Tech-Clarity

Five Ways Shape Search Drives Business Value

Jim Brown | President | Tech-Clarity

In Search of … Effective Search

Finding engineering data is frustrating. Search consistently shows up in our research as a challenge that leads to inefficiency for engineers and others relying on information to do their jobs.

Poor search capabilities are more than just a nuisance, they cost companies time and money. Some may be surprised at not only the number of ways improving search can save money, but how it can positively impact top line revenue. We'll explore these benefits and then provide a template to quantify the value companies can achieve.

A lot of energy has been put into helping companies find parts. There are multiple strategies and approaches to find parts including keyword, metadata, and semantic search. Another technology that's reaching the mainstream is geometric search, also known as "shape search."

Over 1/3 of non-value-added engineering time is spent searching for data or recreating data that can't be found.

Reducing Non-Value Added Work in Engineering - Tech-Clarity

These search tools are better when used in combination, and more valuable when coupled with strategies like filtering results. Of course it's not finding just any part that's difficult, it's efficiently finding the part that you need to help you do your job when you need it. Speed is the name of the game for search, and efficient search relies on strategies like advanced indexing to perform quickly enough to be useful. Let's learn more.

Limitations of Classic Search Methods

Before diving into the value of shape search, it's important to understand the gap it fills. Most search is based on text. It works on metadata or keywords that were either entered by hand, auto-generated, or extracted from underlying documents like CAD files. This information is notoriously inconsistent.

Despite best attempts to categorize and classify data, most strategies rely on people to consistently follow standards and conventions.

"Some of the old models are not named or classified correctly so finding parts can be a nightmare."

Design Engineer | Hydraulics | JCB

"People enter the wrong information, spell things incorrectly, use the wrong naming, or might just call it something different in the US or the UK, let alone China."

Andrew Lodge | Head of Engineering Systems | JCB

Adding naming standard checks in review cycles can help, but manual entry leads to errors. Even auto-generated data is prone to variability as data is moved, migrated, integrated, and transformed over time. Couple those with multiple languages, different supplier naming conventions, CAD systems that manage information differently, mergers and acquisitions, and other business realities and "things happen" resulting in data that isn't uniform and readily searchable. Text-based search isn't enough!

A Primer on Shape Search

This eBook isn't intended to be a deep dive on shape search tools or technology, but a brief overview is in order before putting 3D geometric search into business context and explaining where it provides unique value.

Shape search does not rely on text. As the name implies, it relies on three dimensional geometry. Geometry is a universal language, and like parts tend to have similar shapes regardless of what they're called. That's true for common items like bolts, brackets, and other fasteners, but also for items like castings. As the rule states: form follows function.

3D shape search applies mathematical algorithms to identify geometric similarity. Matches might be duplicates, or may be the same part in a different color or material. But the technology is also smart enough to find similarities, for example to help look for a part "like this bracket." Or, it can be used to find something that looks similar to a sketch or perhaps a laser scan of a physical part so a designer can find a related part. Then, continued refinement by selecting other items yields new results. Those results can be combined with other search mechanisms to further narrow down the results.

Hopefully that's enough of a primer, let's focus on how it helps the business!

"It's nice to see an image of a part, this is a much better (faster) way of identifying parts. It's also useful when you've found a part that's close to the one you wanted but might need something slightly bigger or smaller."

Michael Wright | CAD & PLM Manager | JCB

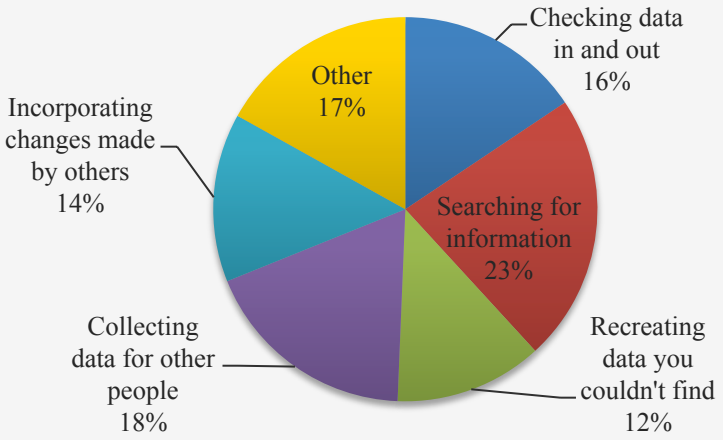
Value Driver 1: Improving Direct Engineering Productivity

Let's start with the easiest and most straight-forward value. Shape search lets engineers stop wasting time searching for items. Searching for parts is a huge efficiency killer and takes away time that could be spent innovating, reducing cycle times, or optimizing designs.

