneurs.

I see more access to funding by African startups in the coming years, I see more Africans building skills in hardware, I see outsourcing of manufacturing becoming easier, I see more policies being put in place to support hardware.

Well, even though a lot of money has been raised by African startups in recent years, raising money is still difficult. First, you really have to have a good idea of how much it will cost you to develop your product and get it to the market.

You can bootstrap or look for funds through grants and competitions to help you develop and build a proof of concept product that you can test. After you can develop several iterations and do very low volume production all to test the product and business model and try getting some traction, then you can go look for investors.

Remember, you should identify a clear problem or missed opportunity that hasn't been taken advantage of yet and at least, show that there exists a big enough market for it and you should be able to clearly articulate your business model to anyone.

Electronics design and embedded systems skills(the guys who design and build the actual hardware), software development skills(the guys who write the software/firmware that communicates with or works on the hardware), CAD/Industrial design skills(the guy who designs casing/enclosures and packaging with mad Solid Works skills). And of course, for every business, you need the guy with the mad sales/marketing skills who goes to sell the product.

Provide several funding opportunities, get experts to provide technical support to these entrepreneurs, a campaign to support and create appeal for locally manufactured hardware products, boosting the engineering capacities of institutions to better equip students with hardware skills, providing scholarships to students who want to major in hardware, low/zero import duty on parts imported for production to reduce the cost of production, these are all ways that will help.

Eight Tips to Ensure Your Hardware Startup will Succeed

 sparkfun.com/news/3932

by [Haileyasaurus](#) August 04, 2021 15:00 Central European Summer Time [0](#)

It's a long journey to take a hardware product from idea to market. That journey becomes even longer, more stressful, and more expensive if you end up taking the wrong path. I want to share eight tips with you that will speed up your journey, and make it less expensive, too. Many of these ideas may not seem intuitive to you, but I believe they are all absolutely essential to achieve ultimate market success.

1. Focus Earlier on Sales and Marketing

Are you neglecting the most important part of launching your startup - sales and marketing? Most hardware entrepreneurs put all their energy into product development, but it's a mistake to think that you can't begin selling or marketing your product before you have it ready to deliver. The earlier you start these activities the better off you will be in the end.

Sales and marketing can also be intimidating and scary for many entrepreneurs - I say this from experience. I was terrified of sales; it was completely out of my comfort zone. But the truth is, if you want to succeed as an entrepreneur you have to leave your comfort zone! If an introvert like me can call on large retailers, run a tradeshow booth, and manage a large team of sales people, so can you.

Another option is to bring on a co-founder with sales and marketing experience. It can be advantageous to have a team comprised of a technical founder, plus someone with sales and marketing experience. Whether you have co-founders or not, I recommend that you hire independent sales representatives in your product's industry. Sales reps work on commission, so you only pay them after your customer pays you for any sales. This arrangement can really help with cash flow.

2. Get Real Sales Data as Soon as Possible

It is easy to believe that positive comments about your product from "potential" customers is proof that your product will sell. Is everyone you know saying your product will sell really well? Don't make the mistake of believing them! No one can know if your product will sell well until it is actually for sale. Until someone makes a purchase, with real money, everything is just speculation. What you need instead is real sales data. You want this data as soon as possible, but it takes money and a lot of time to even have a product to actually sell.

Crowdfunding is a great intermediary solution. Backers put actual money down on your product, so you can use this as actual sales proof. They are putting real, hard-earned money down to get your product, which is massive validation!

3. Build an Online Community Right Now

If you haven't begun building an online community around your product, do so right now! It really is the best way to both market and eventually sell your product. You should grow your online community at the same time as you develop your product. Building an online presence takes time, so the sooner you start the better. Having an online audience of real people is so incredibly valuable. For example, you can collect feedback from them about your product during the development process.

It is also essential for you to already have a large contact list if you are going to launch a crowdfunding campaign. You will never get funded without bringing your own interested audience to help "kick start" your Kickstarter campaign. Once your product is ready for sale, you can sell it to your existing online community full of people who are ready to buy.

One word of caution – do not focus all of your online audience building efforts on social media platforms. Never make your Facebook page, for example, the only way for your customers can find you are contact you. What happens if you get locked out of your Facebook or Twitter account? This happens frequently even when an account did not violate any of the site's rules. There is little to no recourse for business owners if this happens.

This doesn't mean you shouldn't use social media, but be sure to focus on driving your social media visitors to your own website. Then, collect their email address. Unlike social media followers, an email address is a real asset that you actually own.

4. Don't Overpromise to Your Customers

There's nothing worse than running a successful crowdfunding campaign and then failing to deliver your product to backers. Unfortunately, many campaigns have ended up this way. Although Kickstarter reports that only 9 percent of their campaigns fail to deliver rewards to backers, that percentage is certainly much higher for hardware startups. The more complex the product, the higher the fail to deliver rate will be.

To avoid this, never promise to deliver on something until you have it actually in your hands! It is wise to test out your product yourself before you promise anything. This doesn't mean it's a bad thing to have customers, retailers, or investors interested in your product early on. You don't want to ignore sales or customers until you have inventory. But you want to keep customers accurately informed about your progress. Don't promise to deliver if it isn't yet possible. Talk with various experts that have done it before to get their feedback on your proposed development and production schedule before you commit to any dates with customers or investors.

5. Plan for the Complexity of Scaling for Mass Manufacturing

The most neglected step in launching a new hardware product is scaling from the prototyping stage to the mass manufacturing of your product. Scaling up to mass manufacturing your product is costly, time consuming and complex. This is why it is necessary to design your product from the very beginning with manufacturing in mind.

For example, many people are surprised to learn that it is a lot easier to scale your electronics for mass manufacturing than it is to scale up production of your plastic enclosure. This is because the 3D printing technology you used to produce your enclosure prototype is completely different from the high-pressure injection molding technology used in production. It's very easy to design an enclosure that can be 3D printed but that could never be produced using injection molds. When this happens a total redesign of the enclosure may be required, which is obviously very undesirable.

The same can happen with the electronics. It's very possible to have a PCB design that may work when you test only one or two boards, but that starts to show problems at higher production volumes. For example, a 20 percent defective rate may not even present itself if you only test one or two boards. Any time you ramp up production (especially initially) you raise the likelihood of exposing new problems.

Another example is in regards to certifications. For instance, if you design a circuit that could never pass FCC requirements, then that would require a redesign before it could be manufactured and sold. These are all reasons why it's important to design your product for mass manufacturing from the beginning. That way you won't have to make any major design changes when you scale up to higher production volumes.

6. Conduct Rigorous Quality Control Before Shipping

Do you remember the Samsung's Galaxy Note 7 phones that spontaneously burst into flames? Users were injured, and the phone was even banned on commercial planes. It's hard to imagine worse publicity for a product! After this debacle, Samsung determined that the batteries in the device had "significant design flaws." One battery had "an electrode deflection" that caused overheating, and a second battery had "an abnormal weld spot" which caused an internal short circuit. It was estimated that Samsung lost \$5 billion from these design mistakes.

This shows the importance of quality control testing. Why weren't these mistakes caught during product testing? If you put all this effort and money into developing your product, don't ruin it by shipping defective products to retailers and customers. It's very difficult for a hardware startup to recover from shipping defective products, especially to their early customers.

Always err on the side of having too much quality control testing during the beginning stages of manufacturing. Don't sacrifice this even if it lowers your initial profits. It is inevitable that a small percentage of defects will make it past your product testing process. No production run is 100 percent perfect all of the time. Strive for an eventual defect rate of 1 percent or lower, and be sure to meticulously triple check any sample units going to important retailers or reviewers.

7. Don't Underestimate your Product Development

Product development always takes longer than you expect it to. Hardware development is very complex, expensive, and time consuming – so plan for it. When I worked at Texas Instruments, the development of our products always took longer than we originally anticipated. Being a large company didn't make it any easier to forecast development cost and time. Some of this has to do with the debugging process, which is unavoidable with electronic hardware products. You can't plan and budget for debugging problems that you don't yet know your product has. It is pretty impossible to develop a product that doesn't need to be tweaked in some way, so plan and budget for the debugging and prototype iteration process. Remind yourself that creating something brand new is never easy.

8. Avoid Feature Creep

Feature creep happens when you add too many features to your product. Although lots of features may sound appealing, fight the urge to add every conceivable feature to your product. I'm a big proponent of following the Minimum Viable Product (MVP) method, which has many benefits including gathering user feedback.

The MVP method entails developing the simplest possible version of your product. Only include the core features of your product. What you can do is estimate the production cost for any features you might want to add in the future. These costs, along with feedback from customers who bought your MVP, will help you decide whether or not to add more features.

The trap that so many hardware startups fall into is thinking they know what their potential customers really want. It's very likely you are overconfident in your product features, and most of your assumptions will eventually be proven wrong. It is so easy to think you understand what thousands or millions of people will buy but that is a very dangerous mindset. From my experience you are much better off minimizing the number of assumptions you make about what customers want, and instead focus on getting real sales data.

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Running a Hardware Startup: Hind Hobeika on Staying Motivated Through Failure & Cultural Isolation

 startupguide.hbs.edu/expert-insight/running-a-hardware-startup-hind-hobeika-on-staying-motivated-through-failure-cultural-isolation

Shikhar Ghosh, Hind Hobeika and Marilyn Morgan Westner

Hardware startups face unique challenges. **Hind Hobeika**, founder and CEO at Instabeat—a startup that pioneered a revolutionary device that improves performance and motivation—discovered those problems firsthand. While she was completing her undergraduate degree in engineering in Beirut, Hobeika had the idea to create a tracking device that would allow swimmers to monitor their heartbeats and workouts in realtime. Her idea and early prototype impressed engineers and investors. In 2013, *MIT Technology Review* named Hobeika one of the “Top 5 Pan Arab innovators under 35” and *Forbes* featured her as one of 7 “Hottest Global startups.” But manufacturing a viable product from the original prototype took Hobeika over six years. Along the way, she endured cultural isolation, ran out of funding, struggled with problematic prototypes, and missed a deadline for delivering on a crowdfunding campaign. In a candid conversation with **Shikhar Ghosh**, Hobeika discusses the ups and downs of her founder’s journey, including having to move to different continents three times to find a reliable manufacturer. She provides tips on maintaining her focus and shares tactics for well-being that can help any founder undergoing intense stress. A lightly edited transcript follows the video.

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Hind Hobeika interviewed by Shikhar Ghosh at the HBS Rock Center for Entrepreneurship, on September 11, 2019.

Running a Hardware Startup: Instabeat’s CEO Hind Hobeika on Staying Motivated Through Failure & Cultural Isolation

SHIKHAR GHOSH: This is Hind Hobeika. She’s the founder of Instabeat, a company that has just come up in the market with a wearable device for swimmers, which tells you your heartbeat and other measures directly into your goggles regardless of which goggles you’re using. Can you tell us how you started this? How did you get the idea, what are the first steps in your journey on that?

HIND HOBEIKA: Yeah, so I’ve been swimming my whole life. I grew up in Lebanon on the Mediterranean where swimming is a core part of our day to day. And when I was in engineering school, as part of my varsity team, I started realizing that our coach was giving us our workout based on effort zones or heart rate zones. And then we were measuring our heart rate manually by counting the pulse after the set. And I kind of find that it’s a little silly to do that because knowing your heart rate after you’ve finished

swimming, while you're recovering, first of all is inaccurate. But also it's kind of useless because the only thing you can do about it is say, "Oh I should've swum harder or I could have swum harder." So that's when I felt for the first time the need of having my heart rate in real-time.

So, I started asking around and I looked for available solutions and I couldn't find anything. And at the same time I saw an ad for this competition that our dean has sent, saying that if you have a product idea or submit your final year project to this competition. And so that's exactly what I did. I submitted the idea for a heart rate monitor for swimming. And after the few rounds of interview, I got myself into that competition without really knowing that it was a reality TV show where you have to go for four months to Doha, and they would give you the right support and infrastructure to build the first prototype. So that's what I did.

During my last semester, I found a way to convince professors to let me follow my classes online, because one of my parents' hard requirements was you cannot graduate late. And so I kind of went through a hundred petitions to get that done. And then I flew to Doha, and over there for 10 hours a day, I was locked in a lab with 16 other candidates from the Arab world working on my prototype, and then at night studying for my schoolwork. I ended up winning the third prize of that competition. And I had a functioning, very big, bulky prototype that proved that heart rate could be measured from the side of the temple.

SHIKHAR GHOSH: What was it like being a woman entrepreneur in this competition with other, presumably mostly men?

From Engineering Product to Startup

HIND HOBEIKA: Yeah, I mean back then I wouldn't say I was an entrepreneur yet. I was an engineer, but being a woman and with 15 other guys, 15 other more conservative guys from the region, I was very isolated. No one would accept to talk to me on TV. And so a lot of the time the guys were hanging out and I was just alone. It was really, really hard. I would break down quite often. I would go swimming to relax. I was on very little sleep and I had the pressure of winning the competition, but also finishing my schoolwork to graduate. It definitely wasn't easy. Because the competition was in multiple stages, and I remember in one of the stages, I won, versus one of their guy friends, so they wrote a letter to the judging committee telling them that I shouldn't have won, it wasn't fair. It was a very hostile environment and it was the first time that I actually felt that being a woman was a disadvantage in that environment because I didn't have their support.

SHIKHAR GHOSH: So after you won the competition, how did you take this engineering project and make it into a company?

Early Fundraising

HIND HOBEIKA: It was very circumstantial. Back then, it was 2009, 2010. I finished my engineering school and I was looking for a job. I didn't think that I should be doing anything about the product. And then I got a call from the CEO of VariTech, which at that time was a \$6 million fund. And he was like, "Oh, I just spoke to your mom yesterday at dinner and we want to invest in your company." And I'm like, "I'm sorry, you must be mistaken. I don't have a company, I just have this product." He's like, "No, no, you can turn it into a company. Just meet with us." And so I actually met with them and it was the first time that it actually hit me that this could be a company, in some shape or format, and that it could be the thing I do versus the fun project I took part of.

Navigating a Term Sheet

So then a few weeks later they gave me a term sheet, and it was just like reading Chinese, basically. I had never heard of startups or any of the terms that were mentioned in the term sheet and I was trying to find help in order to negotiate that term sheet and it was just impossible to find. My lawyer who was a real estate lawyer would tell me, "No, these terms, they don't work," because they had no knowledge in tech. And then—Actually, I have a fun story. I actually asked my dad, who's an economist, to come help me with the negotiation. So my dad's like, "Yeah, of course. No problem. I'm going to read your term sheet and come with you."

So we get to the meeting with VariTech and he's like, "Okay, I want to start first. I think just don't waste your time with these term sheets and these kind of things. Just send an email to the CEO of GE and tell them, 'Hey, we have this nice product. We won this competition, why don't you buy the technology?'" And it was the first time that actually hits me that if I was going to do this, I was going to be on my own. And so I just Googled every term in the term sheet. I signed a very unfavorable term sheet, but this is a term sheet that got me out of my job and gave me some sense of security that I was going to do this full time.

SHIKHAR GHOSH: At that point when you started, what was your expectation for—over here, when people start, they say, "Oh, I'm going to create this big company. I'm going to," whatever it is. What was your—

Cultural Challenges

HIND HOBEIKA: Yeah. So the first business plan was, we spend six months on prototyping and then we will find someone to license technology. So from that day, six months later, I still hadn't found an engineer in Lebanon who was able to do what I wanted to do. Actually I had found a bunch of engineers, but either some—It was just such a bad cultural experience. One of them had supposedly a family member die every week, which is the reason he gave me why he kept not showing up to work and he kept delaying the deliverable. And then one of them, I gave them some comments about the circuitry and they're like, "Who do you think you are to give me these kind of comments?" And I would say these are cultural challenges, but overall it was—

SHIKHAR GHOSH: It's mostly around the fact that you're a woman?

HIND HOBEIKA: I think it was a lot more to do with the fact that I was a young woman. So, in a country like Lebanon, age has its weight. And also with our parents, we grew up with the argument of, "I know better than you." So people just don't accept comments or aren't used to having direction from someone that's younger. Maybe the woman was a factor. I just don't know how to separate. But basically overall, after six months of struggling, I understood that I was not going to find the expertise I needed in Lebanon. And that's when I started to look outside. So very quickly that business plan of six months in licensing turned it into, we need much more time for the prototyping and we need much more cash for the prototyping. And the licensing was put on the side until we find a good team that's able to really get the prototype to the next conversation.

SHIKHAR GHOSH: So from there you went on to actually build the product?

Building a Prototype

HIND HOBEIKA: Yeah, I mean, the idea was that if it were licensing or if it were commercializing the product, we have to refine our prototype to understand what our IP is and to actually build their IP and demo something to these companies. So we felt that the initial direction would have been the same. Like, we need a technical team, we need to find some patents around technology and need to better define our technology to present it to these companies.

SHIKHAR GHOSH: And so once you had the prototype sort of built, did you do much consumer testing?

