

9

BUSINESS MODELS



E-next

THE NEXT LEVEL OF EDUCATION

IF YOU ARE primarily a maker or a programmer, and not an entrepreneur, you may have only a dim idea of what a “business model” is. In casual discussion, this expression seems to refer almost exclusively to how the business makes money. For example, when one is talking about Twitter or Pinterest or the latest social media sensation, a common put-down is “Have they got a business model yet? Sure, they’re big now, but do they have any idea how they’re going to make money out of it?”

But there is more to a business model than just money. We could define it as a “hypothesis about what customers want, how they want it, and how an enterprise can organize to best meet those needs, get paid for doing so, and make a profit” (www.sciencedirect.com/science/article/pii/S002463010900051X).

This definition brings together a number of factors:

- A group of people (customers)
- The needs of those customers
- A thing that your business can do to meet those needs
- Organisational practices that help to achieve this goal—and to be able to carry on doing so, sustainably
- A success criterion, such as making a profit

All these aspects are relevant as much to hobbyist or not-for-profit projects as they are to commercial enterprises, though for the last point profit might be substituted for “improving the world” or “having fun” as criteria for success.

We start with an overview of business models over time, to get a flavour for the topic, and then look at a commonly used way to evolve a model. We then look at how existing Internet of Things companies have modelled themselves and think about where they may end up. Finally we take a practical look at starting a company, from initial funding, and discuss the advantages of a “lean startup” approach.

A SHORT HISTORY OF BUSINESS MODELS

From the earliest times, and for the great majority of human existence, we have gathered in tribes, with common property and shared resources. This is an almost universal pattern amongst hunter-gatherers, as it means that every member of the tribe can find food and shelter even if they have not been lucky foraging or hunting that day. We could describe this form of collectivism as a basic *gift economy*. Gift economies develop where those with the appropriate skills can provide their products or services—hunting, pottery, livestock, grain, childcare—and expect repayment of this obligation not immediately but with a gift of comparable worth later. This is not a written debt but a social obligation, which the recipient will repay in due course, perhaps when hunting is good, when she happens upon the raw materials for her craft, or even much later in the year at harvest time.

Development of systems such as barter and money developed only at the edges, between different tribes. We could argue that the first of what we could recognise as modern business models developed at these borders and resulted from the technology required to move products and obligations through space and time.

SPACE AND TIME

While neighbouring tribes might have discovered variants in the local area’s resources—animal, vegetable or mineral—it is when trade develops with others from far-off lands that it becomes really interesting. A merchant might sell silks made in his village to a region where these cloths are rare and in demand in exchange for aromatic spices which will be highly prized back home. But long-distance trade brings with it a whole set of problems: while

nomadic hunter-gatherers were adept at finding food and making a home on the move, merchants have to carry larger quantities of goods for sale and want to maximise the time travelling rather than doing the myriad tasks required for subsistence and shelter. Their goods and food carried will have to last far longer, so they will need to be protected and preserved. Above all, they need to have a reliable means of transport for themselves and their merchandise. Technological advancements such as waterway navigation and portage of boats over land opened up new possibilities, as did the domestication of animals such as the camel, which unlocked trade routes through the Western Arabian deserts.

We touched briefly on the preservation of food, whether through salting or smoking, or simply better storage technology such as grain silos. As well as facilitating transportation through space, preservation is also a way of transporting goods through *time*. A farmer or trader who can afford to not eat or sell all his produce during the glut of harvest can fetch a better price months later at a higher price. So, a merchant trader's business is transporting goods through space and time, and his suppliers, the producers, benefit from that by being able to sell a bulk of their produce in one go, after which they can continue with their daily life and work.

Money, then, abstracted trade further, setting an easy-to-calculate exchange rate between a fixed currency (a certain size disc of gold or weight of grain) and the product being exchanged. In the original gift economies, producers could pay their obligations only periodically or intermittently, according to the rhythms of hunting, farming, or craft. With money, this obligation was abstracted and could be paid back at arbitrary times. In this sense, money is another technology which allows travel through time. The versatility and ease of calculation which this development brought with it made it easier to develop new business models, such as investing in other merchants' trade expeditions in return for a given share or the development of interest on loans.

FROM CRAFT TO MASS PRODUCTION

When Gutenberg demonstrated his printing press circa 1450, books changed from being priceless treasures, hand-crafted by monks and artisans, to a commodity that could be produced. Soon every bourgeois family could afford their own books, at least a copy of the Gutenberg Bible, the first mass-produced book. It is no exaggeration to suggest that the invention laid the foundations for an information culture which is currently exemplified by the Internet and the World Wide Web. Now, painstakingly copying ancient texts onto vellum and stamping them onto paper with the latest innovation

appear to end with the same result, a book. That the latter was some thousand times faster was not simply a quantitative change (more books produced) but a *qualitative* one: information is no longer so rare, valuable, and fragile that it must be preserved by gatekeepers (the ruling classes and the church) but can be so widely spread that everyone can have access to it (and will do, whether those former gatekeepers like it or not.)

Trade routes would play their part here too, as the printing press spread to the New World and India via the sea routes that would be discovered by the end of the century. The cost of printing would become ever smaller as the technology spread, leading to new business models with the rise of newspapers and pamphlets. By the time Dickens was writing his novels in the mid-nineteenth century, he could publish them a chapter at a time, by monthly or weekly subscription.

In 1884, the British company Lever Brothers launched Sunlight Soap, the first household soap to be sold not by weight, to be cut in the shop by the grocer, but packaged in bars and branded with a logo. This was an innovation in mass consumerism, whereby the brand established a link of trust direct with the consumer, relegating the middleman, the grocer, to becoming just a way to deliver the product to the consumer.

Mass production, perfected by Ford Motor Company, was another major change in business model, driven not by how Henry Ford sold his cars but by how he made them. Ford moved away from the “craft production” of cars sold by commission to highly custom requirements and made by skilled craftsmen. Rather, his workers specialised on a single task, and he insisted on standard gauges for parts so that the cars could be assembled and fitted together, ending up identical. This approach made it simple to maintain and repair a Ford car, so the average person could afford to buy one without employing a mechanic to keep it working. The fact that mass production also drove down the costs to produce these cars also helped keep them affordable.