Inefficiency isn't just the result of time spent searching. It also includes time recreating information that can't be located and looking up product information for others.

Many engineers are honest in saying that it's much easier for them to create a new part than to find an existing one. That's not good for the engineer, because they're wasting their time recreating things that already exist. It's also bad for the business, because it leads to part proliferation which is wasteful at an even larger scale (more on that later).

Poor search efficiency isn't just a minor source of frustration, it's a real business issue. Specifically,



Reducing Non-Value Added Work in Engineering - Tech-Clarity

"*Manufacturers report their engineers spend 1/3 of their time (on average) on non-value added work*" and that "*the largest contributor to non-value added time is related to trying to find information*," according to Reducing Non-Value Added Work in Engineering. That's a lot of opportunity to give time back to engineers to spend on designing and innovating.

Value Driver 2: Part Standardization and Reuse

Reuse is simply good business. The time spent designing a part is only a fraction of the cost of a part across its lifecycle. Each part created goes through a series of steps to validate and release it. That could include detailed designs, creating CAD models and drawings, simulations, testing and inspection procedures, regulatory reviews, and supplier costs such as identification, screening, sourcing, contracting, and more. Each step costs time and money, opens up the opportunity to introduce errors, and wastes the value of time and field tested parts.

"Reuse and rationalization are on the front of everyone's minds. It's not just cost, but also engineering time, testing, and serviceability. Every time a part is reused there are a whole lot of things we don't need to do."

Andrew Lodge | Head of Engineering Systems | JCB

This is all before a part is purchased and incurs inventory carrying costs including cost of capital, warehousing, insurance, and other expenses. We've seen company estimates for just the administrative cost of setting up a part in their ERP system reaching thousands of dollars!

Shape search can help companies with part classification and consolidation projects by updating metadata of similar parts. Even better, part search can eliminate duplicate parts at the point an engineer makes the decision to include a part in their design in the first place.

The resulting reuse allows companies to continuously improve quality, optimize parts over time, and support the use of preferred parts to help fulfill corporate strategies like using preferred suppliers, volume purchase discounts, and other techniques.

Value Driver 3: Reusing Ideas and Concepts

Not every part a company needs has been designed before. Engineers are innovating and creating new products, maybe even brand new product categories. In this case, it's not reasonable to think that you'll be able to find existing parts for everything, with the possible exception of standard fasteners and other COTS (common, off the shelf) parts. But that doesn't mean you should start from scratch.

Even creating a quick sketch and running a shape search can provide interesting results. An existing bracket may not fit a new product, but it might get an engineer most of the way there. If nothing else, they might learn from somebody else. "*Finding a similar part gives us insight, we can understand why it was designed that way*," explains JCB's Lodge.

Shape search is a great way to extend the value of company intellectual property (IP). Looking by shape can give designers a jump start, and

Activity	Hours to Support the Task	Cost (@ $100/hr.)
Average search time for a part[a]	4	$400
Duplication of effort	2	200
Cost of Establishing a New Drawing of a Standard Part		
Documentation (creation, review & release time; including part analysis & approval)	60[b]	6,000
Failure rate analysis	12[c]	1,200
Maintenance of standard	15	1,500
	Total	**$9,300**

Recurring Costs for Engineering and Design - Reduce Program Costs Through Parts Managements

combining results with additional information goes even further. By combining shape search with a PLM system, engineers might identify prior revisions or related designs that offer a novel approach that saves money or reduces a costly maintenance issue in the field.

Shape search can drastically save on engineering effort and go further to help the total cost of adding a new part (see graphic).

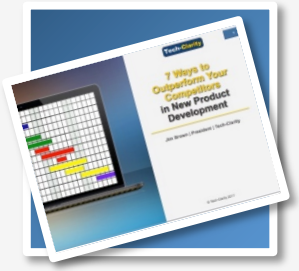
Value Driver 4: Shorten Time to Market

Tired of hearing about cost savings from shape search? OK, nobody in today's competitive markets ever gets tired of cost savings, but let's move on to discuss improving the top line.

Cost and efficiency aren't the only product profitability levers that shape search can improve. Using shape search to find existing parts or designs also reduces design and release cycle times. Existing parts don't need as extensive testing and validation. This can be especially valuable for fast-moving markets where time to market is of the essence or for an industry that requires formal certifications.

Reusing parts and designs, on the other hand, reduces risk and potential delays. It speeds up the product development process so new designs can be introduced quickly. This allows companies to take advantage of market opportunities such as higher profit margins and market share due to "first mover advantage."

As with cost, advantages aren't limited to the engineering phase. A new part might require new manufacturing processes that take time to develop. If new tooling, fixtures, or molds are required then the time expands quickly. Existing parts don't take time to plan the supply chain, either, while new parts might require new sources of supply, validating new suppliers, and negotiating new terms. This all takes up precious time that could be avoided with shape search.