HIND HOBEIKA: So, it's very hard to do customer testing with swimming because it kind of requires the prototype to be waterproof. And most of the prototyping tools do not allow for waterproofing. So we were having conversations with swimmers and we were kind of testing on dry land the form factor, and sometimes the form factor would make it to the pool. But at that stage we still haven't had a swimmer swim with a fully functional product and get the full experience, just because it was impossible to do so with just a prototype.

SHIKHAR GHOSH: So how did you then decide that, okay, this is what we're going to go with, when you didn't know that the consumers actually wanted the full—

HIND HOBEIKA: So I was at a point where we kind of had a prototype form, and basic function. We hadn't tested it in the water, but we had tested it on dry land. And I had very positive conversations with a lot of swimmers, but it still wasn't confirmed that it was a real need. And I was at a point also where the initial money I had raised from VariTech was almost over and I was struggling a little bit to find funding. And so I decided to launch a crowdfunding campaign in order to prove market demand.

Raising Money & Crowdfunding

I was out of money when I launched the crowdfunding campaign. So I hired an intern who was my sister's friends, and both of us together emailed every single person in the world that has anything to do with swimming or tech or press. And that's how we generated all of our orders. We got orders from a few thousand people in 56 countries. And basically,

we got so much coverage around the campaign that we got contacted by multiple swim brands afterwards and we got contacted by multiple investors who wanted to do a follow-on round.

SHIKHAR GHOSH: And so you raised money against that?

HIND HOBEIKA: So we raised money. We raised \$800K then and the idea was that now we have consumers who had committed cash, so now we have to build the products. The licensing model was kind of out of the gate. We started engaging with swimming brands to have a conversation, but we started to build the product with the prospective of manufacturing it and shipping it.

SHIKHAR GHOSH: And through that whole process, you made a promise that said you would deliver in a certain date. How did you know how long?

HIND HOBEIKA: Six months. Somehow, it's just six months of lines to people.

SHIKHAR GHOSH: What was your sense of— Why is it six months, not one year, not two years?

HIND HOBEIKA: I would say a lot of the sense was naivete. I wouldn't say that I had studied the chain of manufacturing and thought six months is a good idea. I had the belief that if we actually did get orders, I'm going to find someone who's going to make it super fast. So it was a lot from a place of ignorance and naivete.

Challenges Manufacturing Hardware

HIND HOBEIKA: And when I actually met the manufacturer, because at that time we had won an award at CS, so I was in CS and I got approached by a few people. And that manufacturer, he was saying all the things I wanted to hear. He said, "Not six months, eight months," which I thought, okay, two-month delay is acceptable. And he was giving me a very good pricing. He said that they worked with big companies before so he had the right experience. So that kind of validated the six months and excused it to eight months. And that was my plan, communicating to investors and how we would move forward.

SHIKHAR GHOSH: So he actually came to you and said, "I can see you have a product. We'll put together a plan, it's going to take us a little bit longer."

HIND HOBEIKA: Yeah.

SHIKHAR GHOSH: And he was the expert. So you said, "Yeah, that's okay. I can-

HIND HOBEIKA: Yeah, because I didn't really understand the intricacies of the product, I kind of believed it. But I never made the assumption that maybe he didn't understand the intricacies of the product. Right. Because back then I thought that working with a big company equals you have really good experience and you can do anything.

SHIKHAR GHOSH: And when you give your word it's going to be-

HIND HOBEIKA: Yeah, I mean, US companies always keep their words, right? So coming from Lebanon, that's kind of the perspective and the limitation I had. Now looking back, looking for a manufacturer is such a different ballgame than actually looking for the software development company or a design company. You can't just look at their previous work. You need to look at exactly what the pain point of your manufacturing problem could be and try to find that being solved in a manufacturing partner.

SHIKHAR GHOSH: So if you had to advise somebody now about finding a manufacturing partner for a hardware product, what would you say?

Manufacturing Requirements

HIND HOBEIKA: I would say first of all, from a business perspective, the incentives need to be aligned, with maybe potentially the manufacturer having a bar a little higher so that you can keep it up to high standards. Because a lot of the limitations of small manufacturer is that their network is small and probably their capabilities and their quality requirements are lower. And so having a manufacturer that's little bit bigger, not too big, not too much bigger. So that's number one. And then number two, trying to guesstimate what are going to be the manufacturing pain points. So for us it was waterproofing, but more importantly it was having the product to be super flexible. So that actually was the hardest part. And then trying to find someone who's made flexible silicone electronic products and not just going to, for example, a goggle company, that expertise wouldn't be so helpful to us because it's not the same problem they're solving.

SHIKHAR GHOSH: So it's like, manufacturing isn't just manufacturing, right?

HIND HOBEIKA: Yes.

SHIKHAR GHOSH: That's too big of a category.

HIND HOBEIKA: It's too big. And also in manufacturing more than any other industry, experience counts. Someone who's had experience can preemptively see problems and solve them super quickly versus someone who's never done it before, who would have to go through multiple iterations in order to get to the solution. So experience does count tremendously.

SHIKHAR GHOSH: And each iteration is going to take you time and money?

HIND HOBEIKA: Yes, each iteration in a norming cycle, it's like a few weeks. Because you have to either cut steel or remove steel, and that costs a few thousand dollars as well. So the cycle of each iteration, usually it's two, three months. And so the lean startup model that is so popular in software doesn't apply at all in hardware because the cost of change is really, really high.

SHIKHAR GHOSH: So that means that if the cost of change is really high, you have to know what you're going to build at least to a pretty high degree before you commit to the manufacturing.

Testing the Product with Customers

SHIKHAR GHOSH: How did you go about testing to see that the actual product you were building was something that consumers wanted?

HIND HOBEIKA: So for us, testing was in two stages. So first of all there was the product testing to make sure that the product actually fits on every face and every goggle, and that was even before the manufacturing phase. So for that, the first step was hiring a human factors expert. And that person identified the major head shapes and then identified the most popular goggles on the market, and then came up with the first theoretical design where in the software it showed that if any person in the world wears any goggles and Instabeat, their goggles aren't going to leak, they're not going to feel it, and the center is going to be flush against the skin. So that was the first step.

Then we took this theoretical design and started swimming with it. First of all internally, on our team, and then obviously it leaked. So we got a camera, we got scissors and cutters and glue, and we started filming it to understand what exactly was causing the leakage. And then we would just take scissors, cut something, then swim again. Film it, see if they were leakage or not. And then iterate a little bit on that. And then we take the changes, implement them into the CAD design. We'd 3D print them overnight, then in the morning, take the new prototype, test it again. And once it passed on the internal team, then we'd recruit swimmers who'd come in and test for us. And it was very important in our swimming panels for people to have different head shapes. So we'd actually internally, in the most respectful way, try to classify people based on their head shapes, their nose shape, their temple shape, how deep their eye sockets were. And then we'd make that.

SHIKHAR GHOSH: So you'd actually call them in and say, "You have deep eye sockets, a big nose, you're beautiful to me."

HIND HOBEIKA: Yes. So we tried to be very politically correct about it because it's very easy to cross the line with these things. What we learned in testing is that some face shapes are so easy, they would just pass any tests. Like mine for example, which was very interesting, because anything I test just works. But then you'd have some people where nothing would work. And then for these people, we'd say like, "Hey, look, it leaks on you. So would you mind coming in a little more often?" And all these people are coming in for free, just to help and because they thought it was cool and why not? So yeah, every time it would internally pass, and we were at that point at seven people testing the product on the Instabeat team, then we'd hire a panel of maybe ten people that come. And each one of them had the swim with the eleven goggles. They had to push off the wall, flip turns to do four different strokes. And we had success criteria for the swim.

HIND HOBEIKA: It didn't pass. We do the filming process and then we kept doing that until we got to a form factor where 95% of the time, any person with any goggle would wear it instantly and would not feel it's there and we'd have an accurate measurement.

Product Iterations

SHIKHAR GHOSH: How many different product iterations do you think you tested in the study?

HIND HOBEIKA: So I would say vague design directions, maybe six or seven. But amongst those, there's maybe ten in each.

SHIKHAR GHOSH: So maybe 60 or 70 iterations on it.

HIND HOBEIKA: Oh yeah, at least.

SHIKHAR GHOSH: And at the end of that you came up with a product that you were happy with?

HIND HOBEIKA: Yes. At the end of that we had the form factor that we thought worked really well on any goggle and any face. So we knew that it wouldn't work on some people, but it would work on most people. And that was the best we could do with our time and budget because we couldn't iterate forever.

SHIKHAR GHOSH: So when you did that, your next step was then manufacturing this product?

HIND HOBEIKA: Yes.

SHIKHAR GHOSH: And so tell us the story of that.

HIND HOBEIKA: So that's when we took the design to Flextronics. And I have to say that the whole getting to the final form factor, I expected it to take us six months. No, I mean, I expected a stick of some time. It actually took us eighteen-month almost. So it wasn't a very long process.

SHIKHAR GHOSH: And that was mostly this process of going to the pool, trying it, coming back, trying it. There was no manufacturing in that?

HIND HOBEIKA: So there were manufacturing conversations, but then we were starting to discuss a design direction with Flextronics and they were starting to get a little tired of us saying we're not ready, we're not ready. But then after eighteen months, we got to the point where we were ready. And so the design direction that we had been discussing, we actually started implementing.

Searching for the Right Hardware Manufacturer

HIND HOBEIKA: And so I hired a design firm in San Francisco that was a block away from Flextronics that Alex, my advisor has worked with. And then we built a whole product based on the design direction that Flextronics gave us, which was to use their own pressure injection molding machine that they had used on Jovan products and other successful products.

HIND HOBEIKA: And so we went with this and then this is the design for the manufacturing phase. And then usually what happens after that phase is that they re-quote everything because now they have the exact details and they commit to the cost of goods here.

HIND HOBEIKA: And so when we finished that phase and we told Flextronics, okay, we're ready for the re-quote, that's when the account manager disappeared. And he started not being responsive, dodging the calls, sometimes answering and that phase of disappearing took six weeks. And then at the end, at the sixth week, he sent an email saying, "Oh hey, yeah, here's your proposal to get started. The team is ready. By the way, this is my last day at Flextronics. Meet during your new account manager."

HIND HOBEIKA: And the proposal was a \$275 an hour and a half a million dollar contract that would get us the first thousand units, which was extremely expensive.

SHIKHAR GHOSH: Yeah, you couldn't sell it for anything like that right now.

HIND HOBEIKA: No. And on top of that, the new account manager was not responsive at all. The previous account manager was extremely responsive up until the point where we got a quote and I was getting a completely different treatment from the new account manager. And I realized very quickly that this was not our path forward, that we had to change directions, to change manufacturing partners.

So at that point, I called every friend that had some manufacturing experience and begged them for an introduction, which they've made. And I called in a bunch of manufacturers as well. And the common response I was getting, I must've talked to maybe a 100, was like, "No, we don't do pressure molding. Sorry, this is too new. This requires equipment. We've never done this before. Your design is too difficult. We don't think we can do it."

I was looking in the U.S at first and I realized very quickly that this was not something that can be manufactured in the U.S. The expertise was not there or the amount of R and D required to get it there was not something the manufacturers were interested in. And so that's when I started looking outside, and another criteria we had then was we don't want to look for a big company, we want to look for a medium to small-sized company.

SHIKHAR GHOSH: You had the experience with Flextronics that you weren't that important for them.

Taking a Chance on a Small Manufacturer

HIND HOBEIKA: Yes, exactly. And at any point they can just drop us when they don't feel like it anymore, because it's more of a feeling than a business incentive. And so we found a small manufacturer in China who my friend was working with, and I went to visit them and it was like two people factory, completely empty. And at that point they had exclusively made vibrators for the last eight years.

SHIKHAR GHOSH: And there was no demand for vibrators?

HIND HOBEIKA: There was demand, but they had actually removed themselves as full time from the vibrator company and started their own manufacturing company. So they wanted to take on more clients. And so I found lots of similarities in the manufacturing techniques, because we also need a product to be waterproof, in touch with the skin, flexible and contains electronics.

So it was the good match we needed. Now the risk there was that it's two percent factory that's only done one product. So their expertise is kind of limited. It's there, but I don't know how much is transferable because they've not had the breadth of clients or of recognizable products I've seen on the market. But they made us an offer we couldn't refuse. So they gave us a contract that for 15K they would spend whatever engineering time is needed in order for us to get the first hundred functional units off of the tool. So not just prototypes, proper tooling. And it was a risk worth taking at that stage, because of us having spent so much money. First of all, wasting so much time and then spending so much money on design directions that wouldn't work.

I decided that I was just going to jump the end of it. And so we start working with them and the design phase went well and then we started tooling and then we got the first prototypes off of the tool, and I start looking at pictures in order to understand how good the prototypes are. And I just couldn't tell. I was asking a lot of questions, I was getting vague answers or I just felt like in order for me to get all the answers I need, I was going to be harassing them online, which was not something anyone wanted to do and which was just going to destroy the relationship.

And also for me, I was living in San Francisco and trying to manage the China portion. So I was living at night mostly, and this was exhausting. So I just booked a ticket for the next day and showed up to China at their factory, and I looked at the prototype firsthand and I'm like, "oh my god, this is not what I saw in the pictures, I'm going to have to stay."

Moving to China to Supervise Manufacturing

SHIKHAR GHOSH: So what happened then?

HIND HOBEIKA: So I learned a few things. Looking at the prototype, I directly learned that in the Chinese culture, they are not going to bring up a problem unless I actively ask about it and there are problems I can predict they're going to happen from our previous run but also there are problems that I don't know are going to happen.

So unless I'm there to see them, I'm not going to be able to ask the right question. And so I just decided to stay for however long it takes because all I wanted at this point was just to ship a product and to fulfill my commitment. And so we would have a prototype, I would go to the pool, I would test it out, we would do the reliability testing also in the lab, and then I would go back that same day. I would give them a list of all the changes we need to make.

They would implement them in the CAD right away and they had absolutely no problem working overtime, as long as needed to implement it into the design. And then the next day they would send it off to make the tooling changes, and they were very respectful of

the fact that I was there, and so they were accelerating their turnaround times tremendously.

Usually, tooling takes a few days to a few weeks to be changed, they were doing it in a few days always, because I was there and so I didn't have a reason to leave, and my two-week trip ended up being a nine-month trip, from the first prototypes that had plastic crushing and didn't work, to a product that actually had a 96% yield and that was passing 100% all of our reliability-testing.

SHIKHAR GHOSH: So you went there thinking you're going to be there for a week or so. You stayed for a whole nine months. What was it like in China?

Cultural Challenges

HIND HOBEIKA: It was very hard. From the small things— Because I always went with the perspective that I'm not moving there or I just always thought I was visiting. And usually when I'm visiting, I always try to embed myself into the other country's culture. So I didn't come with stashes of food and coffee and stuff, and that was the first and most important thing I struggled with.

Being Mediterranean and Middle Eastern, food is 90% of what I think of. Ten percent is business. But I couldn't find coffee in the morning and I couldn't find salads or fresh vegetables to eat because in the Chinese culture, everything needs to be cooked, and they drink tea in the morning or soy milk. So I struggled so much with these small things. They were super off-putting as well as no one in the city I was at spoke English.

SHIKHAR GHOSH: Which city was this?

HIND HOBEIKA: It was Xiamen. So it's a small city that is in the south, right next to Taiwan and Shenzhen. And it's four million people. I was in the suburb of that city and just pretty much no one spoke English, which means that I wasn't speaking. I was silent a lot at the time. Even at work, there was only one Chinese person who spoke English. So, most of the people I interacted with was based on body language and I had to learn the Chinese body language, which is very different from the Lebanese or American body language.

Dealing with Disappointments

And small things, like I couldn't go to restaurants that didn't have pictures in their menu, otherwise I can't order. And then I was very alone the whole time. So I was trying to keep myself upbeat, especially when product iterations didn't go well. And for the majority of my stay, product iterations didn't go well. Because in manufacturing it's one or zero. It's like the product works and it's shippable, or it's not shippable. There's no in-between.

HIND HOBEIKA: So even if the product was a little better and still not shippable, it would still be such a downer every time. So it was really, really hard.

SHIKHAR GHOSH: And so eventually the product got completely done?

HIND HOBEIKA: Yes. Eventually, after nine months the product was done. It was working really well and we actually launched, and we are shipping it to customers all over the world.

SHIKHAR GHOSH: You've gone through this journey that's had ups and downs. How would you describe the journey now looking back? What's it felt like?

HIND HOBEIKA: You know, the entrepreneurial journey, it's just so difficult and I feel like now I look back and I tried to look at the very difficult moments and the very rewarding moments. Maybe rewarding is not the word, is more pleasant and happy moments, and I feel like the difficult moments far outweigh the happy, light ones, and sometimes the difficult moments overshadow the small wins you make as a business.

