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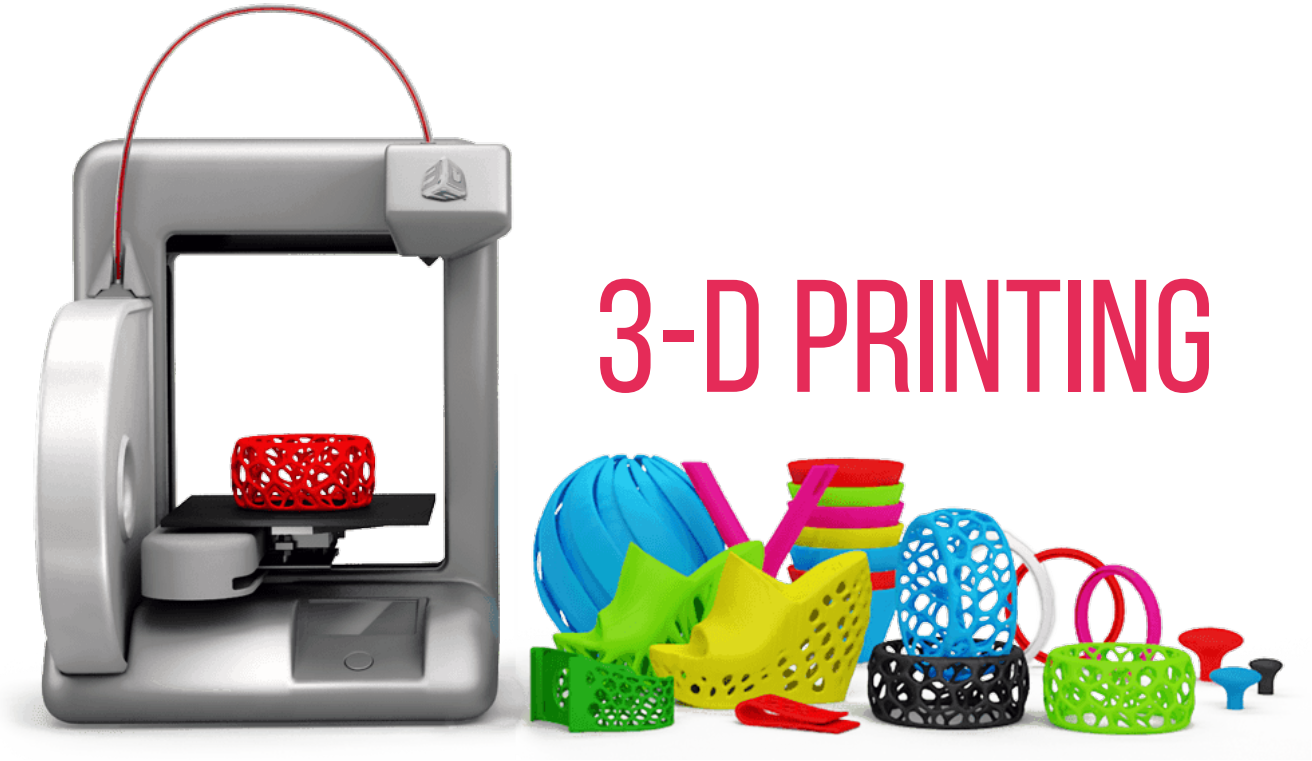

3-D PRINTING

ON THE BRINK OF A CONSUMER BOOM?

- **Total spending on 3-D printing surged 58% to $5.2 billion in 2014.**
- **Use of 3-D printing is currently dominated by professionals, but consumer uptake looks set to boom.**
- **Some 60 million households could have 3-D printers within ten years, FBIC forecasts.**
- **This could mean $39 billion in 3-D printer sales to consumers.**
- **But printer sales are only part of the market's value. Long-term opportunities lie in licensing or selling designs for consumers to print.**

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3-D PRINTING: ON THE BRINK OF A CONSUMER BOOM?

A Burgeoning Market

The 3-D printing market looks set for substantial growth, with consumer ownership and usage of 3-D printers likely to blossom. In this article, we speak to some industry insiders, outline how the consumer side of the market could shape up and look at where we think the value is likely to lie.

Let's start with some numbers on the total value of the 3-D printing market. It's already growing impressively as a result of its nascent status. According to Canalys, an IT insight firm:

- Total spending on 3-D printers, materials and services surged by 58% year over year, to US$5.2 billion in 2014.
- Total spending on 3-D printing will see a 44% compound annual growth rate, to reach US$20.2 billion worldwide in 2019.
- Worldwide shipments of 3-D printers leapt by 68%, to 133,000 units in 2014.
- By region, the Americas lead, with a 42% share of printer shipments in 2014, followed by Europe, the Middle East and Africa at 31%, and the Asia-Pacific region at 27%.