The transition to mass production had its own cost, not least that semi-skilled factory labour may not be as fulfilling as the more varied craftsman role that it displaced. As well as social cost, the typical operation can reach bottlenecks in efficiency. The method of lean production pioneered by Toyota in the 1950s retains many aspects of mass production (efficiency, automation, and high volume of production) but instead of producing masses of a single part, assembly, or finished product, can be run to produce them to order, at a specified date. Thus, Toyota is, for example, able to produce a single car of a given colour, configuration of wheels, and so on, and arrange for the right wheels, tyres, and style of door to arrive on the

factory line where and when they are needed. This approach allows the company a much greater degree of customisation than does mass production, and the emphasis on continuous improvement of efficiency is believed to lead to a more fulfilling and varied environment for the factory worker.

In other areas, the ethic of mass production resulted in new business models such as supermarkets, which pioneered both “self-service shopping” and the sale of a whole range of products under one roof. The first recognizable supermarkets appeared in the 1930s, evolved into the hypermarkets of the 1960s, and now the concept of self-service shopping has evolved to the automated tills where every shopper can be his own checkout assistant.

Fast-food franchising began in the 1930s and exploded with McDonald's and Burger King in the 1950s. Standardized menus, pre-prepared ingredients, and standard practices for each franchisee to follow meant that you could now eat exactly the same meal in any of a chain restaurant's stores in your country (local tastes, laws, and religious observances mean that menus are tweaked globally). In an interesting turn, many new fast-food chains are fighting against this movement by flavouring sauces made by hand from freshly sourced ingredients instead of mass-produced ones. The U.S.-based Chipotle chain was one of Fast Company's 50 most innovative companies of 2012. Here, injecting the ethical sourcing of food and more responsibility in the hands-on cooking for the employees into the successful fast-food business model has revitalized it. Similarly, Lush created a soap empire in the 1990s by selling natural soap in long strips, to be cut into blocks by weight, just as it had been before Lever Brothers' intervention a century before.

THE LONG TAIL OF THE INTERNET

As we have seen, huge changes in business practice are usually facilitated by, or brought about as a consequence of, technological change. One of the greatest technological paradigm shifts in the twentieth century was the Internet. From Tim Berners-Lee's first demonstration of the World Wide Web in 1990, it took only five years for eBay and Amazon to open up shop and emerge another five years later as not only survivors but victors of the dot-com bubble. Both companies changed the way we buy and sell things. Chris Anderson of *Wired* magazine coined and popularized the phrase “long tail” to explain the mechanism behind the shift.

A physical bricks & mortar shop has to pay rent and maintain inventory, all of which takes valuable space in the shop; therefore, it concentrates on providing what will sell to the customers who frequent it: the most popular goods, the “hits”, or the Short Head. In comparison, an Internet storefront

exposes only bits, which are effectively free. Of course, Amazon has to maintain warehouses and stock, but these can be much more efficiently managed than a public-facing shop. Therefore, it can ship vastly greater numbers of products, some of which may be less popular but still sell in huge quantities when all the sales are totalled across all the products.

Whereas a specialist shop in Liverpool; Springfield, Oregon; or Florence, Italy, may or may not find enough customers to make its niche sustainable, depending on the town's size and cultural diversity, on the Internet all niches can find a market. Long tail Internet giants help this process by *aggregating* products from smaller providers, as with Amazon Marketplace or eBay's sellers. This approach helps thousands of small third-party traders exist, but also makes money for the aggregator, who don't have to handle the inventory or delivery at all, having outsourced it to the long tail.

E-books and print-on-demand are also changing the face of publishing with a far wider variety of available material and a knock-on change in the business models of writers and publishers that is still playing out today. Newer business models have been created and already disrupted, as when Google overturned the world of search engines, which hadn't even existed a decade previously. Yet although Google's stated goal is "to organize the world's information and make it universally accessible and useful" (www.google.com/about/company/), it makes money primarily through exploiting the long tail of advertising, making it easy for small producers to advertise effectively alongside giant corporations.

LEARNING FROM HISTORY

We've seen some highlights of business models over the sweep of human history, but what have we learnt that we could apply to an Internet of Things project that we want to turn into a viable and profitable business?

First, we've seen that some models are ancient, such as Make Thing Then Sell It. The way you make it or the way you sell it may change, but the basic principle has held for millennia.

Second, we've seen how new technologies have inspired new business models. We haven't yet exhausted all the new types of business facilitated by the Internet and the World Wide Web.... If our belief that the Internet of Things will represent a similar sea change in technology is true, it will be accompanied by new business models we can barely conceive of today.

Third, although there are recurring patterns and common models, there are countless variations. Subtle changes to a single factor, such as the

manufacturing process or the way you pay for a product or resource, can have a knock-on effect on your whole business.

Finally, new business models have the power to change the world, like the way branded soap ushered in mass consumerism and mass production changed the notion of work itself. If the Internet of Things does change the world, as we go on to discuss in Chapter 11, “Ethics,” it may well be through the business models it permits.

THE BUSINESS MODEL CANVAS

One of the most popular templates for working on a business model is the Business Model Canvas by Alexander Osterwalder and his startup, the Business Model Foundry. The canvas is a Creative Commons–licensed single-page planner.

THE BUSINESS MODEL CANVAS

Designed for: _____ Designed by: _____ Date: _____

Key Partners Who are our key partners? Who do we depend on? Who do we rely on for critical resources? Who do we rely on for critical activities?	Key Activities What key activities must we perform to create value? What key activities must we perform to deliver value? What key activities must we perform to maintain value?	Value Propositions What value do we create for our customers? What value do we create for our customers? What value do we create for our customers? What value do we create for our customers?	Channels How do we reach our customers? How do we reach our customers? How do we reach our customers? How do we reach our customers?	Customer Segments Who are our target customers? Who are our target customers? Who are our target customers? Who are our target customers?
Key Partners Who are our key partners? Who do we depend on? Who do we rely on for critical resources? Who do we rely on for critical activities?			Channels How do we reach our customers? How do we reach our customers? How do we reach our customers? How do we reach our customers?	
Cost Structure What are our major costs? What are our major costs? What are our major costs? What are our major costs?		Revenue Streams How do we generate revenue? How do we generate revenue? How do we generate revenue? How do we generate revenue?		