And I have to keep reminding myself that the product is maybe one or zero, but the business is not. And so every small little win counts, but somehow I shouldn't let difficult persons overshadow the small wins. I would say I had a lot of trouble actually removing myself from the final end goal, and being able to sustain myself all throughout the journey, because it did take six years to get the final product. So one of the challenges is also to dissociate my personal identity from the company or the product, because it's the only professional thing I've ever worked on, really worked on.

SHIKHAR GHOSH: So if you look at it, it feels to me like the negatives so far outweigh the positives. Then would you do it again?

HIND HOBEIKA: I mean, it's interesting. It's kind of a curse, of course, I would do it again. I realize through my journey that there are things that I'm doing now that I couldn't be doing otherwise. For me as an engineer, the ability to take an idea and turn it into a product that other swimmers are able to use, it's such an unbelievable feeling.

It's very hard and there's lots of negative feelings associated to it, but it's just such a nice reward. And I look at my personal growth in this journey and also growth mostly comes usually from negative places. But I've grown so much as a person and I see my personal relationships back then and now, and I see my romantic relationships back then and now, the growth wouldn't have happened if it weren't for all these experiences.

I wouldn't have had the initiative to seek coaching or to seek psychotherapy in order to further develop and deal with my professional life. I just feel like over all it's such a huge win and I would totally do it again. Of course, I would do it differently based on everything I've learned, but I feel like I've been cursed with the entrepreneurial bug of "this is bothering me, oh, let me create something so I can do it." Yeah.

Deciding to Be A Solo-Founder

SHIKHAR GHOSH: So if you think about that journey, it must've been lonely to be bearing the cost of all these things on your shoulder. Why did you not get a co-founder to share that?

HIND HOBEIKA: In the first year of the startup, I wasn't fully aware that it was a business, so I didn't really think I would need a co-founder. It was kind of like, let me figure out what to do with my swimming product. And then when it started becoming a business, I actually did have a conversation with someone that I wanted as a co-founder. And then I realized that they didn't have the same passion I did for swimming, and they weren't able or they didn't want to sacrifice the things I was willing to sacrifice to make happen. And so I just didn't move forward without partnership.

And then I just never met someone who would fit the co-founder role, or at least the idealistic role I've had for a co-founder. As time passed, it became almost too late to call someone a co-founder. So what I actively tried to do is to find people who would replace from a business perspective, a co-founder's role. So I had Alex as a partner and advisor, who would basically come in and try to see the gaps that were happening.

So he was kind of a hands-on advisor, and he would spend almost half of his day at the office just looking and observing and talking to me and doing working sessions, and he was able to identify a lot of the gaps that we had and point me in the right direction. And then Lauren was very much the co-founder support of— The first thing he did for example, called the board to ask to raise my salary, and then he would push me, almost oblige me to go on vacation. But also I was able to confide in him on business terms when it came to the startup.

Using Advisors

SHIKHAR GHOSH: So in some ways, you took the role of co-founder that's often done. You had multiple people doing parts of it.

HIND HOBEIKA: Yes. The only caveat to this is that you can never go to one of these people and say, "Hey, I'm thinking of quitting." Because at the end of the day you've hired these people and these people's incentive is attached to their compensation in the company. And they can leave at any time because they don't have the same commitment of a co-founder. And so there was always a line that I didn't want to cross and I always tried to also not overshare the personal side where I feel, I mean, I don't know firsthand, but I see from my boyfriend's relationship with his co-founder, the personal and business are so intermeshed and that in some sense it's really great because if your down moments aren't aligned, you can lift each other up and be very candid.

But if the down modes are synced, it can cause a lot of problems, and it almost becomes too much of a problem to deal with. And in these moments, observing them from afar I feel very grateful not having to deal with those, because sometimes there's just an extra problem that's just not good for the business.

SHIKHAR GHOSH: Yeah. So having the co-founder can dampen the oscillation, but can also exacerbate it? It can make it much worse.

HIND HOBEIKA: Yeah, absolutely. Sometimes it can slow down some decisions. Sometimes it can slow down the company. Sometimes the employees can really like a co-founder and leave because they hate the other co-founder. There's a lot of problems that

can arise from having a co-founder, and I feel it's almost the same process as finding your romantic match, only on top of that you need to align the business skillset. I thought that I was able to replace what a co-founder— Obviously this comes with the ignorance of not having had a co-founder and understanding the real value of it.

Navigating Cultural Differences

SHIKHAR GHOSH: So, if we switch topics a little bit. You're one of the unusual entrepreneurs in the world. You've come from Lebanon to San Francisco and then actually worked in China on— So you've seen multiple cultures and if you compare, you know, San Francisco to China, and for a company who's doing a manufactured product, what's your sense of that? Because you've tried to do manufacturing in San Francisco as well.

HIND HOBEIKA: Yeah. I'd even take a step back and compare Lebanon to the US. Where in Lebanon, people aren't self-initiators, so people need a higher force to give them direction and lead. And when I had the back office in Lebanon, it was almost like, the time when San Francisco was sleeping, [the] Lebanese office wasn't working. So it was extremely difficult to get them to be self-sufficient. And it was extremely difficult to get them to have a good communication with the US team.

In Lebanon, we tend to hide the problems and even if we need to lie about the problem, we lie, with the hope of it getting fixed soon so that it justifies the lie. And I've had this problem with every Lebanese contractor I've worked with, where it's like, "Oh, I was just pressing send when you called," and then the email never arrives because actually nothing is ready. Versus in the US it's almost the opposite, where the relationships I've had were very honest ones and people turn you down from the start and turn down business if they're not 100% sure that they can commit to it.

I've had so much clashes between the US and the Lebanese team where the Lebanese team just says lots of things that the Americans find disrespectful. And at the same time, the Lebanese weren't able to work on an independent structure. Taking that to the manufacturing, that was more on the development side, so taking more to the manufacturing level. When I started to talking to US manufacturers it— They work from 8:00 to 5:00, Monday to Friday and they try to preserve their cashflow and it seemed like they were extremely risk-averse. Going to China where there's so much competition in the manufacturing and they are so hungry for business that— Also what helps them is that Chinese people do not mind working a lot. As long as the overtime is paid, they are going to work.

The challenge in that working culture is that problems aren't necessarily lied about, they're just not mentioned. And so, if I don't ask about a problem or— They would just never mention it and if I find out about it they'd be like, "Oh yeah", versus a Lebanese person would say, "No, no way. Oh my God, it's the first time I see it." And versus the American person would come and even maybe before giving you the solution, they would be like, "Here is the problem. Please be aware of it because this is the risk you're taking."

This was the first realization I had, and the reason why I stayed because I realized that if I don't know what I don't know, I'm not going to be able to solve it from far. Chinese culture was also very interesting because, you know, it's a little bit like Lebanon where they're not used to young people giving directions to older people. So I had that challenge to overcome. And also it's-

Being a Young Woman Entrepreneur from Lebanon

SHIKHAR GHOSH: Was there a gender issue as well?

HIND HOBEIKA: I mean there were no women managers, right? So it was de facto. I never was disrespected though. I mean, of course, maybe in Chinese I was, but I wouldn't know about it. But I would also say like, the first time I went to the factory I was wearing green pants and I could see the owners did not take me seriously at all. And I understood that actually in the US people don't give any attention and weight to the dress code, versus in China, that was extremely important. And so on my second trip, I had a completely different wardrobe and a completely different attitude, to be respectful and mindful of the Chinese work culture.

SHIKHAR GHOSH: At a couple of places along the journey, you were running out of money, you were behind schedule, you know, a lot of things. And you were considering whether it was worth going on or not. And so, if you'd chosen not to go on or if you couldn't raise the next round of money what—

HIND HOBEIKA: You know, when I was in Lebanon in the first phase, failure was not even a conceivable option. Like, it would've been so detrimental to my relationship with my parents, to the relationship with the press. Back then, I was getting so much coverage because I was an Arab woman that was starting a company, and the press almost didn't care about what I did and where the product was at they were fascinated by the Arab woman angle—

SHIKHAR GHOSH: In a tech company.

HIND HOBEIKA: Yeah. Which was really funny because I always felt like, okay, I mean it's not my fault I'm an Arab woman or I didn't do anything to be one. Like that's just who I am. But, you know, I was getting so much coverage and attention because of that. And it, kind of, make me feel like an imposter a little bit, where I was struggling with so many problems and I wasn't— In my head that I wasn't able to live up to the expectation the press has set.

Expectations for a Woman Founder from Lebanon

And actually people in a culture like Lebanon give too much attention to that— to the press and to the status and to the show. So even when it came to my mother actually, she was telling me things like, "You cannot dress like this, you're a CEO," or, "You cannot buy this car, you need to buy this. It's \$10,000 more because you're a CEO you can't drive a small car," or "You cannot fly economy. You have to fly business class."

And then I'm like, "Well we're a startup. We're a few people." "No, you're CEO you're the most powerful woman. I read it on XYZ." So it was like they had never even— I just couldn't deal with myself going back home to my family, to my friends, to the people who thought I was the most powerful woman and tell them, "Hey, actually it didn't work." And so that was one of the things that was driving my stubbornness.

The other thing was that, we had taken money from a few thousand people in 56 countries and told them we're going to ship you a product and, you know, if I don't ship them a product, in a place like the US it's called, "Oh sorry, you were going to file bankruptcy and I'm really sorry for your money." In a place like Lebanon, they call you a thief. And like, that's the last— I just couldn't associate my business and myself from these cultural aspects. And so a lot of that drove my stubbornness, you know, and my shame. Like I felt that this was my commitment and my way to get out of that loop. And coming to the US, obviously, these get dampened because it's a culture that accepts failure far more. Everyone has tried something and failed and it's actually, kind of, celebrated in the US or it's normal.

HIND HOBEIKA: And I've met so many people who failed to deliver on their crowdfunding campaigns, who have lost hundreds of millions of dollars when I felt bad about losing a few hundred thousand. That, kind of, reset the bar a little bit, but given my origins and background, it's very, very hard for me to detach myself from that and to actually find my self-worth beyond those external criteria.

Staying Healthy and Balanced as a Solo-Founder

SHIKHAR GHOSH: So what do you do when the downs and the challenges and so on are just beyond your control? How do you keep yourself healthy and how do you think about that?

HIND HOBEIKA: I must say that it took me a lot of mistakes to learn to keep myself healthy. So the first few years of the business, I stopped doing sports. I almost stopped swimming. Like every time the prototype would not work, I would just avoid the pool. And I stopped swimming. I gained a lot of weight. I was taking zero care of myself. On top of that, I was in Lebanon where I had a big social clash with people there. And so I kind of found refuge in working. And so I had no social life as well.

The first few years I was still very high on the work itself. So that kind of sustained me and gave me an excuse not to be healthy. But when I had the first hit of, like, I need to raise—I'm out of cash. I need to ship to these people. I cannot fail. So that hit was more than a professional one. It actually made me like, "Okay, who am I? How can I take care of myself?" And so, at that point I picked up running and so I started running— Maybe running away from my pain, but I was running half marathons and marathons and I found peace a lot in running.

Setting Non-Negotiables

I think there's a downside to being obsessive about an activity because this feeds the type A personality. So after that, I've learned to tone it down a little bit. But right now what I do is, my non-negotiable is sleep. So I don't put an alarm in the morning and my natural clock wakes up at 7:00. So that's what I do. And my second non-negotiable, that's more negotiable than sleep, is working out. Actually it's food, and then the third is working out. I've learned that these are the things that are opposite of, they cannot compromise on if I need to take care of myself.

SHIKHAR GHOSH: Food as in?

HIND HOBEIKA: Eating healthy. So I would not grab quick fries just because I'm out of time. I would rather not eat and wait to get a proper meal. That's consistent. Not saying to starve myself, but I just stopped the mentality of I don't have time. Let me eat whatever's in front of me, or I'm stressed, let me snack on whatever. I'm stressed. I'm going to go to yoga class or I'm going to take a walk or I'm going to eat a mango because food is comforting, you know? I can't completely avoid the food cycle. That's actually helped me a lot, first of all get to my natural body weight where I don't struggle with weight issues anymore and sports make me happy. I don't say that these things solve any of the emotional roller coasters, but it gives a good basis to deal with it. And then, now that's my basis.

I do psychotherapy continuously, every week. And then in very difficult moments I call extra, a coach, because psychotherapy and coaching are a little different and while psychotherapy tries to explore the past patterns to explain the current ones, coaching gives more concrete, tactile tips in how to deal with the situation. So I only do that in darker moments. I also am very to have now, a social circle and a partner who are in the same space, who really understand the struggles I go through. And I would say that almost, you know, the fourth most important thing, because without that it's just too long a day. Like this makes it-

Romantic Partnerships

SHIKHAR GHOSH: So you've had romantic relationships before where the partner was not in the same world that you were in?

HIND HOBEIKA: Oh absolutely. I've even had partners who couldn't deal with the fact that I was in the press, so they would like— I've had multiple bad romantic stories but I've had— They're also a startup founder. I've got press. They didn't get press, so they create an issue out of nothing just to destroy. And then I've had partners who would— just could not accept the fact that their girlfriend was working on something cool, so they would totally emotionally abuse and try to disparage everything I was doing. And you know, these are all things that were triggers and that I've had to work through.

SHIKHAR GHOSH: What about on the downside? You mentioned a couple of things when you're up, either press or you're doing something cool. What about when you're down and struggling, then what's the role of a partner then?

HIND HOBEIKA: So the previous partners I've had, usually they were supportive. We have this thing in the Lebanese culture where we kind of enjoy other people's misery. It's a very bad thing to say. Actually, what I've learned from my current partner, there's a quote in Greece that says, and it's not exactly what I'm saying, but it's like, "If your neighbor has a lot of sheep and you're jealous of them, you would rather destroy their sheep than getting yourself new sheep." I don't know why I'd have a sheep example, but anyway, it's that culture of like, in order for me to feel better, I'm going to destroy what's around me. It's like, when I was lingering in my moment of darkness, it was— They were supportive because that was something they were comfortable with, but it's more like on the positive highs that they weren't able to handle, because it was not— It was something that was challenging them and—

SHIKHAR GHOSH: That's really interesting then. It was almost, in the romantic partner category, the highs were more challenging than the periods of being low, where they could stay there and help you.

HIND HOBEIKA: Yes. And I would say I discovered my patterns mostly in romantic relationships as well, because I discovered my weaknesses in business through my weaknesses in the romantic partnership so that, when these clashes would happen, I would deal with them in such an emotional— and it would affect me so much, that has actually got me to understand that it affects me because I'm not separating myself from the business, because I don't know how to deal with myself. And so, working on learning how to actually take care of myself first, and then dealing with the partners. It's all interlinked, like it's impossible to separate.

Emotional Journey

SHIKHAR GHOSH: Right. But so much of what you've been talking about is really the emotional cycle as opposed to the logical, this is the business plan, here's what the go-to-market strategy is and all of those sort of things you can put down on paper.

HIND HOBEIKA: Yeah, I would say most of the Instabeat journey was an extremely emotional one. You know, it was driven from my passion of swimming. All of the people that I've talked to through this journey, whether it's investors or partners I've built a really strong relationship with, and a lot of that relationship is what drove the business forward.

HIND HOBEIKA: At every inflection point, yes, of course, we considered whether there was a market opportunity there, but a lot of the weight came down to, do I have the passion to persevere? Is this something we want to nurture and keep growing? So I think we gave a lot of width to that in all of the decision making.

SHIKHAR GHOSH: So now you have a product in the market and the company goes through yet another stage, which is you have a product, you've got to decide are you going to create more products, get into the market? You also have a competitor.

HIND HOBEIKA: Yeah.

SHIKHAR GHOSH: How do you look ahead and how do you keep yourself so driven for the next big thing?

Staying Motivated

HIND HOBEIKA: Well, that's a hard question. Given that the launch has been very difficult for— You know, we've been the only swimming technology for a very long time and the week we launched, and it hit us really hard because it was a good product that was built by a really good team of 40 people. So, it kind of felt like this was going to hit us really, really hard. The first work I have to do was to detach myself from the rush of the moment of the panic of the moment, and try to look at this from a long term perspective and reconnect myself with, why did I believe that this product was really a good product and why did I take the design decisions that I did that differentiates us from the competitors, and build the long term go to market plan based on these.

Now in the next steps of the company, I'm trying to look at multiple factors. First of them being how the market responds to this product, whether the unit economics makes sense, whether what it takes to actually send new products and then what is the possibility beyond this product? Is it more that's focused more on the swimming experience and building kind of an ecosystem around this hardware product? Or is it creating new hardware for the sport or multiple other sports? Or is it branching out in the swimming hardware, and doing more products around swimming?

So, I have a lot of ideas and dreams and these dreams kind of dampened with manufacturing problems, but now that the product is out there and I'm actually trying to listen really carefully to swimmers, I'm hoping I would get to pick one of those dreams to push forward. Even when the product launched, it's been so much work and it's been so hard fixing bugs, getting people, that I also forgot a little bit to celebrate the launch and enjoy it. But, I'm trying to find motivation and the feedback I'm getting because, at the end of the day, the reward comes from building a product that swimmers enjoy. This time around, I feel there needs to be more business equations in the sense of, is this a product that can scale in the market and is this a product that swimmers want?