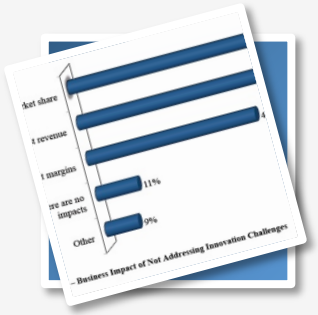
"Top Performers place twice as much emphasis on time to market as their less capable competitors."

7 Ways to Outperform Your Competitors in New Product Development – Tech-Clarity

Value Driver 5: Enhanced Innovation

Reuse and standardization hampers innovation, right!? That's not the case. Companies that put in place reuse programs, from our experience, find this to be a bit of a myth.

Companies can't innovate on everything all of the time. Instead, they have to focus on innovating where it counts – where it will provide new value to the customer. The fourteenth new size of cotter pin isn't likely to excite the customer and drive higher margins.



Not addressing innovation challenges leads to:

- *Lost market share*
- *Lost revenue*
- *Poor profit margins*

How to Empower R&D and Engineering Teams to Innovate with New Materials – Tech-Clarity

In fact, the majority of companies find that today's innovation value comes from product software as opposed to mechanics. This doesn't diminish the importance of mechanical design, and there's certainly a lot of innovation coming from new materials and manufacturing methods like additive. But innovation must be targeted.

Reusing existing parts where possible helps engineers focus on exploring opportunities and innovating on the right things. It also gives them more time to do it, assuming they can find an existing part efficiently.

Shape search can also spark ideas that wouldn't come up with normal search method. Many companies that implement new search technologies report finding products or ideas that they didn't know existed or haven't been seen for years that can be applied to current projects. Shape search expands engineers' ability to tap into corporate knowhow to innovate efficiently.

Calculating the Value

So how do you put a value on shape search? US government research on reuse and parts standardization can help. The research found that the average cost for adding a part is $27,500 (see graphic) for what they describe as a "fairly modest part." That number certainly varies by complexity, compliance requirements, and other factors; but it's a big number. With today's complex products with hundreds or thousands of parts – that adds up quickly!

The numbers will vary for your company, but the numbers are so compelling that's probably OK. For example:

- If you agreed you could reduce part proliferation by 1%, that would more than likely pay for the shape search technology many times over
- If you ignored the rest and agreed that search speed would improve by 15%, that would save 1% of your overall engineering time

Table 1. Average Costs for Adding a Part into a System

Activity	Cost
Engineering and design	$12,600
Testing[a]	1,000
Manufacturing	2,400
Purchasing	5,200
Inventory	1,200
Logistics support	5,100
Total	$27,500

SD-19 Parts Management Guide - US Defense Standardization Program Office

That's cost savings, room for your company to grow without having to hire new staff, or time to develop more new products! Given the relatively low investment required for shape search and the fact it leverages existing 3D assets, it's typically low hanging fruit for companies to improve productivity and save money!

Conclusion

Search is an area that's ripe for improvement. 3D shape search is a proven technology that can help, and is stronger when combined with other search methods. Shape search is becoming mainstream and more commonly integrated with underlying systems like PLM. It can be fast if indexing is done correctly ahead of time (pay attention here, solutions vary greatly in scalability).

Shape search helps reduce direct cost, but also improves innovation and time to market to drive top-line improvements. Because of the business value of reuse, shape search should be a best practice. It should be built into processes like new part requests to institutionalize it.

One of the biggest objections we hear about shape search is that "it sounds too good to be true." We recommend that you pilot a solution using your own data to see for yourself.

Better parts management can help a program with 10,000 parts "easily save $5 million."

Reduce Program Costs Through Parts Managements - The Parts Standardization and Management Committee

"We introduced shape search as part of our reuse measures."

Andrew Lodge | Head of Engineering Systems | JCB

www.tech-clarity.com
clarityonplm.com
@jim_techclarity
TechClarity.inc

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About the Author

Jim Brown is the President of Tech-Clarity, an independent research and consulting firm that specializes in analyzing the business value of software technology and services. Jim has over 20 years of experience in software for the manufacturing industries. He has a broad background including roles in industry, management consulting, the software industry, and research.

Jim's experience spans enterprise applications including PLM, ERP, quality management, service lifecycle management, manufacturing, supply chain management, and more. Jim is passionate about improving product innovation, product development, and engineering performance through the use of software technology.

Jim is an experienced researcher, author, and public speaker and enjoys the opportunity to speak at conferences or anywhere he can engage with people with a passion to improve business performance through software technology.

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