The Business Model Canvas.

Reproduced by licence (CC-BY-SA 3.0) from businessmodelgeneration.com.

At first sight, it looks as though each box is simply an element in a form and the whole thing could be replaced by a nine-point checklist. However, the boxes are designed to be a good size for sticky notes, emphasizing that you can play with the ideas you have and move them around. Also the layout gives a meaning and context to each item.

Let's look at the model, starting with the most obvious elements and then drilling down into the grittier details that we might neglect without this kind of template.

At the bottom right, we have *Revenue Streams*, which is more or less the question of “how are you going to make money?” we used to start this chapter. Although its position suggests that it is indeed one of the important desired *outputs* of the business, it is by no means the only consideration!

The central box, *Value Propositions*, is, in plainer terms, what you will be producing—that is, your Internet of Things product, service, or platform.

The *Customer Segments* are the people you plan to deliver the product to. That might be other makers and geeks (if you are producing a kit form device), the general public, families, businesses, or 43-year-old accountants (famously, the average customer of Harley-Davidson).

The *Customer Relationships* might involve a lasting communication between the company and its most passionate customers via social media. This position could convey an advantage but may be costly to maintain. Maintaining a “community” of your customers may be beneficial, but which relationships will you prioritise to keep communicating with your most valuable customer segments?

Channels are ways of reaching the customer segments. From advertising and distributing your product, to delivery and after-sales, the channels you choose have to be relevant to your customers.

On the left side, we have the things without which we have no product to sell. The *Key Activities* are the things that need to be done. The Thing needs to be manufactured; the code needs to be written. Perhaps you need a platform for it to run on and a design for the website and the physical product.

Key Resources include the raw materials that you need to create the product but also the people who will help build it. The intellectual resources you have (data and, if you choose to go down that route, patents and copyright) are also valuable, as are the finances required to pay for all this!

Of course, few companies can afford the investment in time and money to do all the Key Activities themselves or even marshal all the Key Resources. (Henry Ford tried hard, but even he didn't manage.) You will need *Key Partners*, businesses that are better placed to supply specific skills or

resources, because that is their business model, and they are geared up to do it more cheaply or better than you could do yourself. Perhaps you will get an agency to do your web design and use a global logistics firm to do your deliveries. Will you manufacture everything yourself or get a supplier to create components or even assemble the whole product?

The *Cost Structure* requires you to put a price on the resources and activities you just defined. Which of them are most expensive? Given the costs you will have, this analysis also helps you determine whether you will be more cost driven (sell cheaply, and in great volume via automation and efficiency) or more value driven (sell a premium product at higher margins, but in smaller quantities).

WHO IS THE BUSINESS MODEL FOR?

Primarily, the reason to model your business is to have some kind of educated hypothesis about whether it might deliver what you want from it. Even if you don't use a semi-formal method like the canvas we just discussed, anyone who starts up any business will have thought, at least briefly, about whether she can afford to do it, what the business is, and whether she'll get paid.

As a programmer or a maker, you might believe it counterintuitive to think of a piece of paper with nine boxes in it as a “tool”, but when you have a well-tested separation of factors to consider, the small amount of structure the canvas provides should help you think about the business and give you ways to brainstorm different ideas:

- What if we target the product at students instead of businesses?
- What if we outsource our design to an agency?
- What if we sell at low volume/high value instead?

Many great product ideas turn out to be impractical, ahead of their time, or unprofitable. Being able to analyze how the related concepts mesh will help you challenge your product idea and either make it stronger or know when to abandon it.

The model is also useful if you want to get other people involved. This could be an employee or a business partner...or an investor. In each of these cases, the other parties will want to know that the business has potential, has been thought out, and is likely to survive and perhaps even go places. With a new business startup, you have no track record of success to point to. Although

what will sell the business is primarily the product itself, and of course your passion for it, being able to defend a well-thought-out model of the business is an important secondary consideration for someone who is planning to sink time and perhaps money into your business.

Perhaps to a lesser extent, your *customers* will also be considering whether to invest their time and money in your product. They will ask themselves certain questions about it. Let us look at some of these likely questions, from the wider field of Internet products in general.

- **Why should I waste time trying out Yet Another Social Network? I think I'll wait and see whether all my friends join it first.** This first question is about your “Value Proposition” (that is, the product) and a reasonable concern if you are trying to get into a market that already has good or popular solutions.
- **Will my Internet-connected rabbit become an expensive paper-weight if you go bust?** This happened with Nabaztag, one of the earliest consumer products in the field of Internet of Things. These rabbit-shaped devices delighted their owners by muttering and moving their ears in response to stimuli received via the Internet until the French company Violet went bankrupt. The new owners, Mindscape, factored in this concern by open sourcing the code for Nabaztag (and its successor Karotz) to ensure that customers can continue to use the product no matter what happens to the company. This question is asked with a degree of consumer savvy about business risk. Potential customers have seen other companies fall under and don't want the inconvenience or waste it entails for them.
- **Your online document collaboration looks great, but is it worth my moving my whole business to it? If you stop trading or change the platform, we may have to redo all the work again.** Such customers may well be interested in the details of your business model to calculate whether the risk they've identified is worth their commitment. This isn't just a concern about viability of the company: It's unlikely that Google will stop trading, yet many businesses are still unwilling to rely on Google Drive for editing documents. The reason is, in part, that they don't understand where the product fits in Google's strategy and can't guarantee that the service won't be discontinued or crippled, or predict a cost structure for it in the event that it stops being free.
- **This free service is fantastic, but why don't you let me pay for it, so I can get consistency, receive support, and avoid adverts?** Lastly, many customers are aware of alternative charging models that they would prefer and might prefer a different one. Not all customers vote for the

free option. When the social bookmarking site delicious.com started to lose many of the features that had made it popular, Maciej Cegłowski set up pinboard.in, a paying service. Its charging model is designed to keep the user base small enough that he can keep up the development and support by increasing the small sign-up fee by a fraction every time a new user pays for it.