Measuring Success

SHIKHAR GHOSH: So if you look at your journey now and you say, how do I measure success or what have I got? What's my return on entrepreneurship? How would you look at it?

HIND HOBEIKA: I would say for now, the return is all intangible things that if you knew me very well, you can directly see them. If you're a Lebanese parent, you probably have a harder time quantifying those. The returns on having a startup journey are immense. First of all, from a personal development experience, the person I am today is a much stronger, more confident, better partner, a better friend version of the person I was 10 years ago.

I'm much more open-minded but also with much more business connections, having worked with top people in the field, having gotten the chance to live in Lebanon, but also in the States, in the startup hub of the world, and then in the manufacturing hub of the world. Having interacted with completely clashing cultures and found a way to actually power through and get to my objective. I mean, these are successes, personal successes obviously, that just have no value.

I feel also that as a person, I found myself better through this journey in the sense of I know exactly what I like to do which is build the products and then talking to consumers and building something for them. I realize I wouldn't have gotten this chance through working at a big company. So yeah, I appreciate it tremendously, all of it.

SHIKHAR GHOSH: So if it doesn't work for whatever reason, or you sell it or something, if there's an exit, you'll go back and start another company, that that would be the dream?

HIND HOBEIKA: I think that's the curse. I think that now that I have seen the power of turning an idea into a product, I don't think I can do anything else. And I think having a tangible product is also such a cool experience. And I think that yes, software is easier to build, but it's hardware that changes the world. And so small little hardware products, as a minimum person, I don't have many, but the few I have actually make my life so much better and easier. And this is the kind of experience I like to create. I don't see myself being part of the 6,000 person team, working on a button, whether it's blue or green. I feel that I'm hooked to the bigger mission now. So yeah, it's a little bit of a curse because it's going to be difficult forever.

Advice for Other Founders

SHIKHAR GHOSH: So if you were giving advice to somebody or to yourself in the early part of the journey, someone's going to start their company and they say, "You've been doing this for 10 years, what should we watch out for? How should we think about it? What should we pay attention to?" What would you say?

HIND HOBEIKA: Yeah, I would say, first and foremost, don't lose yourself in the journey. It's very easy to do. And what I mean by that is too generic. I mean that, make sure to keep doing the things that keep you grounded and sane. So for me, this was sleep, this was food, and this was exercise. I think it's the same for a lot of people with different priorities.

SHIKHAR GHOSH: Some people might add connection, relationship.

HIND HOBEIKA: Yes, a little bit. But for me, I'm not even able to get there without those three pillars. So, try to do the things that keep you at a sane level. I can elaborate on this in so many different directions.

HIND HOBEIKA: I would say, in hardware, specifically take the time to really find the partner that can take you there, because of the difference between a partner that knows what they're doing and a partner that is kind of experimenting to get there, is like night

and day. And with the right partner, I've seen how things can go so quick and get you there in a much more stable way.

SHIKHAR GHOSH: And how do you find that right partner?

HIND HOBEIKA: By talking to people, mostly. I would not search on the internet for that.

SHIKHAR GHOSH: So, because you actually chose somebody who had never done this product before and you took a chance on them, and it worked out at the end, but that's kind of violating your rule going off, going with someone who knows what they're doing.

HIND HOBEIKA: Yeah, because they had a lot of similarities in the technique I needed, this is why I chose them. But I agree with you. I didn't have the resources to go to my top choices, but not by choice.

Coping with the Highs and Lows

SHIKHAR GHOSH: So anything else that you would advise them to do in terms of coping with the ups and downs from the expectations of that?

HIND HOBEIKA: I would say that this is so specific to each person. Each person has their different coping mechanisms. I think surrounding yourself with people who are going through a similar experience is game-changing. From actually asking them questions that can help your business, but also to confiding in them and finding out that they have similar struggles. So this kind of makes it a little more relatable.

It doesn't have to be a partner. But talking about the partner side, I would say that having a supportive partner is so important, and it's better not to have a partner than have a partner that is not supportive, because that can bring you down and destroy you very quickly. And this will test the relationship tremendously.

SHIKHAR GHOSH: I've heard a lot of that, particularly in the Valley, you go to gathering of entrepreneurs and everybody's killing it. Everybody's doing this amazing thing and you know that under the water they're sort of really scrambling-

HIND HOBEIKA: Yeah. Fake it till you make it approach.

SHIKHAR GHOSH: Yeah. Right. What's your sense of that? I mean, is that healthy?

HIND HOBEIKA: It's not healthy for me either. It doesn't work for me, the fake it till you make it. I feel like the first portion of my journey was a little fake in the sense that I had too much credit for something I hadn't done yet. That the second part of my journey, I tried to be the opposite. I tried to almost be too honest, and this was something my coach kept telling me. She's like, "Stop saying the product is not working. It's going to work. Just be a little more patient. There's a difference between not working and waiting for it to work."

I would say if it works to pump you up and to get you where you need to be and if it works for you, maybe do it. But I wouldn't say that these people would be friends. It just doesn't work for me. It has to work with your style as an entrepreneur. And for me, I always preferred the candid approach. I've even changed my style in the monthly newsletter I send to my investors. So at first it was like either I don't mention the problem or there's like, "We're running into issues, but we've almost solved it and it's fine." Now it's more like, "We have this issue, we don't know how we're going to solve it, but I have this one person who is spending time on it and we're figuring out how to do it."

So I just felt like the constant feeling of under-delivering was so big, that I actually reversed it and just started stating facts without promises. But that comes from my own trauma of the experience. Right? This is why fake it till you make it wouldn't work. But I would say in general, the words you choose to describe your story are so important and they can impact your perception. So it's one way to say, "The product isn't working," and it's pretty much the same story if I say, "The product now is going through iterations until it works." So, that is something that I'm working on, changing the language.

SHIKHAR GHOSH: Great. Thank you.

HIND HOBEIKA: Thank you.

From Prototype to Mass Production: 5 Challenges Hardware Startups Face When Bringing a Novel Device to the Market

 techpocket.org/5-challenges-hardware-startups-face

By KEN

October 21, 2020

Hardware startups tend to fail. They are more prone to mistakes—and ultimately, fiascos—than their software counterparts. According to research conducted by [CB Insights](#), approximately 97% of hardware startups don't get off the ground or fizz out without ever reaching a triumphant release. Common reasons for failures can be roughly divided into three groups: engineering and technical challenges, financial factors, and sales, marketing, and distribution issues.

Depending on the complexity of the features, [hardware design](#), prototyping, testing, development, and mass production could push the delivery date into an indefinite future. Moreover, finding potential investors, suppliers, manufacturers, and distributors can also become a burden. What can hardware startups do to not burn through their financial resources, speed up their time to market, and deliver a product that's market-fit?

Why Hardware Startups Fail

Jawbone, a fitness wearable startup backed by \$930 million, failed to compete with market rivals and went bankrupt. Electronic cigarette and vaping product company Njoy raised about \$181 million, but had to liquidate its business. A well-funded kitchen appliance maker Juicero, backed by \$100 million, also kicked the bucket. Going deep into [another study](#) from CB Insights, it becomes clear that even successful crowdfunding campaigns and doting investors doesn't mean a startup will make it to the auspicious launch.

The platform analyzed 382 failed businesses and found that the top three reasons hardware startups flop are:

- A lack of market demand for their products
- Overspending
- Fatigue after the initial crowdfunding success

That was the case with [Coolest Cooler](#), when it officially went out of business. The project struggled to launch for five years, and ended up being so costly that the customers never received their coolers.

[Vicis](#), a high-tech helmet producer, was once a very promising Seattle hardware startup. Suddenly, it found itself with no money in the bank and had to sell its assets. The reason for the company's collapse was a high burn rate and excess focus on grabbing market share.

As seen above, hardware startups make a bunch of mistakes while bringing their ideas to fruition. To help teams navigate the path towards a successful product launch, we will zoom in on five inevitable hardware startup challenges every pioneer might encounter—and provide hardware startup tips on how to deal with them.

Top 5 Hardware Startup Challenges and How Your Company Could Avoid Them

Innovation Implementation

In recent years, hardware development technology has made incredible breakthroughs. The tech world is witnessing a number of rapidly emerging hardware solutions and technologies: industrial internet of things (IIoT), edge computing hardware platforms, AI specific hardware, 3D NAND technologies, new chip architecture, advanced mobile robots, additive manufacturing, industrial connectivity and storage solutions, etc.

In order to stay on the competitive edge and grasp the opportunities, hardware products need to be designed with innovation in mind—and in line with the major tech trends. Only then will your solution be efficient and future-proof.

Grabbing Potential Investors' Attention

Investors are no longer willing to finance just an idea; instead, they want to see at least a working prototype or an MVP. VCs are rather reluctant when investing in hardware as building a device requires constant extra expenditures. It is recommended to start with joining hardware accelerator programs like Y Combinator, HAX, and Hardware.co to get initial funding.

A production-ready prototype with competitive advantages, such as strong market potential and the value it brings to end users, is a milestone you need to achieve. An even more effective way to attract hardware startup investors is to find an existing product that sells well and add your own features and updates on top of it.

Finding a Software Development Partner

For hardware startups, it is difficult to create reliable web apps, mobile apps and firmware for their products. Since hardware engineers don't usually understand software well, they have to rely on third-party vendors to bring their ideas to life and deliver the best-suited connectivity option.

Special attention should be paid to firmware resources—especially if your company is working on an IoT device. It is crucial to develop embedded software that, besides collecting and processing data, ensures the device is secure and safe to use, and supports remote control and over-the-air (OTA) updates.

Overcoming Feature Creep

Many startup founders think that more device features translate into more value for their end users. However, the fact is that endless additions to your product only increase the risk of diminishing usability, extra expenditure, missing deadlines, and disappointing your customers. Feature creep is usually the result of poor research, planning, prioritization, the ongoing pursuit of perfection, and underestimating project complexity. To handle feature creep, start your project with an MVP, keep your project on course, and stick to the core product features.

A manufacturer of connected pet products addressed Softeq to design a smart dog collar. The client required the multi-sensor wearable device to help monitor a dog's location, fitness activity, and behavior, and prevent car accidents and straying. Additionally, they wanted to equip the collar with a high-quality camera to track pets in real time. Already at the business analysis stage, our team proved the idea was not feasible—the product would be too bulky and expensive. The customer took our recommendations on board, and delivered the solution with three core features: geofences and location tracking, issuing voice commands via a microphone-speaker combo, and step count. This helped our client get their product out on time, on budget, and test the viability in the market without delay.

Working with Offshore Hardware Manufacturers

Once the board layout is optimized and verified for correct operation and you have a working MVP, take the time to find a hardware manufacturer that has proven experience with products like yours. It might make a lot of sense to go with an outsourcing manufacturer in China. Outsourcing mass device production overseas is optimal, but challenging. Any hardware startup will need a full-time person to purchase components, organize tooling, negotiate price and payment terms, and supervise the entire mass production process from start to finish to promptly eliminate any tech bugs.

A manufacturer of wearables for kids turned to Softeq to build a device with a pet simulation game. We crafted the entire solution in-house—game logic and graphics based on the client's idea, custom firmware, a 3D enclosure model, circuit diagram, and printed circuit board.

To assist our client with manufacturing, we prepared all necessary documentation for production of the custom PCB, enclosure, and hardware components, and handed it over to the factory. Our engineers visited the factory several times to monitor every stage of the production process and assess the quality of the enclosure mold as well as all the test samples prior to mass production.

Avoiding Costly Mistakes

Software development startups may turn to a wealth of ready-made, verified, and bug-free resources to learn best practices and deliver an MVP quickly. For hardware teams, it is always a challenge to accelerate product development. Modifying hardware is a

complicated process involving many restrictions. The problem is that any mistake (even the slightest!) will cost tons of time and money. This is also true when adding any functionality that requires a new hardware module.

Our team helped a startup fix an issue it was having with sound interference in a lung diagnostic device. Before it approached us, the company already had a unique stethoscope consisting of a microphone and a Bluetooth chip. The problem was that once the device was assembled, massive electromagnetic interference in recorded lung sounds was detected, making medical diagnosis impossible. After thorough examination, our team identified a routing defect in an assembled PCB. We managed to achieve better sound quality by applying an electromagnetic shielding on a printed circuit board.

If the process of hardware design is not well thought out beforehand, you may need to modify PCB design, redesign the enclosure, or to fine-tune embedded systems. The later the issue is detected, the more complicated it is to fix.

Conclusion

If you are still on the fence about launching a hardware startup, it's important to remember that hardware startups that succeed can be an absolute goldmine. FitBit was on the verge of going out of business seven times but ultimately became the product standard. GoPro had a humble beginning, and managed to overcome fierce competition.

What is certain is that with so many startup challenges in hardware development, there is still a road to success. It is time-consuming, stressful, expensive, and complex, but rewarding if thoroughly preplanned and executed.

About the Author

Vera Solovyova is a Copywriter at [Softeq](#)—a full-stack development company and an Inc. 5000 honoree. We craft quality content to assist tech startups and large enterprises in engineering, transforming and scaling smart technology systems.

7 reasons why my IoT startup failed

 yourstory.com/2015/06/iot-startup-fail/amp

June 24, 2015

By [Yash Kotak](#)

June 24, 2015

After five months of toiling 14-hour days, making a hardware IoT (Internet of Things) product from scratch and spending lakhs of rupees of investor money, it suddenly dawned to me and my two founders that our product won't sell.

We had to do something about it or the startup was doomed. The month was December 2014.

Being first-time entrepreneurs, we made tons of mistakes. I'll mention the top seven mistakes we made that led to our failure. But first the story to give you some background!

July 2014

Our vision was to make super-smart internet connected switches that learn from user behaviour and personalize electronic appliances in a home to its owner. We named the product Lumos (Yes, I am a big Harry Potter Fan!)

We headed off to our alma mater, IIT-Gandhinagar, to get incubated after taking some pre-seed money from an angel investor. We converted a lab into our office space and the Lumos saga started!

We built like crazy. Being engineers, provided with an interesting problem to solve, we forgot everything else and just built. Our first prototype, which automated lights, was ready in 45 days.

The second prototype, which could automate lights, fans, ACs and water heaters was out in another month. Pretty fast for a 2-person team, building hardware and software at the same time!

November 2014

We got one more co-founder on board to help us out with machine learning. In mid-November, we started moving from the ugly-but-functional prototype stage to the beautiful product stage. In December, we were already in talks with investors to raise the next round of funding.

We were on track to have a hardware product on the market in less than one year. We were pleased with ourselves. The investors were pleased with us. Life was good.

December 2014

Until it was not. We had underestimated the work, time and funding that goes into making a market-ready hardware product. We had overestimated the demand and utility of our product.

“Hardware products sell at 4 to 5 times the component costs. How did we not know this?”

Our price estimates were wildly off the mark. And when all this realization came together, we were in a crisis.

January 2015-April 2015

We were forced into making major pivots.. We had to go back to the drawing board and think about what we should work on.

Not knowing what you will work on might just be second to running out of money, in the list of worst things that can happen in a startup.



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We made bigger mistakes. We left IoT as a sector. One of our co-founders decided to call it a day and take up a job.

Now that you have some background, here are the top seven mistakes we made in Lumos and what we learnt from them.

Mistake 1: We were neither experts nor target users of the product that we were building

We had never used the existing home automation products in our homes. We were not veterans in the IoT sector. When you are inexperienced at something, you give yourself the famous Dunning-Kruger pass on your decisions.

Had we been users of existing smart switches, we would have known that the incremental value that our product was offering was quite low. Had we been experts in IoT, we would have known how to price hardware, and the difficulties in building it.

By avoiding this mistake, you can avoid a lot of other mistakes which happen as a result of this one.

Learning: *Work on something where you are either an expert or a top user. If not, become an expert/top user.*

Homejoy Founder Adora Cheung herself worked as a professional cleaner to understand the business.

Mistake 2: We did not do the due diligence on the idea before we started building the product

We did not understand the market and competition well enough. We also did not figure out the persona of our customer, and whether the customer was looking for the value that we were providing.

It is always possible to validate or invalidate a lot of assumptions about the product, market and competition without building the full-fledged product.

One way we could have done it was by selling existing products to our potential customers.

Learning: *I learnt this very useful method in an accelerator. Make a thorough list of hinge-breaking assumptions for your market, product and competition. Hinge breaking assumptions are those that can make or break your company.*

Rank them according to probability of the assumption being wrong and subsequent risk to company. Start validating from the top while building as less as possible.

Mistake 3: We thought that we were smarter than everyone else

I have seen this in dozens of entrepreneurs I met in the past year. I think it comes as a part of the entrepreneurial mindset; which makes cash-strapped entrepreneurs take on billion dollar companies and beat them at their game.

