



FORMLABS WHITE PAPER:

When to 3D Print In House and When to Outsource

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Prototyping with 3D printing helps teams communicate with stakeholders and ultimately results in better end products. At a relatively low cost, teams can show 3D printed prototypes to customers, business partners, and people across the company. Designers can receive feedback and quickly iterate designs. High quality visual prototypes can be used for marketing and sales. Functional prototypes can be user tested and quickly revised, resulting in an end product that meets customer needs.

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There are three main methods of prototyping with 3D printing: you can outsource to a 3D printing service bureau, 3D print in house with industrial machines, or 3D print in house with desktop 3D printers.

3D Printing Methods: Overview

3D PRINTING SERVICE BUREAUS

Service bureaus are best for low quantity and high complexity. Choose this option if you need less than 5 parts per month, especially if those parts are large and call for non-standard materials. Service bureaus are also useful when your parts have very different materials or applications. In other cases, this is by far the slowest and priciest option.

IN-HOUSE INDUSTRIAL 3D PRINTERS

In-house industrial 3D printers are a solid option for large batches of parts (200 a week or more) with the same material and a size over 30cm³. Still, industrial machines are often not used enough to make the cost worthwhile, unlike desktop machines.

DESKTOP 3D PRINTERS

Desktop 3D printers are great when you need parts quickly. If you print a large batch of parts (200+) per week, then a print farm of multiple desktop machines is cheaper than and just as effective as an industrial machine. Multiple printers would also give you more flexibility and would give you access to several materials at once. Service bureaus can be occasionally added to this flexible workflow if you occasionally need larger parts or uncommon materials.

Black and Flexible Resin brush prototype, printed on The Form 2.



3D Printing Methods: Pros and Cons

METHOD	PROS	CONS
Service Bureau	Usually have several technologies in house such as SLA, FDM, and SLS.	Higher cost than in-house desktop and (at a high throughput) industrial 3D printers.
	Have more materials available than an in-house system.	Much slower than in-house 3D printing (can take several weeks instead of one day).
	The bureau can give advice on the best materials and their limitations.	
	If you're not pleased with the bureau, it's easy to fire and forget.	
Industrial 3D Printer	Lets you take a deep dive into the technology.	Significant investment: about \$30,000 for an entry-level system, \$300,000 for a true manufacturing system.
	Quicker than service bureaus.	True manufacturing systems require over 30m ² of floor space, industrial HVAC, finishing stations, cleaning stations, etc.
	Lower cost than service bureaus at high throughput.	For a true manufacturing system, accounting for all costs, a single build would cost more than a desktop 3D printer (Approximately \$3,000 plus usage and labor).
		At a low throughput, this has a higher cost than both service bureaus and desktop 3D printers.
		Higher cost per part and higher TCO than desktop 3D printers even at a high throughput.
		Limited range of materials compared to service bureaus.
		Material cost for industrial machines ranges from \$45 to \$360 per lb.
		Requires an FTE.
Desktop 3D Printer	Lowest up front investment.	Lower reliability and repeatability than industrial machines.
	Lowest cost per part and lowest TCO.	Smaller build volume.
	Quickest time to part.	Many desktop 3D printers don't have great warranties or support.
	Lets you take a deep dive into the technology.	
	Smallest form factor, lowest requirements for your office, and least required space.	



White and Flexible Resin toothbrush prototype, printed on The Form 2.

The method you choose should be tailored specifically to your workflow and project goals. Here are the biggest considerations before choosing the method that's right for your team:

- How many parts per week will you need?
- How quickly will you need your parts?
- What materials will you need?
- What is the function of your parts — visual display? Functional prototyping? Casting into end products?
- How many of your parts can you fit into one build volume of a desktop and an industrial machine?
- Order sample parts from various service bureaus and 3D printer manufacturers. Ask each company to provide more information about the sample part such as: how long did it take to print, how much material was used, and the layer thickness.
- Calculate cost, machine usage, and time to part.
- Attend 3D printing meetups and ask printer owners how happy they are with their machines.
- Go to 3D printing events to speak with vendors and service bureaus about service contracts and TCO.

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For most teams, the best choice is to have several in-house desktop printers and to outsource to a service bureau for large parts. This is almost always the most cost effective choice for not only design and engineering teams but also large multinational companies. Industrial machines are often under-utilized, so they don't pay for themselves over time like desktop 3D printers do. Industrial printers are best when you need large parts with high compliance such as for the aerospace and medical industries. Whatever option you choose, your 3D printing system should be tailored to your needs. With enough research, it's easy to find the best option for your team.