As Cegłowski says, “You don’t really know that the cool project you signed up for is in a skyscraper in Silicon Valley, or like me: one dude in his underpants somewhere who has five windows open to terminal servers” (www.economist.com/blogs/babbage/2011/04/price_fame). But partners, investors, and informed customers will *want* to know. Though, as we’ve seen, a commercial enterprise may drop a product as readily as a one-man team; the business model provides, among other things, a useful tool for understanding what plans there are to keep the service running in both cases.

It has been stated about “free” products: “If you’re not paying for something, you’re not the customer; you’re the product being sold”. This formulation was popularised by Andrew Lewis in 2010 (<http://www.metafilter.com/95152/Userdriven-discontent>) but builds on a long line of commentary about consumerism, such as Adbusters’ classic video of 1999 “The Product Is You” (http://www.adbusters.org/abtv/product_you.html). But as elegant as such a phrase may be, is it true? Derek Powazek, CEO of social startup Cute-Fight, challenges several assumptions often made:

- Not paying means not complaining.
- You’re either the product or the customer.
- Companies you pay treat you better.
- So startups should all charge their users.

—<http://powazek.com/posts/3229>

Powazek suggests that the actual lesson to be learned is that:

Your business plan cannot be secret anymore. People are too smart for that, too tired of getting burned, too wary of losing their contributions when a startup dies, and too annoyed by sudden changes to the terms. Communicate your business plan from the start and you’ll avoid a thousand problems down the road.

—<http://powazek.com/posts/3250>

MODELS

We have looked at the Business Model Canvas as a tool for generating and analysing models. As we saw from our history, the models have many common variants. It is a good idea to have a look at some of the models that Internet of Things companies have used or might use and consider some of the parameters these models relate to on the canvas.

MAKE THING, SELL THING

The simplest category of models, “make a Thing and sell it,” is, of course, valid for the Internet of Things. Adrian sells custom-built Bubblini, and the startup Good Night Lamp is preparing to ramp up production of its eponymous lamps as an off-the-shelf product. As you will see in Chapter 10, electrical products sold in shops (physical or online) may be subject to legislation and certification (RoHS, Kitemarks, and so on), which is an additional factor and cost to consider. Many small-scale projects take the option of selling the product in “kit” form, with some assembly required. Because kits are assumed to be for specialists and hobbyists rather than the general public, the administrative burden may be lower. However, making a decision to limit your target market may well limit the potential revenue also.

SUBSCRIPTIONS

THE NEXT LEVEL OF EDUCATION

A Thing would be a dumb object if it weren't for the important Internet component which allows the device to remain up to date with useful and current content. But, of course, this ongoing service implies costs to the provider—development, maintenance of servers, hosting costs, and in some cases even connection costs. A subscription model might be appropriate, allowing you to recoup these costs and possibly make ongoing profit by charging fees for your service. Many products could legitimately use this method, but perhaps the more complex, content-driven services would find it more convincing. Paying Bubblino a monthly fee to blow bubbles might seem steep, but the BERG Cloud, which delivers nicely formatted news and entertainment to its Little Printer, might have seemed an ideal product for this model. As it stands, content consumers do *not* pay for either BERG Cloud or for any content subscriptions. In the future, content publishers may pay for certain premium services. Perhaps this example shows that there is not yet a market for paid subscriptions to Internet of Things products. This may mean that there is a market to be built. People happily pay subscriptions to music services, corporate groupware, and of course, mobile phones, so perhaps Internet of Things products in these spaces will find subscription more appealing to their consumers.

The so-called freemium model (a portmanteau of “free” and “premium”) has always been a way to encourage paying customers while not alienating free ones. In this model, a smaller or larger part of your product is free, while the users are also encouraged to pay a premium to get additional features or remove limits. This model could be combined with our first two models: Buying the physical device gives free lifetime access to the associated Internet service, but additional paid services are also available.

CUSTOMISATION

We touched on the improvements to mass production whereby the process of buying a car can be tweaked to the buyer’s requirements. For an Internet of Things device, at the intersection between solid thing and software, there are options for customisation that we believe may lead to new business models.

For a mass-produced item, any customisation must be strictly bounded to a defined menu: a selection of different colours for the paintwork, options for fittings such as tyres, the trimmings and upholstery inside, and for features like the onboard computer control and display. Fordian logic dictates that all these components must be optimised for manufacture and fit well together.

The world of software is, by contrast, pathologically malleable, if we let it be. Early websites explored the new medium of HTML to its garish extremes, with `<blink>` tags and animated .gif images. Yet today’s equivalent of home pages, offered by incumbents such as Facebook, Twitter, and Pinterest, offer small degrees of customisation within strictly defined boundaries: a selection of (tasteful) colour schemes and a choice of image to use as your avatar.

Many Internet of Things products have some possibility of customisation: Every Bubblino has a name (given to it by Adrian), but the user can also change which phrases he listens to on Twitter. BERG’s Little Printer offers a selection of content to be printed but also an option of which smiley face it will print for display while waiting for a new delivery. (Of course, only a limited number of choices are available currently.) Although printer output is as flexible as the software that feeds it, BERG has limited the options to fit into its product aesthetic.

The new manufacturing techniques, such as laser cutting and 3D printing, should allow great possibilities for customising even the physical devices. MakieLab (<http://makie.me>) make dolls that can be designed online. Built to your specification, they are therefore unique and entirely *yours* in a

way that a mass-produced doll couldn't be. Whereas many of the components are indeed chosen from a limited list (wigs, tops, scarves), others are modified using a slider: the "attitude" and "ferocity" of the eyebrows, for example. One could argue that this is effectively the same superficial customisation we mentioned previously, except with a larger number of variables. Yet in some way, the combinatorial explosion of these numerous options *does* make the process of creating "your" Makie seem like a genuine personalization. The Makies are made using a combination of 3D printing, automation, and manual assembly. While a Makie may not be an Internet of Things device in its current iteration, it does already bridge the real and virtual worlds, making an online "avatar" real. In the future, such dolls will certainly cross the line and become Internet-connected devices. In the meantime, they are an interesting case study for new techniques that might be useful for your Internet of Things product, too.