But it can also be a lethal trap; as it was in our case. We knew that companies like Belkin sold internet-connected switches at \$50. How can they be so stupid? Don't they understand that selling switches at a lower cost will give them better volumes? We will sell smarter switches at half the price. (Yeah, right!)

Nest's machine learning algorithm is not perfect. But ours will be. You get the idea.

Learning: *You will have to be smarter than your competitors to beat them. But you should be able to quantify why. You should have a logical answer to the famous YC question: "What do you understand about your business that other companies in it just don't get?"*

Answers like "Machine Learning" and "Better Design" usually don't make the cut. You have to understand that your established competitors have more resources and more hiring power (Andrew Ng works with Google!). To beat them, you should be doing something fundamentally different.

Mistake 4: The ROI for our product did not make sense

The incremental value that Lumos switches provided did not justify the cost that the target customer had to pay for it.

Learning: *The value-pain equation for your product should make sense for your target customer. Unless value>pain, your product will not sell.*

The product will not sell because it is cool; or because the market is projected to be worth \$19 trillion in the next 5 years. It will only sell if customers get significant value out of the product.

Mistake 5: We let sunk cost bias affect our decisions about pivoting

It was not that we were clueless about the problems in our product. We had doubts in our minds. In a startup, you almost always have doubts. But we had built so much. We were in love with our product. And we were not ready to ask the difficult questions.

Is it okay to be doubtful about your product? Is it okay to voice your doubts and bring the team morale down?

Or make your co-founders feel that you are not as committed to the idea and the vision as they are?

“It helps to be transparent about your doubts with co-founders in the long run.”

It would have saved us a couple of months and some money.

Learning: *It is absolutely necessary for founders to be committed to the vision of the company. However, there are multiple ways to achieve a vision. Don't fall in love with it one way. Accept the possibility that you might have to start things over from scratch.*

Build a culture of transparency in your company. Encourage dissent among co-founders and deal with it objectively.

Mistake 6: We were trying to do everything for everybody

We were making switches that could automate your lights, fans, ACs and water heaters. We would have tried to automate your TV, Fridge, Oven and Car as well had it been feasible to do so.

We were pitching power savings as well as luxury. This made the product and the pitch very complicated.

Learning: *As a startup, you are constrained by your resources. So it is always better to identify and solve one problem very well instead of solving n problems in a so-so way.*

Nest solved the heating problem. Dropcam and Canary solved the security problem. Try to be a drug for your customer instead of being a vitamin.

Mistake 7: We underestimated hardware

Building a successful startup is hard. Building a hardware startup is 10 times harder.

Pebble, with all its Kickstarter success, is still in troubled waters.

Building a prototype is the easiest part of building a hardware startup. The real challenge comes in product design, production engineering, manufacturing, distribution and marketing/sales. And you need to have friends in China.

Also, hardware product validation and iteration cycles are much longer than software ones. Getting funding is relatively difficult; VCs ask for traction (~\$1M on Kickstarter/Indiegogo, last I heard) because of the inherent risk in a hardware startup.

Managing cash flows is hard because you have to pay your vendors months before you get paid from your customers. ([source](#))

Considering all this, we were not the right team to build a hardware company.

Learning: *Understand what you are getting into if you are starting a hardware company and plan accordingly. Get experienced people on your team or get into a hardware accelerator like HAXLR8R.*

Today

Eventually, we ended up leaving hardware and IoT and decided to build something that solves a problem that we had experienced. Since Gandhinagar (where Lumos was located) does not have many startups, interacting and sharing experiences with other entrepreneurs was always a big problem for us. Also, we had to subscribe to a lot of blogs (crowded inbox) just to stay updated with top content on Entrepreneurship.

We decided to build FundaMine to solve this problem.

FundaMine is a community for professionals to discover what experts in their profession are reading and discussing. FundaMine has communities (mines) on Entrepreneurship, Product Management, Android Development and IoT. Do check it out and wish us luck!

The Challenges of Starting a Hardware Business

 spaces.fundingbox.com/spaces/fundingbox-spaces-startup-sme-lounge/5db1a5f952317832f8590488

0 Comments · 247 Views

At the beginning of July in Birmingham, United Kingdom, took place the TaaS (Transportation as a Service) Technology Conference aiming at highlighting and rewarding the most innovative and successful startups in the smart mobility field.

FundingBox was well represented with 8 accelerated startups (by the Impact Connected Car programme) taking part in the nominee list. Among them, can you guess how many were **doing hardware, that is to say manufactured tangible devices?**

1. Hardware is expensive

After dismantling it piece by piece, some German automotive engineers found out that a Tesla Model 3 would have production costs nearing \$28,000. Taking into account a selling price of \$35,000, there is not much margin left after also discounting marketing and other costs.

On the other hand, would you be able to guess how much it costs to build an MVP* mobile application?

Well, around \$10,000 says this article from Thinkmobiles . Not to mention that once it is built, commercialisation can easily be scaled (unlike a car, you don't need to rebuild an app if you want to sell it to your n+1 customer).

Manufacturing a product also involves in general higher fixed costs. Indeed, what is potentially more expensive: renting a 30 people office at WeWork or setting up and maintaining a 3,000-square metre factory?

Granted, these examples might seem extreme but in the long run, a continuous comparison would lead to the same assessment: hardware is intrinsically more expensive.

This means you need a *lot* of cash at the beginning. And according to CBS Insights, running out of cash is the number 2 reason why startups fail (29%).

2. Everything is much slower

Ordering pieces, building and rebuilding a prototype, shipping your product, etc. "*Patience is a virtue*" and it's even more the case when you dedicate yourself to hardware which involves inherent manufacturing delays.

As a consequence, Agility processes are much harder to implement. In comparison, think of a software programme for which you can release a new version every week and ask for immediate feedback to your customers.

On the contrary, when it comes to hardware, the moment you ship your car, you cannot change it anymore. And neither can you afford to send an “updated” one on a weekly basis to your clients.

This means that in addition to patience, perfectionism comes in handy too. It’s only if you make yours the two aforementioned qualities that you’ll slowly but surely start making profit.

3. Experience matters more

Have you heard of aircraft manufacturers other than Boeing and Airbus? Well, there are a few: Tupolev, founded in 1922, Bombardier, founded in 1942 and Embraer, founded in 1969. Boeing and Airbus were respectively founded in 1916 and 1970.

And that's it.

In brief, hardware manufacturing requires know-how, know-how requires experience and experience only accumulates itself with time and this is one of the reasons that explains why the aircraft industry still remains an extremely closed market.

Do note however that this list is not exhaustive. You'll have to keep on reading 5 kilometres of other options before you actually start running a real 5K with one of those apps.

Starting a hardware company is a challenging move to the extent that gathering all the tech manufacturing knowledge around you takes time and is sometimes just impossible due to talent scarcity.

Indeed, in 2018, Industry Week was quoting that the US will need to add 4.6 million manufacturing jobs in the next 10 years, 2.4 million of which may eventually be unfilled. And the same assessment can be made for Europe.

The Top 3 Challenges Between Launching & Scaling Your Hardware Startup

 3d-innovations.com/blog/hardware-startup-top-3-challenges-between-launching-and-scaling

October 12, 2016

Each stage of launching a hardware startup comes with its own set of challenges. While the challenges are unique for each business and each industry, below are the top three universal challenges we have seen arise time and again.

As you read through the two lists, you will notice a theme developing between the stages. During the launch phase, the challenges tend to focus on the startup founder and business acumen. As the hardware startup scales though, the challenges tend to focus more on the manufacturing side of the business. This is why the importance of finding the right manufacturing partner for your startup from the get-go cannot be stressed enough.

Challenges when **launching** a hardware startup:

- 1. Funding.** Whether you plan to bootstrap or seek outside assistance, funding is typically the main hurdle. Unlike software development, hardware development requires a large amount of capital for prototyping, testing, packaging, and tooling/mold for production manufacturing. The initial round of funding will usually suffice through the development and prototyping stages, but will likely require additional funding once the product is ready for production and distribution.
- 2. Lack of Knowledge.** Most startups do not have the internal resources and knowledge to plan and thoroughly develop each product development stage. This lack of resources means that necessary design, prototyping, testing, certification, and manufacturing requirements can get overlooked. Main challenges with the manufacturing process include, vendor management and supply chain resources. Both of which are critical to developing a successful startup. In order to combat these challenges, connecting with outside product development firms/resources and experts will not only help accelerate product development but also ensure that these challenges will be manageable and not the downfall of your startup.
- 3. Identifying Opportunities.** Identifying market opportunities and developing go-to market strategies is another common pitfall. While hardware startup founders are intensely focused on product development, creating a sound business strategy can fall to the wayside. Connecting with distributors and existing sales channels early in the product development process should be happening while the product is still in development. Building these partnerships takes time and the earlier you start, the better.

Challenges when **scaling** a hardware startup:

- 1. Manufacturing & Inventory Management.** Scaling up manufacturing requires a larger influx of capital as compared to the launching stage. However, this is a good problem to have since it means that the market has received your product well and demand is abundant. It will also mean that some level of product inventory is required, so having additional space and location for the product is not only necessary, but a vital part of your logistics plan.
- 2. Manufacturers Capabilities.** Depending on your manufacturer's capabilities, this can make or break scaling opportunities. Manufacturers may not have enough resources, machinery, and capabilities to meet your product's demand. If a manufacturer is not setup for high volume production, then the output required will not be able to keep up with the required amount needed to fulfill orders. Several well-known and successfully funded Kickstarter campaigns have run into this problem, causing headaches for the company and frustrated customers waiting for their products to be packaged and shipped.
- 3. Meeting Demand.** Meeting the demand of the market will be dependent upon the manufacturing capabilities. You need a manufacturing partner that will be able to deliver enough of your product on-time and on-budget. If your manufacturing partner cannot keep up with customer demands, your startup, brand and product will suffer —and this could spell doom for your business.

The Challenges of Hardware and IoT Startups

 startupblink.com/blog/the-challenges-of-hardware-and-iot-startups

By StartupBlink

January 18, 2019

You and your team have decided to build an unrivaled Hardware and IoT startup. The idea is great, and everyone on your team is passionate about it. Soon after your pitch, you get a local investor or an angel who is ready to open his wallet for your hardware startup needs. You build and test a prototype with the help of industry-leading engineering simulation software obtained through the [ANSYS Startup Program](#), and it works impeccably. So, you start mass production right away and your hardware and IoT startup becomes a phenomena of success.

Sounds just fine, right? Well, the reality is slightly more complicated, and every hardware and IoT startup builder encounters challenges like finding investors and taking charge of manufacturing and distribution. Since these issues are inevitable and prevalent in every hardware startup, it is important to take them into account and be prepared beforehand.

In this article we focus on the most common challenges.

Financial obstacles

Building a hardware and IoT startup is an expensive task, and the very first issue that engineers face is a lack of financial resources. Not only do hardware founders have to cover the expenses that a regular software startup would have, but they must also deal with extra costs for prototyping, inventory, manufacturing, and distribution. From the beginning, cold reality insists that builders have sufficient funds to nurture their startup; otherwise the development of the idea should be postponed. Lack of funds limit the ability to test the product and, consequently, can result in lower quality or even cessation of the project. Thus, it is necessary to dedicate more time raising enough investment at the initial stage and ensure that you have a decent sum in your back pocket that could serve in case of unpredicted expenditures (and there will always be some).

Building an initial prototype (MVP)

Getting a demo to show to potential investors and buyers is another major challenge. Hardware and IoT startups, unlike software startups, are building actual products, therefore an initial prototype is necessary to grasp potential investors' and buyers' attention. Thus, if in some cases, a software MVP costs \$1,000, an MVP for a hardware startup would start from \$5,000. For that, you have to prepare in advance since building an initial prototype is both time and money consuming, especially with the endless try-outs crucial for testing product operation in different conditions. As a way out of pricey

leveraging, specific companies, such as ANSYS, are offering virtual simulation solutions (you can read more about the benefits of virtual prototyping [here](#)) at a discounted cost to eligible startups and early stage companies through their [ANSYS Startup Program](#).

Investors

Since hardware startups require capital, investments are a great challenge. The majority of the investors, from angels to institutional investors, are rather reluctant when investing in hardware. One of the reasons is that hardware solutions are cash-intensive. They require constant financing for covering the cost of extra layers like prototyping, inventory, manufacturing, and distribution. Just like software solutions, investors would focus on the milestones achieved so far in the project. To demonstrate a product's potential, such crowdfunding platforms as [Kickstarter](#) or [Indiegogo](#) are a way to go; they allow startup owners to take the best of both worlds: observe the customer's needs and validate the product, while at the same time raising funds.

Manufacturing

When the challenge of a fully functioning prototype has been overcome, the manufacturing hurdle is next. When deciding where to manufacture your product, you have to deal with the cost, volume, intellectual property issues, and flexibility. Depending on the stage of your startup and the demand of your product, you can either stick to local manufacturers or look for partners at the national or international level. Keep in mind that neither under-demand, when you order more products than people buy, nor over-demand, when you order less products than people end up needing, is beneficial. At the moment of manufacturing, the success of your product is in the hands of the manufacturer. Thus, it is vital to choose a competent partner who meets deadlines. Do not go for the first to show, always talk to numerous candidates to choose the one who can meet high quality and scheduling expectations.

Inventory and distribution

Inventory storage and product distribution are challenging. When a product is manufactured, you have to think of where to store all the units and how to distribute them to the customers. Finding a warehouse in a specific location that would be suitable for storing your particular product and would not cost a fortune might be a headache, especially if you have not considered such a need at the beginning. Startups should always think beforehand on the storage of their products, as well as designing them in such a way that their assembly, shipping, and delivery is as easy as possible. The process of distribution development is tough to manage. Unlike software products that clients can receive within seconds, hardware's physical assets require transportation that can be high in cost and time-consuming. For that, you might want to check on numerous delivery companies and their terms and conditions before choosing the one to partner with.

Safety

For hardware and IoT startups, safety is crucial. Most hardware products are used in rule-sensitive sectors, like fintech, medtech, and healthtech, where safety is the highest priority. The moment a physical unit reaches the customer, it has to be flawless from the first round. Poor functioning products can negatively affect the reputation of the startup, and in the worst case scenario can cause physical damage to the user. Despite the fact that the end user is the one who truly matters, safety regulations should not be limited to the end product; safe manufacturing processes have to be kept in mind as well. Sometimes safety regulations and requirements can differ from country to country; thus, if you are planning to build a startup that will sell in international markets, it is always advisable to dedicate some time to scrutinizing specific regulations that the market you are targeting requires.

We have also discussed some of the biggest mistakes that hardware startups should avoid in our previous [article](#). Make sure to check it out and save your startup from making one.

After knowing the challenges that most hardware and IoT startups face, it might seem that the road to success for startups is quite off-putting and discouraging. Nevertheless, every coin has two sides; just like in hardware startups there are challenges; there are opportunities too. Wonder what are those? Stay tuned and read all about them in our blog in the future!

Preparing Your Hardware Startup to get Funded

 prgnpi.com/preparing-your-hardware-startup-to-get-funded

February 5, 2017

Are you a hardware startup seeking funding? If so, you will want to prepare your business to gain the edge with investors. Hardware technology entrepreneurs often come from the engineering and research areas, and may overlook core business elements such as a complete team, a minimum viable product, sizable market, and a profitable cost structure.

For a pulse on the current state of hardware funding, take a look at a recent TechCrunch article on [Who Invests in Hardware Startups 2016](#).

Join us for the next [SV Hardware Startup-to-Scale Meetup](#) on Tuesday, February 7, 2017 to hear from an expert panel of investors, finance, and a hardware startup.

Venture-Capital Tips for Hardware Startups

Investors ask a lot of questions – understand what is important before you present – you'll find that investors want more than a cool product and passionate founders. Lior Susan, partner with [Eclipse Ventures](#), a Silicon Valley VC focused on hardware startups, and keynote speaker at the [2015 PRG Hardware Symposium](#), described the 3 things he looks at when investing in hardware startups:

1. The team.
2. The product.
3. The market.

He looks at the people on the team, whether they've worked together before, and the breadth of their engineering, design and manufacturing experience. As to the product, the question is whether it makes sense and can be manufactured (feasibility). For market, the industry must exist, such that spending is taking place. Another note about product, Lior does not believe in hardware standalones. A good hardware product model includes software and data.

Alastair Trueger, Founding Partner of [Creative Ventures](#), an early stage hardware investor, recommends the following 5 Tips for Hardware Startups:

1. **Choose your team wisely.** Recruit excellent people that are aligned with your business and with your market. ie. consumer vs. industrial vs. medical.
2. **Understand underlying business economics.** Hardware products don't scale as fast as software. How big is the market? What are your margins? What will it take to get your product to scale? Will your business be of interest to investors?
3. **Have multiple paths for success.** Hardware commercialization is hard.
4. **Don't get stuck on valuation** when dealing with investors. The most important thing is the overall value that the investor will bring to your business.
5. **Focus.** Do one thing well.