Unsurprisingly, a number of big names in 2-D printing are now piling into the market: Canon, Epson and Hewlett-Packard have all said they are developing or launching 3-D printers.

Get Ready for a Consumer Boom!

Consumer Demand vs. Professional Usage

A big shift is coming, and consumer purchases of 3-D printing products and services are expected to grow fast. The 3-D printing industry is currently dominated by professionals working on product development, including rapid prototyping. Broadly speaking, this includes designers in areas such as engineering and architecture, who use computer-aided design (CAD) and benefit from handling a physical prototype. This type of usage will remain, but the professionals will be joined by consumers.

Consumer Uptake Looms

Consumer demand for 3-D printing will almost certainly thrive, but it will likely not happen just yet.

"We believe the market will be much bigger than the 20 million CAD users," Romain Kidd, CEO of 3-D printing shop iMakr, tells FBIC. In the same way most people now have access to an ink-jet printer, "almost everyone will have eventually have access to a desktop 3-D printer, whether that is in their home or workspace or through a vendor," Kidd says.

This view is shared. Jim Larsen, Director of the world's biggest 3-D printer store, 3D Printhuset in Copenhagen, tells us he expects to see "heavy growth" in consumer ownership, but that "it will probably take a few years until we see adoption in the mass market."

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Canalys analyst Joe Kempton also forecasts strong demand in coming years: "We expect to see the consumer sector advance at a rapid pace," he says. "Many of these 3-D printers will be plug-and-play devices that will begin to hit the $500 sweet spot," which will prompt wider uptake.

But Price Is Not the Main Issue

Consumer uptake is not just about hitting a low price point, however. Adoption rates depend much more on ease of use and plug-and-play convenience. After all, you can already buy 3-D printers for under $500.

"Desktop machines need to be printing better quality, [and be] easier to use and faster," Kidd tells FBIC. Larsen agrees, saying issues with "calibrations, poor software and connectivity" mean using the machines requires technical know-how. Consumer uptake "will depend on these issues and not the price," says Larsen.

"We need software that makes it easier to print," says Klaus Mogensen, Senior Futurist at the Copenhagen Institute for Futures Studies. "And we need more intelligent software that can tell the user if the design is suitable for 3-D printing."

Consumer Familiarity Matters Too

Consumers need to be able to answer the question "What can we use a 3-D printer for?" says Mogensen. A lack of familiarity with the concept and its application to their lives is a barrier still to be overcome.

And a shift in consumer motivations to print will help drive mass uptake, says Liza Wallach, co-founder of HoneyPoint3D, a training and education company. "The tipping point is when consumers have a desire–not just a need–to print objects," says Wallach.

What Will Consumers Be Printing?

In response to this question, Kidd says, "Almost anything." Mogensen concurs, "The application is enormous." Domestic users could be printing toys, (plastic) jewelry, accessories and spare parts in years to come. If this proves to be the case, device ownership will break out of consumer niches such as do-it-yourselfers and hobbyists and into the general population.

When Will This Happen?

One big unknown so far is time scale: Right now, it's unclear how long it will take for consumer adoption to gain traction. In large part, this is because making the devices quick and simple enough for mass consumer use requires further technical improvements, and we don't yet know when those will happen.

Fledgling Retail Activity

There are three core business models that can serve demand for 3-D printing:

- Stores selling desktop printing devices for at-home and at-work printing.
- Printshops offering print-on-demand services.
- Remote printing, similar to online photo-printing services, where the customer uploads designs and the finished product is mailed out.