BE A KEY RESOURCE

Not every Internet of Things business will be selling a product to the mass market. Some will sell components or expertise to other companies—that is, component manufacturing or consultancy services. Effectively, in this kind of business, you are positioning yourself as a "key resource" or a "partner" in somebody else's business model. These business models are perfectly valid. Small companies such as Adafruit and Oomlout sell electronic components to hobbyist makers. Manufacturers produce printed circuit boards (PCBs) and other custom electronics for the producers of gadgets such as Things. On the consultancy side, work will be available either simply providing your skills for hire or indeed in providing vision and expertise for strategic planning to a company that wants to engage with the Internet of Things.

These fairly straightforward supplier/consultant relationships make the point that enterprises will need to solve problems, just as consumers will. In this book, we have mostly looked at consumer products because they fit best with our notions of technology for humans and the Geocities of Things. However, the market for enterprise customers may be just as important. Sequoia Capital's Jim Goetz commented that he sees many more consumer startups come to him for funding, yet enterprise startups are significantly more likely to succeed: "It's shocking we don't see more engineers and entrepreneurs interested in enterprise" (www.businessinsider.com/sequoia-capital-jim-goetz-on-enterprise-startups-2012-9).

Environmental data consultancy amee (www.amee.com) provides means for not only consumers but also businesses and government bodies to improve their environmental impact by getting hard data about their carbon footprint—not just their direct energy usage but also the energy used to

dispose of their waste. Although in many ways amee is a software Internet company, collating data about the carbon cost of various activities or products, its interest in environmental data makes it naturally interested in the Internet of Things also. The company has modelled a factory process for producing bags of coffee beans such that sensor data monitors the carbon cost of grinding and packing each bag in real time, and the final packaged product can be stamped with that data, to help consumers make an informed decision about their purchase.

PROVIDE INFRASTRUCTURE: SENSOR NETWORKS

Sensor data is a fascinating topic in the Internet of Things: Although there are official data sources, often very accurately calibrated and expensive to create, they may be hard to access and of course can exist only where a government body or company has chosen to apply its large but finite resources. The long tail of third-party data sensor enthusiasts can supplement or sometimes outclass the official streams of information. What is needed is a platform to aggregate that data, and one of the companies competing to fulfil that role is Xively (<https://xively.com>—formerly Pachube and Cosm). They allow any consumer to upload a real-time feed of sensor data—for example, radiation levels in Japan after the Fukushima Daiichi nuclear disaster—and for the data from many feeds to be mapped, graphed, and compared. Many of the Japanese engineers and enthusiasts who submitted this data used homemade, and calibrated, Geiger counters. Any one device might be of dubious accuracy, but once they were aggregated, real patterns emerged which a single official body would have struggled to discover.

Xively have, since the beginning, intended to provide a free, public infrastructure for open source data while also providing enhanced commercial offerings with enhanced capacity and privacy options and formal service level agreements (SLAs). While their provision of an Internet of Things “middleware” may be hard to monetize at time of this writing, becoming a major player in the infrastructure for the growing Internet of Things market is a huge potential prize. Xively sold in 2011 to LogMeIn for \$15 million, with the new owners bankrolling the startup’s estimated \$1 million per quarter operating costs and negotiating collaborations with partners such as ARM (http://readwrite.com/2011/07/20/pachube_acquired).

Air Quality Egg, sponsored by Xively and funded via Kickstarter, is a project to create the same kind of sensor commons project via a standardised product (<http://airqualityegg.wikispaces.com/AirQualityEgg>). Although the Egg is an open source project, developed by a community beyond the project initiators, it also points a way for similar products

which might combine a social intent with a commercial model. For this kind of project to succeed, Australian technologist Andrew Fisher proposes that it must

- Gain trust
- Become dispersible
- Be highly visible
- Be entirely open
- Be upgradeable

—<http://ajffisher.me/2011/12/20/towards-a-sensor-commons>

There is no reason why a commercial product couldn't fulfil all these requirements, although we will certainly see companies embrace and extend the good intentions purely for profit. Sensor data is information, which can be shared freely or might simply be sold. Many energy suppliers are rolling out “smart meters”, which promise greater efficiency and therefore cheaper bills but also aggregate huge quantities of information (especially when triangulated with other data sources). We look at the ethical questions raised by sensor data in Chapter 11. As regards the business model, you need to consider the legality of such collection (now and in the foreseeable future) and whether it fits with your company values.

TAKE A PERCENTAGE

In the example of sensor networks, if the value of the data gathered exceeds the cost of the physical sensor device, you might be able to provide that physical product for free. In fact, energy companies quite often do this with their smart meters. You could also link devices to advertising to reduce the price. Although this practice is controversial, many US consumers have chosen an ad-supported version of the Kindle e-Book reader to save the initial outlay.

As we suggested earlier, even without charging the *end user* of your Internet of Things device, there will be many options to make a profit from somewhere (ad revenues, payment for data services from companies or state organisations, commission for data bandwidth incurred, etc.) Within the burgeoning field of the Internet of Things, exactly what the “product being sold” consists of is a field that remains to be explored. Perhaps future versions of Bublino could also be triggered for occasional promoted tweets. Perhaps your Internet-enabled fridge will make tutting noises when you fill it and suggest other (promoted) options for your next shop.

FUNDING AN INTERNET OF THINGS STARTUP

As important as future costs and revenues are to a well-planned business model, there will most likely be a period when you have only costs and no income. The problem of how to get initial funding is a critical one, and looking at several options to deal with it is worthwhile.

If you have enough personal money to concentrate on your new Internet of Things startup full time without taking on extra work, you can, of course, fund your business yourself. Apart from the risk of throwing money into a personal project that has no realistic chance of success (which this chapter's aim is to avoid!), this would be a very fortunate situation to be in. And luckier still if you have the surplus money to bankroll costs for materials and staff.

If, like most of the rest of us, you aren't Bruce Wayne, never fear; there are still ways to kick off a project. If the initial stages don't require a huge investment of money, your time will be the main limiting factor. If you can't afford to work full time on your new project, perhaps you can spare a day in the weekend or several evenings after work. You might be able to arrange to work part time on your day job; even an extra afternoon or day might be enough to get things moving. Many people try to combine a startup with a consultancy business, planning to take short but lucrative contracts which support the following period of frantic startup work. Paul Graham advises some caution on this approach, as the easy money from consulting may be too much of a crutch and remove one of the primary motors for a startup, the fear of failure. In an acerbic footnote, he expands on this theme:

Consulting is where product companies go to die. IBM is the most famous example. So starting as a consulting company is like starting out in the grave and trying to work your way up into the world of the living.