To help enable your hardware business success, and make it more attractive to investors, think about incorporating the [Four Enablers: Making Hardware Less Hard](#) by [Tandem Capital](#), a Silicon Valley Seed investor.

The Finance Perspective

Ryan Keating, Managing Partner at [Keating Consulting Group](#), a Silicon Valley based financial and professional services firm, works with a startup preparing to seek funding, and suggests the following set of guidelines:

- Without exception, before getting funding, you have to be fundable. Focus on getting fundable. Funding will follow.
- Investors generally don't invest in good products alone; they invest in good businesses.
- Financial model and plan has to show a realistic path to profitability and scale.
- Financial model should reflect metrics that hardware investors hone in on. It shows you know your stuff.
- If you raise funding, your reporting and visibility requirements will become real.
- Investors need to feel comfortable with your financial discipline.
- Take this opportunity to impress and prepare for growth.
- Try to stay "diligence ready," within reason.
- Stay focused on real traction (product & growth) – don't get distracted by minutia.

Don't Underestimate Development

According to Michael Keer, CEO of the Product Realization Group, hardware startups are notorious for underestimating critical development areas, and recommends the following:

1. Set a realistic development budget supported by your business plan.
2. Define a Minimum Viable Product (MVP) and manageable scope of development.
Feature creep can blow your schedule and budget.
3. Plan design iterations and validation testing into your schedule – one is not enough, it may three or more, depending on product complexity.
4. Take regulatory requirements seriously – getting on the wrong side of regulatory agencies like the FDA can shut your business down (think Theranos).

As part of our [Product Roadmap](#), PRG assesses hardware startups, identifies gaps, works to overcome areas that may have been overlooked, and delivers critical expertise.

Advice from a Hardware Startup – Roost

As Roel Peeters, Founder and CEO of [Roost](#), described it at the [2015 PRG Hardware Symposium](#), the challenge to becoming a successful company is understanding the milestones you will achieve with the money you seek to raise and understanding how to mitigate risks to achieve milestones. At the Angel stage, Peeters used a Kickstarter campaign not to raise money, but more importantly to generate feedback and market validation of their product.

Before seeking series A venture funding, Roost engaged in a Product Roadmap to better understand Roost's operational and manufacturing risks, which helped to set the pricing and schedule for Kickstarter, and ultimately led them to bring on a VP of Operations before they sought their series A funding. Peeters described this as part of pro-actively knowing, understanding and mitigating his potential investor's risks.

When a start-up invests early in assessing risks before scaling a product to mass production, the cost to make any course correction is greatly reduced. PRG recommends organizations to invest early, test early, study feasibility early— identify and mitigate risks as early as possible.

The 5 reasons why hardware startups fail

 techinasia.com/talk/5-reasons-hardware-startups-fail

July 18, 2016

 Daniel Ellis · 18 Jul 2016

On July 7, 2016, Theranos CEO Elizabeth Holmes was barred from owning or running a laboratory for two years. Theranos also had its licence to operate its laboratory in California revoked.

This highly consequential decision by the US government regulator, hot on the heels of Forbes' downgrade of Theranos' valuation from \$9 billion to \$800 million and Ms Holmes' own net worth to zero, should come as no surprise. The company has been struggling to maintain its credibility since October 2015, when its practices and technology was first brought into question by the WSJ.

As Ms Holmes' problems mounted, she famously paraphrased Gandhi by saying, "First they think you're crazy, then they fight you, and then all of the sudden you change the world."

It seems not that long ago that Theranos was held up as the shining example of a hardware startup taking on a big, established industry. It's the latest in a series of high profile hardware startup failures that includes Coolest Cooler, Zano, Makerbot, Pirate 3D, Novelsys and Better Place. There are many others. Too many to mention in one article.

But why look into failures?

Surely there are many more success stories like Tesla, Xiaomi, and Raspberry Pi that one can rather strive to emulate?

Not so simple!

Reason being that when it comes to hardware startups, the challenges seems to be remarkably similar; for failed companies and successful ones alike. Not just that, it transcends geography and industries.

Unfortunately, mistakes tend to only reveal themselves after a startup fails, so those are the best places to look in order dissect, learn from them, and create future success.

"At some point, everything's gonna go South on you. You're going to say 'This is it... this is how I end.' Now, you can either accept that, or you can get to work. You solve one problem, and then you solve the next problem, and the next, and if you solve enough problems, you get to go home." – Mark Watney (as played by Matt Damon in the movie The Martian)

Not all failures are created equal

Prof. Amy C. Edmondson from Harvard Business School [wrote an article in 2011](#) that asserts not all failures are equal. She splits them up into three categories:

- Preventable failures in predictable operations
- Unavoidable failures in complex systems
- Intelligent failures at the frontier (or rather... happy accidents)

In this series, I'll be looking more deeply at five overarching, preventable failures, the lessons to learn from them and the skills needed to either avoid or recover from them.

Over the next few weeks I'll be working through detailed case studies and conduct interviews to help break down and analyse the biggest challenges hardware startups face and if circumstances makes them unavoidable, look at options how to overcome them.

Unlike most similar type articles, I'll delve deep into each topic to be as comprehensive and thorough as possible. Keep in mind that although this series focus on hardware startups, the business lessons to be learned is helpful for all founders.

Without further delay, here are the 5 reasons hardware startups fail, in no particular order.

1. Engineering/technical design issues

Here I'll show how technical issues, bad product decisions, over-promising and too many changes can delay or derail a project completely.

I'll also look at the type of testing you should be doing at each project phase.

2. Superiority bias

The traits of the typical entrepreneur can, in many cases, be seen as overconfidence, arrogance, naivety or unemployability. These traits can be either a boon or a bane for the project and the company as a whole.

We'll show how to recognize and manage said traits to further increase chances of success.

3. Timing problems

Not the dark magic many people think it is. I'll provide you with the checklist to be more sure whether the timing for your concept is right or not.

I'll also use case studies to illustrate where timing has made a deciding difference in the success of a product.

4. Poor execution

Execution can refer to Operations and Decision making or Internal Admin and Regulation. I'll discuss both separately.

I'll discuss the commercialization process in detail and point out the various pitfalls along the way. The administrative process, often seen like a necessary evil when it fact, it being a structure that supports your project and company, is a strong indicator of future business success.

5. Insufficient funding

The one we obsess most about and so very often get horribly wrong.

I'll discuss the various options of funding available to hardware startups and elaborate on ones that spare you from giving away too much equity to make your dreams come true. I'll also show you how to prepare a budget for a hardware project and work through a sample product.

There are many other reasons startups fail, but speaking from my own experience and research, these are the ones that present the highest risk that are at the same time, manageable. While I do not claim to be an expert in each of these issues, I will take the necessary effort to include data, case studies and expert opinions.

Please join in the discussion and share your own experiences. Let us all learn from each other.

This article is the first of '[The Hardware Series](#)', where the author covers in detail why hardware startups fail.

Editing by Sim Yanting

Community Writer

[Daniel Ellis](#)

Daniel J Ellis is firstly, trained in financial management and accounting, and secondly, a tech geek who loves playing with the latest technologies and electronics boards.



Avoiding startup failure

 sentineldubai.com/blog/2021/8/29/avoiding-startup-failure

August 29, 2021

The United Arab Emirates has increasingly grown into the premier destination for doing business in the Middle East with an excellent drive for entrepreneurial growth and innovation. A recent report reveals that around 50% of registered businesses in Dubai are early-stage startups which contribute 47% of the UAE's annual GDP. However, an aspiring business owner should not easily dismiss the risks of launching a startup. While a good number of startups fail, this does not have to be the case. It is essential to take note of why startups struggle and create plans to mitigate this risk.

Market Problems or Lack of Market Demand

The lack of market for a product or service is one of the top reasons startups fail. Before launching a business in Dubai, it is important to research the marketability of the startup's idea. This provides a realistic perspective of whether the market can foster growth and success. One method is to conduct thorough market research to determine the viability of the business idea. A startup's target market can offer critical firsthand information about the value of the product.

Running Out of Money

Adequate startup funding is especially critical during the efficiency stage when sales are still picking up. Still, many startups soon lack the funds to scale their business in sales and marketing activities. A business owner must create a scalable business model while wisely allocating funds to essential activities. In addition, the business owner needs to manage expenditure by outsourcing non-strategic aspects. Hiring external parties to handle time-consuming tasks such as bookkeeping, customer service, and digital marketing will allow them to focus on core activities that will lay the foundation for the business to succeed in the long term.

Poor Team Management

A startup's vision will not be effectively executed when there is a poor working relationship from top management to employees. Furthermore, the culture of the organization and the skillset each person brings must work in harmony to promote the business. It is important to hire the right team to match the core values, skills, and attitudes that will enable the company to succeed. Leadership should offer proper training and create a culture that makes the team feel valued.

Product or Service Problems

The consumer market in Dubai is forecasted to grow by \$58 billion in retail sales by the end of 2021, but sometimes a startup comes up with a good product that fails to gain ground. It may be that the product is poorly executed, does not address the market's pain points, or has a poor pricing model, and this will reflect in the sales and profitability. It is natural to undergo continuous revisions, testing, and evaluations to offer a product or service that fits in the market. Consistently reviewing the company's service or product offering will strengthen the marketability and potential for success.

Strong Competition

19% of startups fail because they ignore the competition. This can occur if the product or service has an existing and growing niche market. Smart business owners go beyond the product's design, packaging, and pricing to determine the Unique Selling Point or Unique Value Proposition. This focuses on how unique the product or service is from other competitors in terms of the positioning, the problem it solves, and why it is the best option in the market. It also shapes the marketing and branding focus of the startup.

Running a startup comes with risks and uncertainties, but it is feasible to grow into a successful brand with the right plan in place. It requires effective management of operations as well as investing time, effort, and resources to sustain the growth. It is also essential to have the right team to keep track of market changes and competition. To learn more about startup licensing and more business setup support in Dubai, contact our team at Sentinel Business Centres.

Fatal flaws: Here's why UAE SMEs fail

 gulfnews.com/business/fatal-flaws-heres-why-uae-smes-fail-1.1549868052509

Noni Edwards | Special to REACH BY GN

A lack of working capital and unrealistic revenue projections are some of the reasons SMEs fail in the UAE
Image Credit: Supplied

If you've done your homework and launched your start-up to be fully-aligned to market conditions, then hopefully you'll never need to consider it, but failure is a real risk for many entrepreneurs so it pays to be aware of worst-case scenarios.

We spoke to two experts in about why businesses in the UAE might fail to thrive.

Khaled Talhouni is managing partner of Wamda Capital, an entrepreneurship accelerator in the tech sphere. "Very commonly companies fail because of external factors that are not necessarily addressable internally."

When we asked Pratik Rawal, Head of Business Development at Creative Zone about why businesses fail he said, "That's a very grim question, albeit an important one. Our nine years in this business, have shown us a few common denominators that have put small businesses out of business."

Here are just a few reasons SMEs fail:

Capital

Talhouni says the ability to raise capital is crucial, given how thin capital markets are for early stage companies in our region.

Rawal believes there are two aspects of capital to watch out for: not having enough, and not spending it wisely.

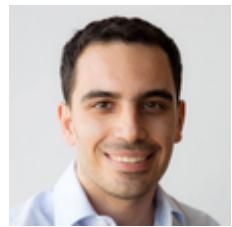
READ MORE AT IDEAS RUNWAY

- [How to successfully launch a business in the UAE](#)
- [How to deliver a pitch investors can't turn down](#)
- [Nurturing talent for success](#)

"There have been many startups with modest capital that have done well, and many with a sizeable capital gone kaput. The key is to maximise on the available resources and shed keeping up appearances," says Rawal.

Teamwork

The calibre of skills, experience and cohesion among founding team members is essential for start-ups, according to Talhouni.



Very commonly companies fail because of external factors that are not necessarily addressable internally.

- Khaled Talhouni, managing partner at Wamda Capital

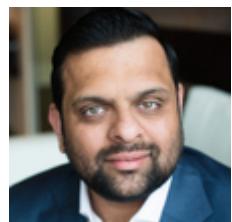
“I think that one key factor to consider is that it is absolutely critical for early stage companies to be helmed by a founding team able to address challenges in market realities and adapting or pivoting the business to address the challenges,” he says.

“Most early stage companies will have to re-invent themselves in a process of continuous evolution before they reach a stable path to growth and sustainability.”

Research

Market research needs to built into your model right from the outset, according to Rawal. “When starting out, all you have is an idea and lots of time: use it.”

“Build on your idea, do research, study your competitor, market analysis, rope in a financial expert and work on those numbers,” he says.



If you are doing great in initial phase do not rush into expansion without careful evaluation, it can be tempting but you will certainly get there more effectively if you plan well

- Pratik Rawal, Head of Business Development at Creative Zone

“Whether you are in trading or manufacturing, or a service provider or consultancy, ensure you know exactly how much capital and time will it take for your entire operation to function until the business is able to sustain on its own, that includes costs involving company set up, legal framework, permits, infrastructure and staffing. A feasibility study will help you get to a ballpark figure,” says Rawal.

Product

Most entrepreneurs will feel like they are fully focused on their product and their market, but getting the two perfectly aligned is one of the trickiest parts to starting a business.

At Wamda, Talhouni sees the lack of product-market fit as a common reason that tech start-ups fail, when the company pursues a solution to a problem that is not particularly pressing or critical enough for users to adopt the company's offering.

Rawal agrees: "Know your niche and build your brand around it and most of all, believe in your idea because if you don't, no one else will."

Timing

Being impatient and too hasty to expand is a main driver for failure, according to Rawal.

"If you are doing great in initial phase do not rush into expansion without careful evaluation, it can be tempting but you will certainly get there more effectively if you plan well," he says.

Equally, getting stuck in a rut and being unable to pursue business expansion when needed can hamper growth too.

"Difficulties in accessing new markets and expanding, in particular being able to scale into new geographies or territories across the region," says Talhouni.

Learn more at [Ideas Runway](#)

Why 97% of Hardware Startups Fail and 5 Success Stories – ROYBI Robot, UVEye, and More!

 titoma.com/blog/hardware-success-stories

Electronics development and manufacturing is no easy task, certainly not impossible to do, but it presents many challenges.

As mentioned in FORBES, 97% of seed funded hardware startups fail.

You may be wondering why this is?

For startups that make it to the market, the leading cause of failure is a lack of market need.

For new hardware devices, there's just so much to consider.

Nonrecurring engineering costs can vary considerably depending on the electronic device you're looking to manufacture.

It can go from some US\$ 150,000 to US\$ 1,000,000

Prototyping is a lengthy process on its own. It will undoubtedly require many iterations, going from POC through mock-up prototypes and culminating in an MVP.

A proper selection of components is vital for the long-term survival of new electronics that make it to the market.

Components determine 60% of the cost your product will incur over its lifetime.

Oh, and selecting the right components is not enough; you have to learn to navigate through crazy long components lead times of up to 32 weeks.

No wonder some people say, why would anyone even go into electronics manufacturing?

These are just the technical reasons people also fail due to personal reasons as well, that have more to do with personality and the way in which they work.

The main pinpointed reasons are

1. Lack of a focus in the right directions Or to much focus in two many directions

Sometimes people can get excited and find themselves pursuing too many things at once, which is natural considering the huge scope of options that will be given to you upon starting your startup.

However, even if all of these directions have their merits a business can easily fall apart when someone is trying to do too many things at once.

As normally pursuing too much can lead to everything being pursued not well made.

An equal problem can come about when pursuing a direction entirely, that may be the wrong one. So always do your research.

2. Overestimating there need for help

Sometimes people struggle to understand when to listen or when to seek help from people who are more knowledgeable in certain areas than they are.

No one person is perfect in everything and a wise person knows that seeking help does not mark an inadequacy but instead shows a deep intelligence.

3. A lack of passion

Sometimes people may decide to start a start-up due to the fact that they believe there's money in it, or that it will do well, or even because it makes the most sense.

However, problems can arise if that is the only reason and they don't have any real passion or interest in what they are creating.

A startup is a lot of work. Therefore the thing that at the end of the day may be the difference between success and failure is what is driving you.

When its passion and love for the product, that may be the very thing to keep you going when the going gets tough.

4. management

One example would be when people start startups with their friends, friendship when put to business can become very difficult, you may find that you have differing ideas, different ways in which you want to do things which can result in issues where your employees are given ambiguous direction.

Another example is a person with a really great idea for a startup but with no knowledge of how to manage people.

It's really important to have strong management when starting a business because there is such a thing as the trickle-down effect, if it's chaotic from the top, it will be very hard to grow your business as well as keep it structured.

5. Lack of knowledge of all the areas of business.

Sometimes the person trying to start a startup may not know about the financial aspect or marketing etc.. if that is the case, make sure you have people on your team that do, because without full control of these aspects it's going to be hard to get your business afloat

I hope instead of this article freaking you out you are instead more aware of what your in for and how to avoid some of the pitfalls that could make it difficult for you.

Now for some inspiration!