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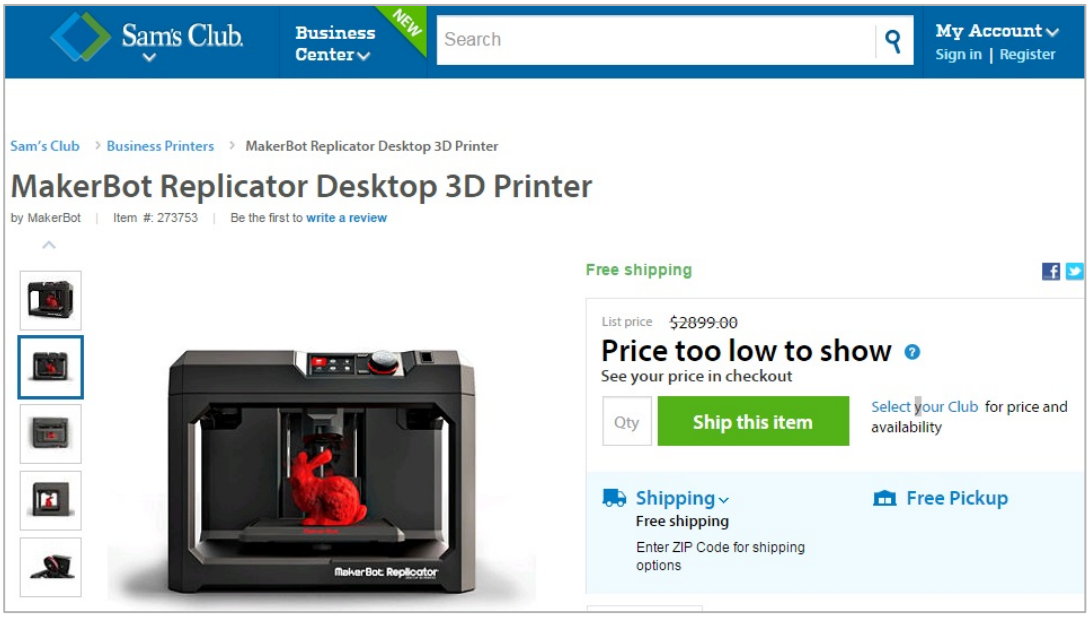
In each of these areas, we've seen some big, mass-market retailers offer headline-grabbing, consumer-friendly options to shoppers:

- In the traditional retail market, US shoppers can now buy MakerBot 3-D printers in Sam's Club stores.



- In the printshop-services arena, UK supermarket Asda launched "mini-me" 3-D printing booths in some of its stores, allowing shoppers to print miniature models of themselves.

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- And in the remote-printing area, Amazon launched a 3-D store in July 2014 that offers ready-made and customizable printed items.

Big Waves Ahead

We think physical and virtual printshops are likely to lead the charge into the consumer market. Just as Internet cafés brought online access to many consumers in the era of Web 1.0, so 3-D printshops are likely to introduce this technology to shoppers.

At-home ownership of devices will probably follow. But printshops are likely to be sustained by consumer demand for more complex projects, as a complement to simple at-home printing tasks, thinks Larsen from 3D Printhuset. Danish Futurist Mogensen and HoneyPoint3D's Wallach both agree, saying printshops will differentiate from at-home printing by offering more advanced and better-quality printing.

What Are the Prospects for the Consumer Market?

Domestic Ownership Forecast

Predicting uptake for such a nascent market is tricky. And it's more complex for the 3-D printing market because mass adoption is largely dependent on technical improvements, the timing of which is hard to foresee. We're likely to see a jump in uptake once printers become easier and faster to use.

- As a ballpark forecast, we think worldwide domestic ownership of 3-D printer units could reach 60 million households over the next decade, representing around 4% of all households worldwide. The basis for our forecast is outlined below.
- Major uptake will not begin until two or three years' time, we forecast. Ownership rates will jump once technical improvements reach the market.

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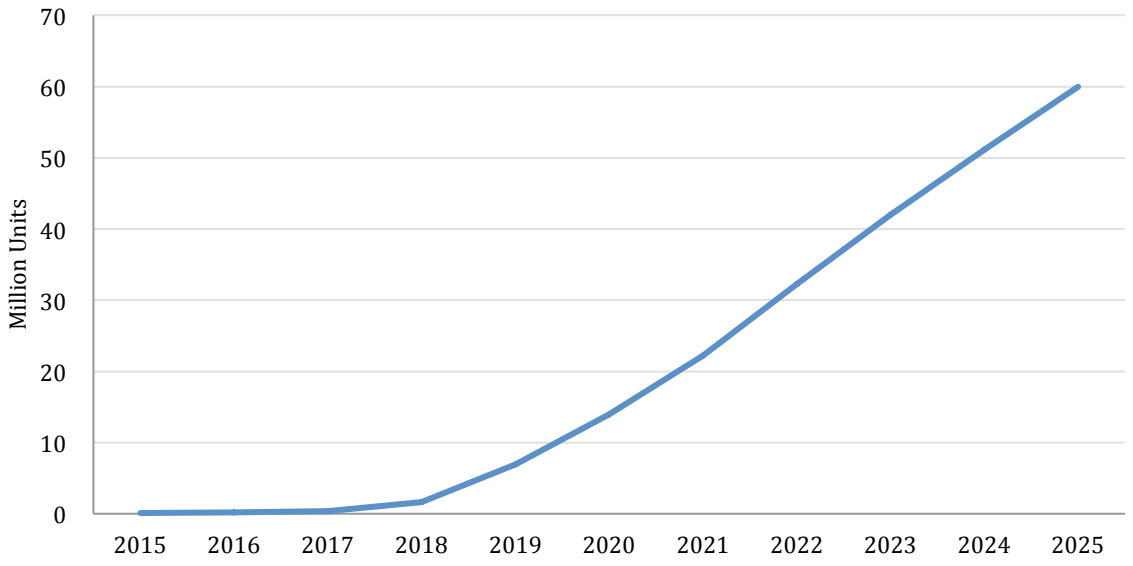
- In the early years of growth, year-over-year increases in ownership will be exceptionally high (from low base figures). Later, year-over-year growth in ownership is likely to settle in the low double digits.
- We forecast that, at peak growth, about 10 million 3-D printers will be bought per year for domestic use.