—Paul Graham (www.paulgraham.com/startupfunding.html)

Making sure that you *don't* need to spend huge amounts on the startup is key. You probably don't need an office in the early stages, and perhaps you don't need expensive Aeron chairs. You can work from your kitchen table, a café, or out of a co-working space.

Everything we've discussed in the chapters on prototyping is designed to get a Minimum Viable Product out to show to people and start gathering interest. You can get surprisingly far with a cheap hosting account or a

service for deploying apps in the cloud, such as Heroku, an Arduino Ethernet, some basic electronic components, some cardboard, and a knife. Until you get funding, you may be able to scale up your spending on any of these as and when you really need to.

HOBBY PROJECTS AND OPEN SOURCE

If your project is also your hobby, you may have no extra costs than what you would spend anyway on your free-time activity. This is perfectly valid, although if you are reading this chapter with an intent to turn your product into a successful business or community, you may wish to proceed at a less leisurely pace than a pure hobby might entail.

One way to make a project grow faster might be to release all the details as open source and try to foster a community around it. This approach can be hard work and can benefit from a natural talent, experience, or luck in attracting and maintaining good collaborators. After you have open-sourced a project, you can't close-source it again. Yes, you can probably fork the project and continue to work on it in secret, but the existing project may carry on if your collaborators are enthusiastic enough about it. Indeed, your idea, code, and schematics could be used by others in their own commercial offering. Careful consideration of the license used may be critical here: A more restrictive license such as the GPL requires those who build on your work to share their source code also under the same terms. Hence, using the GPL may help restrict commercial exploitation to only those groups that are happy for *you* to, in turn, reap the benefits of their work. Also, when thinking about open source, remember that as the project initiator and owner, you would be the best placed in forming a company around the project and are more likely to reap benefits from the relationship with the community:

- Many pairs of eyes and hands testing, reporting problems, fixing them, and building new features
- Many passionate users with real use cases and opinions about the product—better than any focus group
- The goodwill of that community, with its ready-made network of personal recommendations and social-media marketing

Running an open source project takes work, and the risk of losing control of your project may not be for everyone, but it is certainly an option to consider.

VENTURE CAPITAL

Of course, getting funding for a project from an external investor presents its own work and risks. The process of applying for funding takes time, and although much of this time can be justified as thrashing out the business model, it's not directly related to the work you actually want to be doing on the product itself. Startups often concentrate their fundraising activities into *rounds*, periods in which they dedicate much of their effort into raising a target amount of money, often for a defined step in their business plan.

Before any official funding round comes the informal idea of the *friends, family, and fools* (FFF) round. This stage may be the one in which you've contributed your life savings, and persuaded your aunt, your best friend, and a local small business to pitch in the rest, on the basis of your reputation. Although it's important to consider the possible impact on your personal relationships, this round of funding may be the most straightforward to get hold of.

A common next step would be an *angel* round. The so-called angels are usually individual investors, often entrepreneurs themselves, who are willing to fund some early-stage startups which a more formal investor (such as venture capitalists that we look at shortly) might not yet touch. The reason might be that these angels have a technical or business background in your product or simply that, as individual investors, they may have more scope to go with their own intuition about your worth. Angels typically disburse sums that are significant for early-stage startups—in the region of tens or possibly hundreds of thousands of pounds. However, the personal interest and experience that angels can bring to your company means that their advice, contacts, and other help may well be as useful as any money they provide. Though angels take on a lot of risk in investing so early, before companies have proved themselves, they tend to invest in a number of companies to spread the risk. They usually want equity in your company, a percentage of the value of the company, that will pay back their investment if and when you do well. These angels might also demand a place on your board of directors, to oversee their investment, but also out of interest in helping the company to succeed.

A good place to find an angel in the US could be AngelList, a long tail aggregator where investors can meet startups (<https://angel.co>).

The *venture capital* (VC) round is similar, but instead of your courting individual investors, the investor is a larger group with significant funds, whose sole purpose is to discover and fund new companies with a view to making significant profit. VCs may be interested if angels have already

funded you and will certainly be interested if other VC companies are already looking at funding you. VCs will certainly want equity, probably a significant amount of it, and a position on your board of directors. Again, this last role may be as much to help fill gaps that your management team don't cover as much as it is to keep an eye on you and their money. Typically, VC funding will be larger chunks of money, from half a million pounds up.

If your idea is a good one, and one of your team has the time and temperament for it, there are opportunities to play the VCs against each other to get the best deal for you, as described in detail in Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist, by Brad Feld and Jason Mendelson (Wiley, 2012).

A related option, especially in the early stages, would be an *accelerator*, which might be run by a venture capital firm. In this case, part or all of the money that could be awarded to your company is paid in kind, in the form of free office space, consultancy, and specific training and mentoring in areas that the investor believes will make you a success. Accelerators may accept applicants only at set points in time (like rounds of entry) or may accept good startups at any moment (given sufficient capacity). The fact of being collocated in an incubator with other smart new companies may be of great benefit, and the training and contacts you gain could well be valuable.

Current accelerators that may be specialized in the Internet of Things, or cover the field as part of their area of interest, include

- HAXLR8R (<http://haxlr8r.com/program/hack-what>)
- PCH Accelerator (www.pchintl.com/accelerator/accelerator.aspx)
- Berlin Hardware Accelerator (<http://www.berlinhardwareaccelerator.com/>)
- Bolt (<http://www.bolt.io>)
- Lemnos Labs (<http://lemnoslabs.com>)

At the time of this writing, more accelerators operate in the US, but the concept is spreading in the UK, Europe, and elsewhere. Every scheme is different, and some are more valuable than others in the quality of their accommodation, mentoring, neighbouring startups, and so on. You would benefit from checking out each scheme and getting recent testimonials about it to make sure it's something that will work for you.