Well, if you do make it, rewards are worth it.

We reached out to successful entrepreneurs that went into the electronics business and made it.

We asked different questions to understand how their product ideas came to be, the most significant challenges they faced, and how they overcame it.

And finally, asked them for advice for those who are just starting in their electronics product development journey.

We'll be updating this article as more stories come in.

Roybi – Robot

- Company: Roybi Robot
- Interviewee: Elnaz Sarraf
- Electronic: Roybi– the world's first smart toy to teach languages and STEM skills.

How did you come up with this product idea?

I noticed that our education system needs a fundamental change, and through talking to experts, I learned that change starts with early childhood education.

Every child has his/her own unique set of skills, and our focus needs to be on their individual capabilities and, thus, the importance of individualized learning.

We saw a significant gap in this area and decided to use technology and artificial intelligence to bring about change to help children, parents, and teachers.

We developed Roybi Robot to interact with children as young as 3-years-old because early childhood is the most critical age in a child's growth and future success. We're always engaged in thinking about the benefits of robotics and AI in early childhood education.

What was the biggest challenge you encountered in the product development process?

I've experienced many challenges in growing the company, but I think the main challenge was creating a practical robot design.

We had to consider many aspects of the design, size, specialized compartments, weight, and appearance.

Because our product is designed for young children, we wanted to make sure it is lightweight, attractive looking, and safe.

Our customers might be young, but they are very intelligent.

We knew from the beginning that if our robot is not designed for them, our goal and product will not be impactful and effective in what it wants to achieve: quality and individualized learning.

How did you overcome it?

We worked together as a team. Our team is very diverse.

Each team member has a different set of skills and comes from diverse backgrounds that give us an advantage because we could create many more options and put them to the test to make sure we finally have the right version.

What advice would you give to someone starting in hardware manufacturing?

Continuously test and make sure you go through all the Product Development Steps without eliminating any steps.

Start with a small number of prototypes, test those, build another 50–100 units for testing, and then do a pilot run about 250 units to see the results.

When you have your product, don't just test it in your environment.

Try to find friends, family, beta testers in different locations and settings so that you can further test your technology under different scenarios.

You'd be surprised how many issues you may find in each testing round.

When you are ready for mass production, always keep in mind that you must have some extra cash in case some parts need to get redone or if any unforeseeable circumstance arises.

Uveye – Vehicle Inspection Devices

- Company: [UVEye](#)
- Interviewee: [Ohad Hever](#)
- Electronic: Artemis – Tire Inspection

How did you come up with this product idea?

We already had a product scanning the undercarriage of a vehicle for security threats or mechanical issues and got several requests from clients to build a product based on Artificial Intelligence to inspect the tires for damage and tread depth issues.

Imagine leaving a car wash, driving next to a system, and being notified that your tires are too old and worn out, a dangerous hazard, without you even knowing.

What was the biggest challenge you encountered in the product development process?

When creating hardware in the automotive industry, it needs to be robust and operate even in the harshest weather conditions.

We have built Artemis to work inside or outside, rain or shine, and still, deliver high-resolution images of the tires that can be analyzed by our AI software and deliver great insights.

We have been working on Artemis for over 2 years and have upgraded it several times.

Each time tailored to assist in another use case including car manufacturers, bus fleets, delivery fleets, car dealerships, auctions, and logistical companies.

How did you overcome it?

We installed the right mechanisms, sensors, and materials to keep the system fully operational with all of our use cases and clients no matter what the weather, temperature or environmental conditions are.

Artemis – Tire Inspection

What advice would you give to someone starting in hardware manufacturing?

Do not assume you know what your client needs.

Try to be in touch with the field and adjust your efforts according to your use cases.

Your clients will know best which specifications they need and how the hardware is going to be mounted.

In our case, our Artemis device can be installed in a drive-through entry lane to a dealership car park or at the bus parking lot. We needed to understand this and work accordingly.

Lithion Power – Providing Lithium Batteries for E-bikes and 3 wheelers

- Company: Lithion Power
- Interviewee: Chandrashekhar Bhide
- Electronic: Battery Management System – BMS-16 Cell

How did you come up with this product idea?

We started developing these devices because we did not find good quality ones in India. Most of these products were imported and were not configurable or even dependable.

It took us around 15 months to roll out the first commercial product, BMS for 16-cell.

The next few product variants (i.e., BMS for other cell configurations) were done relatively faster as we had figured out the basics in the first product.

What was the biggest challenge you encountered?

Our product development process was set back by a month because we got stuck in, at what the moment was, a very complex technical issue, and it took our team quite some time to figure it out.

The issue was a faulty LDO (Low Dropout Regulator)

How did you overcome it?

During the initial troubleshooting phase, there was no reason to suspect that the LDO could be faulty, as it was from a reputed source.

But when the problem persisted after multiple changes, we started eliminating probable causes one by one.

And that's when we understood that the LDO was faulty. It seems trivial in retrospect, but it wasted a lot of time & effort.

BMS – NQ16

What advice would you give to someone starting in hardware manufacturing?

We had to do multiple iterations of our products over several months & with different customer segments.

So, our advice to startups is – do rapid prototyping & test it out with a pilot customer (could be even for free, their early feedback will significantly help your future product versions)

SKUMA – Recreates Alkaline Mineral Water at Home

- Company: [Skuma](#)
- Interviewee: [CEO and Founder Alexandre Yunus Mahé](#)
- Electronic: Skuma Recreates Alkaline Mineral Water at Home

How did you come up with this product idea?

When I first moved to the UK following the completion of my degree in engineering, I was shocked to find a massive consumption in bottled water in a country where the tap water is of excellent quality.

I was set on a mission to understand the real reason behind this wasteful consumption and what pushes customers to purchase a free commodity.

After months of research, two reasons were apparent, taste, and more importantly, trust in bottled water.

I then decided to form a team with a couple of engineer friends who knew a thing or two about product development. We then managed to come up with the **concept for Sküma**. A device that transforms your **tap water into** water with the same mineral composition **as Evian**.

What was the biggest challenge you encountered?

At first, we managed to successfully secure a couple of grants from the UK government and the Canadian one, which allowed us to take our idea to the next level.

We also managed to get selected by the Design Council for their 2019 Spark hardware accelerator program.

But like most of us know, **building a hardware startup is much harder** than software-based startup (or SAAS), and money is vital.

We struggled for more than six months to raise additional funds, which slowed down our development tremendously.

How did you overcome it?

What might seem evident to most was not for us.

We were dedicating all our efforts to raising money. While we were continuing the device's development, 90% of our time was dedicated to contacting investors who would ultimately not follow-up.

About four months into the process, we decided to change our strategy and focus on bootstrapping our development with whatever we could gather as funds.

We bought a 3D printer for £200 and started to work on our visual prototype and transformed it into a fully functional prototype. This prototype allowed us to share our vision more clearly when approaching investors.

This clear approach led us to finally close our pre-seed round of funding for a pre-money valuation of more than **half a million pounds (£600,000)** from a Hong-Kong based water purification company.

What advice would you give to someone starting in hardware manufacturing?

Our experience with raising funds was an unpleasant one but one that we had to go through like any company.

The lesson to be learned is not to focus your time on raising money but instead build the product.

Unless your goal is an exit in the next X years and raising money will directly help you.

Develop your hardware because that is what you are ultimately selling. **Everything can be bootstrapped and even if the result is not the best or even close to being satisfactory, continue improving until it is enough to get you to the next step.**

Tanvas – Tactile Experience with Multi – Touch + Haptics

- Company: [Tanvas](#)
- Interviewee: [Joe Mullenbach – Senior Mechanical Engineer / Product Manager at Tanvas, Inc.](#)
- Electronic: The first surface haptic touchscreen for digital signage and conference rooms.

How did you come up with this product idea?

We wanted to produce a touchscreen and display module that would fit into a kiosk product for digital advertising experiences.

Tanvas produces a haptic touch sensor. There were many non-haptic touchscreen modules on the market, so it was essential to find a contract manufacturer that made a similar product to what we were trying to build.

We met Mimo Monitors at an industry trade show. The company not only had an existing product that exactly fit the specifications we wanted, but they also had another desktop monitor product – the Mimo Vue – that would make a good development kit for us.

The partner fit was there from the beginning, and their team was excited by our technology.

Instead of hiring Mimo Monitors as a contract manufacturer, we worked out a licensing agreement for TanvasTouch technology, and they became a customer.

How many prototypes did you have to do?

When we started with Mimo, we already had the [first round of touchscreen prototypes produced.](#)

From there, we had two additional formal rounds of hardware prototypes before production. It's hard to count individually since parts get modified, replaced, broken apart, and reassembled during development.

But including those that we made to test for consistency and reliability, we produced around 75 individual pieces of hardware for prototypes, with countless [firmware and software variations.](#)

What was the biggest challenge throughout the product development process?

Having Mimo as a partner allowed us to focus on our unique value-add of designing revolutionary haptic touchscreens, while they handled all of the non-touchscreen manufacturing and supply chain challenges.

These challenges are not trivial for a startup, especially in a technical and price-sensitive industry like electronics.

We also avoided much non-touchscreen product development work, tooling expense, and inventory expense using the majority of the parts directly from the Mimo Vue.

We fitted exactly into the footprint of an existing product, though, and this did present some integration challenges around the physical layout, connectors, and power.

Ultimately, however, our touchscreen and controller board dropped directly into the Mimo Vue to become the Mimo Vue with TanvasTouch.

The big challenge that we faced in development was around the ability to iterate on touch panel design.

There is a high upfront tooling cost to make a glass touch panel, with very long lead times.

We had to decide on the touch panel design early on in the process and then wait. Once we got it back and tested it, we learned more about how we could optimize it.

Because changing it wasn't an option, however, we had to invest more effort in other areas like firmware design, and specific improvements had to wait for the next product altogether.

The slowest, hardest to change thing ends up being the bottleneck that drives your development's pace and limits the improvements you can make.

What is one advice you would give to hardware startups?

1. Identify where your most significant value-add is as a technology or as a product and make sure that your engineers are spending most of their time there.
2. Identify your design bottleneck, and solve those problems first. Figure out how to make it easier and faster to iterate on your bottleneck through sample runs, simulation, or by pursuing parallel design paths.

As you can see through these stories, although the products vastly differ from each other, the people interviewed seem to share similar sets of rules and ideas around their process so that they have been able to maintain the original goal and purpose of the product from the beginning to the end.

I hope these insights give you the inspiration and the knowledge to start to your own journey.

5 forces to overcome as a hardware startup

3D develop3d.com/product-design/5-forces-to-overcome-as-a-hardware-startup

August 20, 2021

To gain some further advice for a hardware startup looking to expand this year, we spoke with Alan Clayton, a business coach and mentor who works with the likes of go to market strategy experts Bridgehead Agency and its strategic partner HAX.

Clayton focuses much of his time on helping grow hardware distribution and sales networks globally, having assisted over 250 hardware startups, helping many great products launch successfully around the world.

Here are Clayton's five major forces at play that hardware startup founders have to overcome, and the lessons to learn from each.

1 Clock

Everything takes longer than you think, and despite knowing this intellectually, founders continue to underestimate how long it takes to bring a 'looks like' and 'works like' bench project to factory scale production – likely not even in the same country you cooked the project in the first place.

HAX was set up in Shenzhen, China to solve this problem. HAX is a US/EU based investor, but much of the hardware you have around you still comes from China. Try ordering a random electronic component online and see what happens; shipping delays, wrong part arrives, customer service doesn't exist, money transfers fail, returning the part wastes more time, and intermediaries you didn't know about get involved.

HAX makes it possible to work literally in the doorstep of the world's biggest electronics market, and round the corner from the tool makers, prototyping shops, and other suppliers you need. Why do you think Elon Musk likes to have car battery makers near his car plants?

LESSON: Allow more time for everything

Advertisement

2 Competition

Hardware startup founders also have a narrow view of who their competitors actually are. At the highest level, none of us have "spare" cash to spend on gadgets of any kind, especially new ones from companies we've never heard of. So there is *always* competition.

When teams claim, 'Nobody is making one like this' I have to take them to one side and explain – the car was a competitor to the horse!

Even today, car makers don't compete just with other cars, or even other electric cars, but with all alternative forms of transport that take the customer from A to B.

The same applies to any hardware startup. If, for example, you are building an automatic cocktail maker, like Bartesian, which we have at HAX, although there is no such machine on the market, it is clear that customers have many ways to satisfy their craving for a refreshing cocktail, many of which cost less, and are more convenient.

So the last point on competition is that your 'new' product must be at least 50 per cent 'better' than the competition just to turn the customer's head. Nobody is dying from lack of automatic cocktail makers, nor most other hardware products you might be thinking to build.

LESSON: Broaden your view of the competition

3 People

The third major (sadly often a negative) force at work, and arguably the most influential over time, is the people you work with. Breakdowns in how the team works together contributes to over 60 per cent of startup failures. And it's not just your immediate co-founders that count, but suppliers, investors, partners, advisors and others.

"It takes a village" as they say, and whilst the original startup team works well as a small family, managing and leading this expanding group of multi talented people is hard.

Based on the data from 1,000 startups I've worked with, startup founders tend to be smart (intellectually – engineers, scientists, software geniuses) and imaginative, which makes for a perfect start. They lack the essential people and organisational skills to keep everyone together, and on time and on budget.

Hiring a Head of Sales/Biz Dev and a Head of Operations are two major steps to building the diversity of thinking into the team, unless you are up to learning and deploying those skills yourself.

LESSON: Recruit a diverse team from day 1

4 Corporatism

Sadly, investors do not want to invest in that great hardware product you've invented, but rather in that great hardware COMPANY that you're building.

Founders often get hung up on a single product unit, such as a cheap, well designed, accurate breathalyser. But the question you get asked is, 'What are you going to do next' when that sells out, when the bigger and better financed competitors copy your idea, or when technology moves on again?

Founders often don't plan far enough ahead. So if the breathalyser is just the beginning of a broader healthcare or safety company, that would be much more attractive.

LESSON: Build a company not just a product

5 Communication

It turns out you can build a truly unique product, that makes perfect sense (financially) in the marketplace, and can be scaled reliably over several years, and still fail. Why? Because nobody cares about it.

Hardware startup founders are not usually gifted storytellers or marketers, and struggle to communicate the story of their product to the outside world. And even though investors are paid to be dispassionate and analytical in their work, and even customers in theory, it turns out we're all human and driven by emotion over intellect.

So hardware products need to be designed, built and presented in a way that gets people emotionally engaged – excited, caring, empathetic to the cause etc. The force of great communication is hard to argue with, but one which hardware founders usually need help with.

Think about how many pointless hardware products you know (or even own!) that made fortunes for their owners simply because the communications campaign created so much FOMO that sales went ballistic for five minutes, and that was enough to declare a success.

Nine hard steps towards success in a hardware startup

 encata.net/blog/nine-hard-steps-towards-success-in-a-hardware-startup

Nine hard steps towards success in a hardware startup.

In this article we discuss the Technology risks, Team risks and Market risks any hardware startup faces.



In recent years, I've seen hundreds of scientists and researchers willing to commercialize their lab invention. Engineers and scientists, having worked for one or two decades on their laboratory technology often dream about their research to be brought further in the form of a device, industrial technology or a product. At the same time, nearly all of these innovators had one thing in common – a lack of understanding of how to bring their development to the market.

To cut the further story short, the success of a hi-tech startup in bringing the product to the market depends on several factors: it is a working technology, appropriately allocated investment, great team (yes, an investor is a part of the team), prominent entrepreneurship skill of the founder / CEO and a great leader who can push the project through different hardships. But where can a scientist or an engineer find these ingredients of success?

Risks, chances of success and investment

Any technology startup, starting with just an idea or a laboratory technology, has a number of risks:

- Technology risks – will the engineers be able to implement the laboratory technology in batch production? Note that the idea itself may require considerable effort and investment to demonstrate the worthiness.
- Team risks – the presence of an entrepreneur in the team. Ability to work together and ability to play down ambitions and focus on the project delivery. It is also crucial to have an engineer in a founding team as a CTO / product owner.
- Market risks – will the product be able to get into an open market window? Is there a market demand for the product?

Statistics say that more than 90% of startups fail at the earliest stages. According to the world-famous accelerator Y Combinator, only 0.4% of startups become successful. Do you remember the much-discussed failures of hardware startups Juicero, Pearl and Hello in 2017? And these are just the failed hardware startups featured in media. Most of others died quietly and never grew into a large company or business with a positive cash flow.

From investor's point of view, high risks of the project failure mean high-interest rate. So, venture capitalists expect to receive at least a 35% return on investment per annum (doubling the invested amount every 3 years after the project exit), because the likelihood

of the startup's death is extremely high. Thus, most of the investors are indeed quietly hoping to invest in "the next unicorn". However, there is one paradox here: the investor's money can't buy a great team or motivation.