Figure 1. Projected Household Ownership of 3-D Printers



Source: FBIC Global Retail & Technology forecasts

To place these figures in some context, let's compare them with some other household devices and tech products that are on the discretionary end of the spectrum:

- US coffee brand Keurig says it sold 10.9 million of its K-Cup coffee machines in 2014.
- Some 13.6 million health-and-fitness tracker devices were sold worldwide in 2014, according to GfK.
- And 7 million dishwashers were sold in the US in 2014, according to *Appliance Design* magazine/Association of Home Appliance Manufacturers.

Household Penetration Rates

Here's some reasoning behind our math. The table below shows total number of households for a handful of substantial, advanced economies. We've picked countries that have relatively mature levels of Internet adoption, which reflects more tech-savvy and affluent populations.

- If 3-D printers eventually reach penetration levels of one household in 10 in these regions, then that would suggest 31.5 million units in domestic use.
- In turn, a household adoption range of 5%–20% across these markets would suggest 16–63 million domestic devices.
- The countries listed represent just 16% of the approximate 1.9 billion global households, although they are among the most economically and technologically advanced. So, if we add in countries such as China, with 372 million households (in 2013), the picture becomes much bigger.

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Figure 2. Number of Households and Potential 3-D Printer Penetration Levels: Selected Countries

	Households* (Millions)	At 10% 3-D Printer Penetration (Millions)
US	116.7	11.7
Japan	51.8	5.2
Germany	36.9	3.7
UK	26.4	2.6
France	27.1	2.7
South Korea	15.9	1.6
Canada	13.3	1.3
Norway/Sweden/Denmark/Finland	11.5	1.2
Australia	7.8	0.8
Netherlands	7.6	0.8
Total of the Above	315.1	31.5
At 20% 3-D Printer Penetration	**63.0**	**N/A**
At 10% 3-D Printer Penetration	**31.5**	**N/A**
At 5% 3-D Printer Penetration	**15.8**	**N/A**

**Latest data available, mainly from 2011 or 2013.*

Source: National statistics/United Nations/FBIC Global Retail & Technology estimates

Our forecast may well prove conservative.

One-third of homes in the West could have 3-D printers within 20-30 years, says Wallach. Mogensen thinks fully 50% of households in some technologically advanced Western countries could own a 3-D printer, but reaching this level may take up to 20 years.

Mogensen also says that 3-D printing may appeal in developing countries, where access to off-the-shelf products may be more limited; just as some developing countries jumped straight to mobile Internet connectivity and bypassed the desktop phase, we could see a move to 3-D printing to serve consumer demand for hard-to-get products.

What's the Potential Market Value?

Let's take our ballpark math one step further. If we assume global consumer ownership of 3-D printers reaches 60 million devices in the next decade, at an average consumer price of US$650 across the period, that would suggest around US$39 billion of accrued global spending by consumers on 3-D printer hardware through 2025.

Intellectual Property Provides Potential Revenue Stream

Buying printers is only half the story. Users need the materials, training and, crucially, workable designs in order to print. Once access to printers is established, the designs become the bottleneck…and the business opportunity.