Y Combinator (<http://ycombinator.com>) is also an accelerator, and its founder, Paul Graham, welcomes hardware startups and talks of a "Hardware Renaissance":

There is no one single force driving this trend. Hardware does well on crowdfunding sites. The spread of tablets makes it possible to build new things controlled by and even incorporating them. Electric motors have improved. Wireless connectivity of various types can now be taken for granted. It's getting more straightforward to get things manufactured.

Arduinos, 3D printing, laser cutters, and more accessible CNC milling are making hardware easier to prototype. Retailers are less of a bottleneck as customers increasingly buy online.

—<http://paulgraham.com/hw.html>

Even though funding may sound like “free money”, we’ve already seen that getting investment comes with conditions: equity and some measure of control via your board of directors. The trade-off is obvious: You couldn’t get the money to grow your business otherwise. Even if losing some control in the company is heart-wrenching, a smaller percentage of a valuable company will be worth more than a large percentage of nothing.

We’ve seen some of the considerations in funding. In addition, you need to be aware that by accepting investment through venture capital, you are committing yourself to an *exit*. An exit strategy is a “method by which a venture capitalist or business owner intends to get out of an investment that he or she has made” (www.investopedia.com/terms/e/exitstrategy.asp). Because your investors will want a return, your long-term goal can’t just be to make your company successful but to do it in such a way as to pay back the investment. Typically, you have only two exits:

- **You get bought by a bigger company:** In this case, the buyer buys out the investors; that is, the buyer pays the investors the value of their percentage equity of their perceived valuation of the worth of the company.

Founding members of the company often transfer to the purchasing company, as they constitute one of the company’s principal resources. To keep them motivated in working for the new business now that they’re no longer in control, they typically are paid a part of their payout in shares; it is “vested” over a certain period (for example, that can be redeemed only after a year’s service).

- **You do an IPO (initial public offering)—that is, float on the stock market:** This involves new shares being issued and sold to the stock market. Although this option “dilutes” the value of the shares already issued, the existing holders are able to then sell their shares on the market too, to get back their investment, or to retain the shares if they believe that the shares will grow in value.

Although an IPO is also a good way for the company to raise further money, being on the stock market does mean that you have new commitments: quarterly reports, voting rights for new shareholders, and a duty to be seen to be doing something when the market periodically reassesses your share value.

Obviously, neither of these common exits provides any place for alternative business models, such as cooperatives, or worker-owned capitalist corporations such as John Lewis in the UK. These are perhaps so far outside the standard discourse of contemporary trade that they can exist only if everyone with a share of financial interest agrees in the alternative ideal.

GOVERNMENT FUNDING

Governments typically want to promote industry and technological development in their country, and they may provide funds to help achieve particular aims. Attempting to cover the variety of funding schemes across the whole world would be a project in itself, so we make some mostly general notes based in many cases on the current situation in the UK.

Although governments can and do set up their own venture capital funds or collaborate with existing funds in various ways, they generally manage the majority of their funds differently. For one thing, they also want to fund *existing* companies to do new research and innovation, which might sit uncomfortably with the concept of equity.

The money provided still has “strings attached”, but they are likely to be handled differently:

- **Outputs:** Deliverables (aka outputs) are the metrics that an awarding body may use to tell if you are doing the kind of thing that the body wants to fund. This metric may simply be a test that you are managing the money well or may be related to the goals that the body itself wishes to promote. You might be required to write regular reports or pass certain defined milestones on schedule. If your funding is given in stages, the later payments may be conditional on successful delivery of previous outputs. You should be very clear on what needs to be done and how onerous the task is. Even a large sum of money is worth less if you are going to spend significant amounts of time on secondary activities. You may be required to *match funds*; that is, if you were awarded £10,000, you would also have to raise £10,000 yourself. Certain UK bodies such as the Technology Strategy Board (TSB) currently operate in this way. It is important to understand the way this matching works.

For example, you may be required to make payments with your matched funds first and then reclaim the amount spent in arrears. If the awarding agency pays these funds irregularly—for example, quarterly—you may be left without money at key moments. You therefore need to understand the process, as it may require additional fundraising, cashflow management, or resources spent begging for money from your awarding body. (This requirement makes perfect sense for large companies that are willing to invest some of their cash reserves in research if the government will match the funds. It is less well suited to funding startups on a shoestring budget.)

- **Spending constraints:** Some funding may require you to spend a proportion of the money on, for example, business consultancy or web development, perhaps with the fund facilitator's company or associates. This requirement may be highly valuable, of course, but the practice appears slightly misleading; it would be better to clarify this as a funding “in kind” rather than cash. If you are running a shoestring startup, you would probably source the service at a much lower cost. You also must consider the time and management overhead in making use of the (possibly unwanted) service. Make sure you understand what expectations the funding comes with upfront!

After having looked at the “rounds” of funding for venture capital, you might be interested to see where government funding fits into the scheme of things. Funding may well cover feasibility studies, research and development, and possibly production rounds designed to help bring a prototype idea into production. From the point of view of a maker or hacker, “feasibility” and “research” may seem superfluous. That’s something you do as a matter of course; it’s often the next step, of taking the prototype into production, that you could use help with. Governments will, however, try to split their pot of money to fund the outcomes that they are interested in as policy. Quite reasonably, this may tend to favour grants for research over grants to help get to market. After all, after the product is proven, the company should be able to afford to fund it by itself or get VC funding.

It is perfectly normal for companies to work through multiple sources of funding. Having successfully worked through a government innovation award may stand you in good stead for approaching VCs for more money later, for example.

CROWDFUNDING

We’ve already looked at the long tail as a business model; we can think of crowdfunding as the long tail of funding projects. Getting many people to

contribute to a project isn't exactly a new phenomenon. Walter Gervaise built the first stone bridge over the River Exe in 1238 through public subscription by approaching friends and other wealthy citizens (www.exeter.gov.uk/index.aspx?articleid=2879). Earlier, after 27 BC, Augustus Caesar sponsored a public subscription for a statue of his physician Antonius Musa (www.gutenberg.org/files/21325/21325-h/21325-h.htm). Over millennia many civic and religious monuments and constructions have been funded at least partly by the public. However, such projects have been mostly sponsored and given focus by some influential person or body. With the efficiencies of the Internet's long tail, people can seek funding to print limited editions of their latest comic book, CDs of vocal-only covers of every song by the Smiths (<http://thesmithsproject.blogspot.co.uk>), or perhaps your exciting new Internet of Things product.