Dream-team

Have you ever heard about a scientist combining entrepreneurial, management and engineering skills? Hardly ever. So the team should comprise professional design engineers, electronics engineers, software programmers, manufacturing and production engineers and marketing/PR specialist. In my opinion, having a neat management execution is absolutely crucial as most of the challenges the startup will face will not be easy. There are numerous examples of "combo-personalities" – such as a talented scientist who can manage and supervise further business development as a CEO.

As the startup develops, the importance of technology owners, engineers, manufacturers and market specialists shifts. During the R&D stage the role of the scientists and engineering team rises high, as technology developing and building hardware is critically important here. R&D management is another tricky thing – development never goes predictably smoothly and there is a great number of compromises to be made.

When the product is developed, it's time for a marketing and sales specialist to rise and shine. There is nothing more important than first sales for any startup. A talented entrepreneur (and a manager) is this "glue" that sticks together the mosaic of the project and the team.

Technology readiness

Technology is the foundation of a startup. New products are emerging on the basis of technologies, allowing the startup to create value for consumers and get a considerable added value and pay off the money invested. Not every startup can offer a breakthrough invention. Historically, new technologies tend to emerge either in centers of excellence created in the past 100 years by a willful decision of the state for military advancement (Silicon Valley in California, Houston, Minsk, Novosibirsk, the LAVI project in Israel), or within the universities and large corporations (MIT, MFTI, Bell labs, Samsung, IBM, Xerox, Toyota, Dupont and others). The main asset of these centers of excellence is smart people who create future technologies in the labs. Sometimes, these technologies, having found no application in the military or in corporations, emerge as startups in public life.

In my experience, some of the scientists and investors lack the understanding that their idea or even technology has a very-very long way to mass application and investment. In reality, in order to bring your technology to the market, you have to pass nine circles of hell, in other words – the stages of technology development. When assessing the stage of high-tech projects, we employ actively the methodology of technology readiness levels (TRL) developed by NASA. It's hardly possible to get from an idea and laboratory prototype to the batch production of your product without a pretty sum on your bank account.

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Investments into development

No one is ready to invest in just an idea. Virtually none of the professional investors are ready to invest in a project that has not reached TRL-4, a prototype “mockup” or PoC (proof of concept). At this stage of development, the project / technology will be of interest only to desperate business angels with industry expertise or state development institutions that are committed to support research and development.

I often have to see the mistakes of business angels and venture funds investing in a “ready-made prototype” (which actually is TRL 3-5). These funds, having no technical insight and expertise in technology evaluation, invest in too raw technologies that are at much lower stages of TRL than the startup declares. It all turns to be a waste of money, time and nerves for the venture capital funds. The majority of angels, having gained the experience of investing “in ready-made prototypes,” keep saying it was the last time they invested into a hardware startup.

We believe that the development of a proof of concept (PoC), demonstrating the working capacity of the technology, should take place in the research institute or in the garage and hackerspace, using startups’ or a scientist’s own resources. Technology development may take years. The components will cost several hundred dollars. For example, Jobs and Wozniak put together a keyboard and a TV set and, thus, developed their first PoC in the garage, having shown the prototype of the first Macintosh (and, by the way, the sales of the Macintosh started only in 5 years).

TRL levels fit perfectly the investment rounds: pre-seed (development stage) and seed (batch production and market entry). Actually, pre-seed investments are needed to bring the technology to pre-production prototype. Our experience suggests that the necessary investments in developing industrial prototyping (TRL-5-8) of a hardware product can amount to 50k to 500k. Rare investors take the risks associated with the product technology. I want to stress this once again: venture and seed funds do not know how to assess such risks, because they are not engineers themselves. Risks, associated with the technology, are extremely difficult to identify without going into development. Therefore, at this stage, it is very difficult to raise investments from venture funds. But don’t be discouraged – the closer your prototype is to TRL8, the higher are the chances of receiving the investment.

Market risks

Professional funds (Sequoia Capital, Baseline Ventures, Lowercase Capital and others) will review a project only at the seed stage when there's already a prototype ready for pilot batch production. But these funds are even more eager to invest when the money is needed for commercialization and market entry, i.e. marketing and sales launch. Closer to TRL 9, a project will require \$ 2-10 million of investments for batch production, logistics, working capital and marketing. At the same time, you should understand that there are still no sales, and it is necessary to prove the demand for the product by sales. At this stage you will need a proactive manager (if you aren't this guy yourself), a talented market specialist and sales guru. The proceeds from the sale of the first product may be spent on hiring additional engineers to improve and optimize the product on the base of the first customers' feedback.

Long way to Fiji starts with the first step

Each of the steps, especially the first four levels of TRL, can take years of scientific research and laboratory experiments. Therefore, the result of any individual laboratory development, invention and technology is almost impossible to predict. But if we assume that there's a 50/50 chance that a startup gets to the next TRL, then we get a 0.39% probability that a startup will eventually reach TRL9 from just an idea, which corresponds to the statistics of 0.4% for the Y Combinator projects.

If you managed to demonstrate the efficiency of the technology by creating the simplest prototype "with a bluetack and scotch tape" (TRL-4), then you can easily start looking for cooperation options with successful technological accelerators (HAX, BOLT, Y Combinator, EnCata + HACKSPACE); partner with design studios and design engineering companies, which have experience in development and manufacturing, and bringing such projects to the market.

Partnership with accelerators, development catalysts and engineering companies increases your chances of success in the eyes of investors. Most accelerators engage in cooperation with the projects that have reached TRL4, and the participation of professionals in a project certainly increases the chances that a team or a specific development will succeed.

Top 5 Manufacturing Challenges For Hardware Startups

 kreatize.com/blog/cloudmanufacturing/5-challenges-hardware-startups

March 30, 2021

Hardware startups have a unique set of challenges they must overcome in order to find success. KREATIZE is a startup that was created in part to provide solutions to these distinctive problems. Allow us the opportunity to show you how!

Starting a business is always a challenge.

Starting a hardware business that requires manufacturing services perhaps even more so.

Why?

Manufacturing is a capital-intensive process that requires many factors and a sophisticated set of interdisciplinary teams to develop products. At its core, manufacturing is a technology-based industry that is constantly evolving as a result of improvements within its industrial processes. Therefore, a degree of agility is necessary in order to accurately meet the demands of the market. This flexibility is often naturally present in startups, but it can only be of value if they also possess some of the core elements of a mature manufacturing business.

Hardware startups have distinct challenges they must face on their journey to maturity. As a startup that helps these businesses, KREATIZE was created to transform the outdated and inefficient procurement processes of both small and large hardware businesses. We are also deeply familiar with some of the challenges faced by startups in this space. In fact, one of our main goals is to provide fellow startups with solutions to their specific problems as nascent businesses that require top-notch manufacturing services.

Here we would like to present you with the 5 main challenges hardware startups face, and how KREATIZE helps solve them.

1. Building The Right Supply Network:

Startups are naturally hyper-focused on their products. This product-centricity is actually one of their greatest strengths. Equally important, however, is developing the right network to have all the industrial components necessary to manufacture their products. This part of the equation takes a lot of time and resources to develop effectively though. This part of the process can chip away at their go-to-market timeline, and add expenses.

Startups usually lack the manpower to develop both their product and a superb supply network simultaneously. The due diligence, negotiations, and back-and-forth between potential suppliers and their business is an exhaustive process—one that shifts their focus from creating their products and revenue-generating activities.

How can KREATIZE help?

By working with KREATIZE a hardware startup will have immediate access to a network of audited suppliers and part manufacturers. This effectively liberates your company from request-for-quote (RFQ) processes, back-and-forth negotiations, and from having to develop the high-caliber supply network necessary to allow your business to operate effectively. We essentially allow startups to skip a painstaking part of the process, and provide them with better chances of success.

2. Product Quality:

Another aspect that is very much tied to the supply network challenges discussed before is quality. Smaller companies often lack the resources to quickly find stable and quality suppliers. They also may not have the time and team expertise necessary to ensure quality supplies. Even upon finding the right suppliers, startups may lack the production volume to fully obtain the best service from them. Companies with larger bulk orders tend to experience better customer service, get preference for key talent, and as a result, get better overall quality from suppliers. We've seen many startups grow frustrated, rightfully so, as a result of their quality expectations not being met.

How can KREATIZE help?

By working with KREATIZE you will have access to our very own quality center. We are in close contact with each supplier, and work to ensure that your parts are being made the right way by our partners, thereby providing you with a high degree of quality assurance. At KREATIZE, we also bundle multiple orders from our clients and place them with our top-notch contract manufacturers. This has an obvious beneficial effect on lowering the price, but it also has a positive effect on quality. By bundling our orders, we get better customer service and access to our supplier's key talent pools so we can ensure a better quality product. This allows us to provide startups with a way to get the same quality service as larger established players, from the very start of their development process.

3. Skilled Labor:

The manufacturing industry as a whole is struggling to recruit and maintain skilled laborers. Startups may feel this reality even more acutely, as established players often have more resources to attract the best candidates. The sheer fact that there is a skills gap across the industry also means that startups may have to work with less permanent or freelance talent, which can create additional operational complications.

How can KREATIZE help?

With KREATIZE you will be able to cut down your staffing needs and operate with a leaner team. For starters, your procurement needs will be almost entirely digitized and require less staff to operate effectively. You will also invest and build less manufacturing

infrastructure that requires lots of manpower—you will find the suppliers you need with our proprietary cloud software. As stated before, by bundling, KREATIZE also gets better professionals from our top suppliers to work on your orders. The KREATIZE team acts as your partner throughout all of this. We will even help you review your component drawings to ensure you have the best product possible. Your engineers will get access to data from our cloud solution, allowing them to optimize their designs in real-time during the production process. KREATIZE provides your teams with insights and an agile platform for product innovation.

4. Systems Know-How:

Hardware startups usually have a high IQ in terms of product development and innovation. However, when it comes to actually setting up a system that can deliver their product within a proper time frame, they stumble. This is often because they lack experience in setting up high-volume manufacturing operations. The journey from initial vision to final product is a challenge for anyone, and startups may require more time or a more experienced partner to show them the ropes.

How can KREATIZE help?

At KREATIZE we love working with hardware startups and have found that we can be the most helpful when we get involved from the beginning of a project. This way we can help them build supply capacity early on and address any problematic features within their initial component drawings. The latter is important because it allows us to assess any issues early on, so we can recommend a material or part that may be more effective, and even less costly to make. These are insights that will allow your startup to scale more effectively.

5. Scaling:

Speaking of scaling, in order for a startup to find success, it must bring itself to a position where it can foster and support the growth of its business. This means having the capacity to grow without major impediments, and the ability to gain greater market share and introduce new products to the market without major disruptions in business operations. This is the ultimate challenge for any startup and can only be attained after successfully tackling all of the previously stated challenges.

How can KREATIZE help?

In order to achieve growth at scale, a startup needs the right staff, systems, technology, supply chain, and partners. KREATIZE is a one-stop solution to help hardware startups address all of these factors. We provide everything you need to build a quality supply chain, access highly skilled labor, and manage procurement. Plus we offer a team of

experts that is ready to give you valuable, real-time input as you design the components for your products. With all of this, we are offering you the agility necessary to scale your business and continuously improve your product, without fear of disturbing your existing business processes.

Are you a hardware startup that is looking to tackle these challenges? Do you have a problem in product development that needs immediate solutions?

Our mission at KREATIZE is to provide manufacturing that the world loves. This means helping your startup create innovative products, providing your engineers with the necessary tools to develop great products, and helping you to deliver your products to the world easily. With our proprietary and patented software, **KREATIZE uses the power of cloud manufacturing to give you access to the very best industrial facilities through our expansive network of first-class suppliers.**

Start now with your free account by making an appointment with one of our cloud manufacturing specialists today, and allow your business to enter the future of manufacturing. Or by creating your account for KREATIZE Manufacturing Services today, and allow your hardware business to make a leap into the future of manufacturing..

Are you a large hardware business in need of solutions to your challenges? Please read our article for large hardware businesses to see how we can help you as well.

The Challenges Faced by Hardware Startups

 medium.com/globalluxsoft/the-challenges-faced-by-hardware-startups-f4f7b9b81458

June 26, 2018

Software startups are not a novelty anymore; they have become ingrained in our lives. Burgeoning entrepreneurs have access to tons of useful information and strong support, which are available from numerous sources. If we speak about hardware startups, the situation is a bit different. This direction of technological development is becoming more and more promising one, opening wide horizons for ardent innovators. However, it is not a primrose path for the latter; the guys who decide to devote their time to a hardware product need to make their way through many challenges.

This type of business differs from other startups, and it requires the consideration of its peculiarities. If you've never brought the hardware product to the market but you are willing to do this, you will find some useful information below. Who knows, maybe it will save you from making a crucial mistake.

1) The Costs Challenge

The first fundamental challenge that lays wait for a startupper is the financial aspect; in most cases, hardware startups require more funding than software ones.

Cold reality requires you to have enough funds to nurture your startup; otherwise, you should postpone your plans. The costs for yet habitual, but still expensive, software development are gradually lowering. Hardware development still costs a pretty penny.

For instance, there is a possibility of underestimating the development costs. The process can always take a sudden turn, leading to devastating consequences. At the initial stages of your startup's development, your profit margins will be zero or close to zero. This is a normal occurrence since you can't apply an economy on the scale yet. As soon as your production and sales go up, you should take measures on lowering your production costs without hurting product's quality to increase your profit margins. But if this plateau period extends, you will feel hog-tied without the possibility to substantially invest back into your business.

In order to avoid this, you need to acknowledge your Cost Of Goods Sold index (COGS) at different stages of production and to make predictions regarding your profit margins. COGS denotes the accumulated total required to create and sell the product.

Then, it is more expensive to build MVP for a hardware project. If, in some cases, an MVP for a software solution can be built with less than \$1000, an MVP for a hardware one would cost minimum \$5000.

Thus, you always need to have a decent sum in your back pocket that can serve you in case of unpredicted expenditures (and most probably there would be some). Yet, look at the brighter sight of things: a restrained budget can motivate people to make smarter choices.

2) A Prototype Challenge

Creating a prototype for a high techproduct takes a good deal of time. Even the simplest solution would require at least 6 months of painstaking work.

In the course of scaling a prototype to mass manufacturing, the product can change drastically; in result, the original prototype and the product that is aimed at mass production may have little in common.

We recommend introducing Design-For-Manufacturing (DFM) practices as soon as possible to save money and make the process more predictable.

Do not limit yourself to one prototype; create them as much as you can – it will give you a possibility to test various functions separately and to boost the clients' interest manifold. And do not hesitate to show off your brainchild to receive proper feedback.

3) Distributed Development Challenge

Being a virtual asset, a software product can be endlessly improved; by contrast, a hardware solution is a physical asset and it should be created almost perfect from the beginning. It means it has less room for mistake. And, unfortunately, fewer maneuvers with the development process.

The process of distributed development is not easy to manage. Any person involved can receive software literally within seconds since the transportation of hardware between the locations takes a substantial amount of time.

Whatever strategies of the project and team management you choose, always pay attention to visual work management tools, which imply visibility of resource queues, efficient management of resources' application, instant feedback, clear project priorities and decentralized project management and planning.

4) Investment Challenge

The majority of investors — ranging from angels to institutional investors — are hesitant when it comes to investing in hardware. They are reluctant to pump into something before it's a proven market. Venture capitalists prefer spending their dollars on something that transparently boosts the value of the business, e.g., recruiting talented staff.

In many instances, it is connected with investors' experiences. Many of them have some roots in software background and engineering, which means they can't evaluate the offered high techinventory with an objective mind.

The solution here is to demonstrate market validation and demand for the product. Such crowdfunding platforms as Indiegogo and Kickstarter are heaven-sent opportunities, allowing startup owners to kill two birds with one stone: first, finding customer appetite and thus validating the product, and, second, raising funds.

5) Human Resources Challenge

As compared to the world of software, the talent pool in hardware sphere is much more shallow; in order to find the qualified specialist who will suit your needs, you will probably have to work for it.

On top of that, hardware startup requires the involvement of more people. If it is possible to launch the simplest web product by efforts of 3 people, hardware teams should consist of minimum 8 persons (4 of them are responsible for hardware development, 2 – for software and 2 persons communicate with clients and do marketing).

It's not a reason to despair. You as a startup owner should place a premium on your team. Gathering talented people under the same roof is the key to startup's success and its highest priority. It concerns not only executives but co-founders as well. Who knows whether Apple would have taken the world by storm if it had not been ruled by a perfect combination of two charismatic personalities, who in fact were very different and thus complemented each other.

To sum up, you need to be aware of all these hurdles and remember to apply the custom approach to your project. Even taking all this info into account can't guarantee the success of your project. However, it lifts your chances of success.

Despite all the challenges that may lurk in the way, building hardware startups is not only hard. It is a unique and inspirational experience that is able to open bold technological ideas to the world. Now that you've read this article and you are somehow forewarned, we hope you'll continue working on your hardware product, keep on exploring the opportunities and find the right people to rocket your project. Initiatives blossom in capable hands, so go for it!