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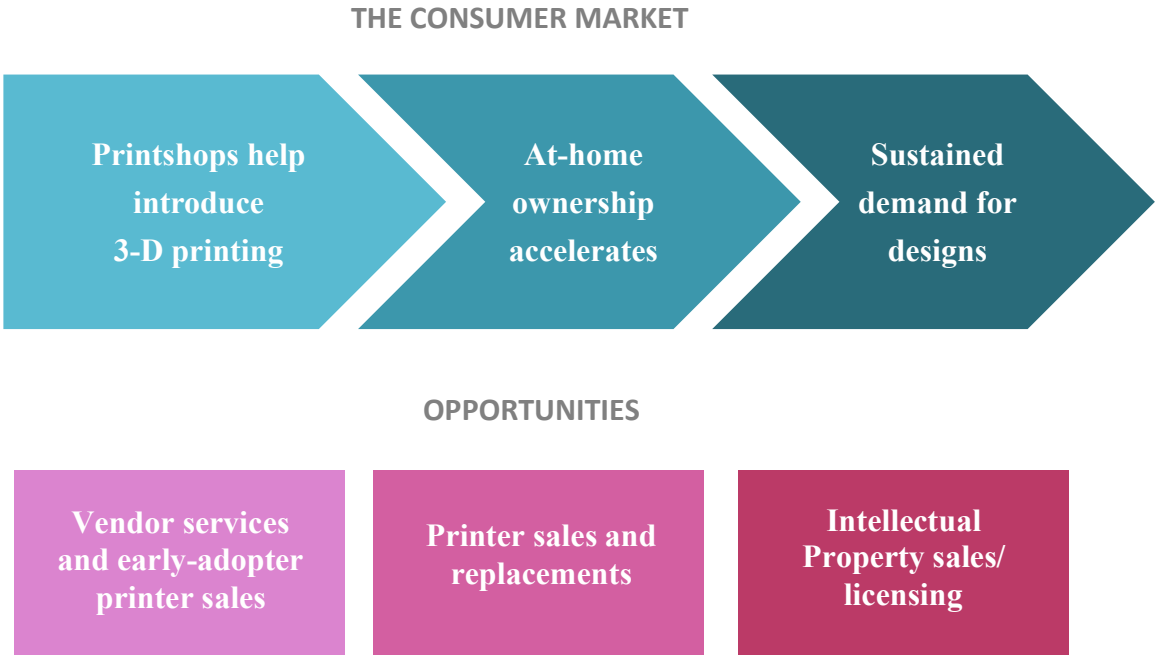
If users hope to print anything and everything—from a new case for their mobile phone to a children's toy to a spare part for their coffee table—then they'll need the designs to do so, which implies major long-term value in the sharing and selling of printable designs. "Designs will be very valuable," says Nick Kloski, co-founder of HoneyPoint3D, "Once you get designs, people will want to monetise that".

There are echoes here of the iPod and tablet computer ecosystems: demand for content (or intellectual property) provides the revenue stream once the device has been bought. The natural conclusion is that device makers will race to tap the market for designs. This suggests that we may see some device manufacturers follow the Amazon Kindle model of selling hardware at near-cost prices in order to generate long-term revenue from intellectual property.

In summary, this is the potential progression of consumer adoption—and where the resulting market opportunities are likely to lie.

Figure 3. The Potential Pathway of Consumer Adoption



Source: FBIC Global Retail & Technology analysis

But Intellectual Property Will Prove a Complex Market

Tapping consumer demand for designs will not necessarily be straightforward.

- First, designs will in many cases need to be customizable, since one selling point for do-it-yourself printing is being able to tailor a product to your own needs or desires. "Design will be a much more dynamic process," says 3D Printhuset's Larsen. "It won't stop with the designer; the user will also be a part of the process."
- Second, a complex ecosystem will likely emerge around designs. "There will be competition between open source and private enterprise, and between legal and pirated designs," cautions Mogensen. "Intellectual property is a complex issue." Much like the ecosystems we see around operating systems, software, and content in MP3 and MP4 formats, there will be different providers serving the market for designs, both legally and illegally.

One outcome of this complexity is likely to be a race for leadership: suppliers, whether open-source marketplaces or for-profit companies, face a battle for control of the design market.

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In Summary: What's Ahead

- The consumer market for 3-D printing will take off—but not just yet.
- 3-D printers need to be made easier and faster to use before they'll appeal widely to consumers, and domestic users need to understand what they'll use 3-D printers for.
- Ultimately, we think selling 3-D printer hardware is likely to constitute only a minority of the total consumer market value.
- As in some other tech-focused markets, intellectual property—rather than hardware—provides a more valuable, on-going revenue stream.
- The market for designs will likely create a complex ecosystem, similar to those we already see in software and digital content.
- So, we could see companies adopting the "Amazon Kindle" model of selling hardware at near-cost prices in order to generate long-term revenue streams from intellectual property.

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