As of 2013, the main options for crowdfunding are Kickstarter (www.kickstarter.com) and Indiegogo (www.indiegogo.com). Historically, Kickstarter was available to use only for funding projects based in the US, whereas Indiegogo set itself up to be "the world's funding platform". Now Kickstarter is available also for UK projects. If you are based in a country not covered by this organization, you might consider Indiegogo. The alternative would be to find a core collaborator in the US or UK, but this, of course, brings on more communication and organizational overhead.

Kickstarter currently has somewhat better traction than Indiegogo. More people have heard of it, and this may make it more likely that people will fund you. Indiegogo is open to all types of projects, including community and charitable ones, whereas Kickstarter is only for those creative projects that end up with a product, be it artistic or technological. With the greater restrictions set by Kickstarter, it is not surprising that there is an application process required to create a project. Not all projects are approved. Indiegogo plays much less of a gatekeeper role, allowing you to start promoting your project immediately without an approval process.

Although a government fund might look favourably at you if you make your application in terms of the outputs it is meant to be supporting, and a VC may wish to know that your business model is sound and the team are competent, the elements that make a crowdfunded project a hit may be harder to determine. A great concept is still important. Appealing text, slick videos, and great design may make the difference between yours and a competing project. Because even some successfully funded projects may fail, older and wiser crowdfunders may be more likely to fund projects in which they see some attention to the business model or a track record for successful completion by the project team.

In short, your funders are real people and will have all the variety of concerns and foibles that any group of real people have. This interaction with a large and diverse group is a key part of the interest of this method of funding: It is far more than just the money. We've already looked at how the long tail allows consumers with all manner of niche interests to find the producers who are interested in satisfying those niches. Crowdsourcing allows you to do this before even investing your time and money in the product! Assuming that the aggregators (Kickstarter, Indiegogo, and the rest) are doing their job well, they will reach a good segment of the potential customers for your Internet of Things product. If there is no interest, perhaps the product is not a winner as currently specified and advertised. If the project goes viral, as happens occasionally, and gains far more than the targeted amount, you know you have a potential hit on your hands. Just as receiving funding from VCs might be valuable as much for the mentoring and networking opportunities, so crowdfunding may be as valuable for the market research and viral marketing as for the money raised.

LEAN STARTUPS

We've looked at the advantages of running a startup on a low budget. The mentality needed to do this includes spending time and money only when it's really necessary—staying hungry and *lean*. The concept of a “lean startup,” pioneered by Silicon Valley entrepreneur Eric Ries, springs from this idea (*The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*, Crown Business, 2011). The option in the preceding section of crowdfunding a project presented an even more appealing step on this route: running the project only *if* there is a demonstrable niche market for it.

Many lean proponents suggest setting up a landing page for a project with a simple form to register interest. This is quick and simple to do, especially as numerous startups do exactly this (unbounce.com, landerapp.com, and others). These simple pages allow you to propose many projects and focus only on the ones that have most feedback. However, if you've already done some prototyping work and have a good feeling about a single idea, taking things a step further and creating a project on a crowdfunding site may be even more appropriate. Doing so represents more work than creating a simple form, but you will learn far more from it!

In many ways, this “laziness”—doing the minimum now and putting off the hard work till later—is also the reason that we have split the *prototype* from the final product. There is a time to market your project, a time to ensure that the idea works, and a time to build a sellable product. If you are thinking

“lean”, you should be applying this idea at all stages. For example, at the first stages of production and marketing, you should be working towards the “Minimum Viable Product”. This is still a sellable product rather than a prototype, but with all extraneous features removed, it may *feel* like a prototype of your final vision for the product. All the initial efforts are towards making this product because it can be sold. If you have time and money afterward to add additional enhancements to the product, service, packaging, and so on, this will add more value. But adding those enhancements to an incomplete prototype would not result in a working business model.

The essence, then, of lean is to be able to iterate, performing the tasks that are required to get things moving at this stage, without investing time upfront to make everything perfect. The fact that your business model is a *hypothesis* and not set in stone can encourage you to tweak it in response to the feedback you get from iterating your product in the real world. Such tweaks are known as *pivots* and usually work by changing one part of your model—think one of the boxes on the Business Model Canvas. For instance:

- **Zoom-in pivot:** Focus on what was only a part of the value proposition, and turn that into the whole Minimum Viable Product.
- **Customer segment pivot:** Realise that the people who will actually buy your product aren’t the ones you were originally targeting. While you can continue to make exactly the same product, you have been marketing it to the wrong people.
- **Technology pivot:** Accomplish the same goals as before, but change the implementation details. While prototyping will almost certainly involve many changes in technology while you establish the best way to make the product from an engineering perspective, this pivot would be a business decision, made to improve manufacturing costs, speed, or quality.

Ries’s book goes into much greater detail on the different types of pivot and how best to apply them.

SUMMARY

A business model is a hypothesis about how to run a project well, for commercial profit or some other success criteria, to develop a product that solves problems for a specific group of users. Throughout history, people have invented new ways of doing business; new technology is the factor that is most likely to bring about entirely new models. Faced with the certainty that the Internet of Things, as a technological paradigm shift, will facilitate

entirely unexpected new business models, it is increasingly important that you analyse, discuss, and iterate your own model. It is, after all, only a hypothesis and can be changed in the face of the existing evidence. This is one of the important factors of the “lean” approach.

In the fast-moving, competitive, and increasingly business- as well as tech-savvy world of the Internet, it is vital to be able to show your business model to potential investors, partners, and customers. The Business Model Canvas is one useful set of shared categories and terminology that may facilitate your communication and discussion with these groups. This is important because if you are planning to scale up your project into a product, making your vision a reality will rely on their involvement. We looked in particular at investment, from friends and family to angels, government funds, venture capital, and accelerators.

Of course, you need more than funds to create a product. In the next chapter we look at the challenges involved in moving from the project prototype to manufacturing it for a wider market.

