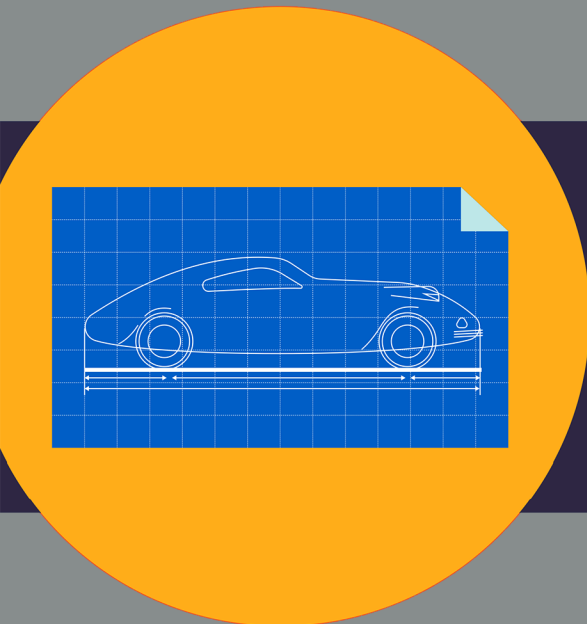


# INDUSTRIAL DESIGN

A Competitive Edge for U.S. Manufacturing Success in the Global Economy





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**Industrial design** is an underutilized catalyst for growth for small and medium-sized manufacturers and a key ingredient for the future success of these firms.

This report makes the case that industrial design is an underutilized catalyst for growth for U.S. small and medium-sized manufacturers (SMMs) and a key ingredient in the future success of these firms. SMMs are defined as manufacturing companies employing fewer than 500 people. The success of these firms is key to the U.S. manufacturing sector as SMMs create 56% of all new manufacturing jobs, comprise 98% of manufacturing firms and complete 60% of the process of taking goods from raw material to consumer product.<sup>1</sup>

The U.S. manufacturing sector is facing many well-documented economic issues. SMMs, particularly the supply chain firms who provide parts and components to large manufacturers, are challenged because they have limitations that large firms do not. They have fewer resources and a slower pace of innovation.<sup>2</sup> They also have less market diversification,<sup>3</sup> in that they often have one or two dominant customers. When such challenges affect a segment of an industry it is a market failure,<sup>4</sup> such that SMMs do not have the same access to resources and information as large manufacturers and thus are affected negatively. This creates a space for intervention in response to the challenges faced by SMMs. Several regional partnership models are in place that show how integrating industrial design into SMM manufacturing operations can be a significant growth factor for these firms.

This report is informed by an extensive literature search and interviews with experts in the industrial design and manufacturing fields. More than 40 interviews were conducted nationwide with leaders of design firms, professors teaching in design schools, and directors of leading manufacturing associations, and MEP Centers.

The report distinguishes between Design for Manufacturing and Industrial Design. Design for Manufacturing (DFM) is the general engineering art of designing products in such a way that they are easy to manufacture, whereas, according to the Industrial Designers Society of America, Industrial Design is the professional service of creating products and systems that optimize function, value and appearance for the mutual benefit of user and manufacturer.<sup>5</sup>

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<sup>1</sup> The White House, Executive Office of the President and the U.S. Department of Commerce. *Supply Chain Innovation: Strengthening America's Small Manufacturers*. (March 2015). [https://obamawhitehouse.archives.gov/sites/default/files/docs/supply\\_chain\\_innovation\\_report\\_final.pdf](https://obamawhitehouse.archives.gov/sites/default/files/docs/supply_chain_innovation_report_final.pdf).

<sup>2</sup> Schumpeter, "Big and Clever: Why Large Firms Are Often More Inventive than Small Ones." blog, *The Economist* (Dec. 17, 2011). <http://www.economist.com/node/21541826>.

<sup>3</sup> Mike Collins, "The Argument for Market Diversification in Manufacturing." *Forbes* (August 24, 2015).

<sup>4</sup> Library of Economics and Liberty, *Market Failures, Public Goods, and Externalities*. <http://www.econlib.org/library/Topics/College/marketfailures.html>.

<sup>5</sup> Industrial Design Society of America, *What Is Industrial Design?* <http://www.idsa.org/events/what-id>.

“Now that **design thinking** is everywhere, it’s tempting to simply declare it dead - to ordain something new in its place. It’s a methodology always in pursuit of unforeseen innovation, so reinventing itself might seem like the smart way forward. But in practice, design thinking is a **set of tools** that can grow old with us. And I’d argue that in order to create sustained competitive advantage, businesses must be not just practitioners, but masters of the art.”

-Tim Brown, CEO, IDEO



Industrial design is not a new field; it has been around since the mid-18th century. What is relatively new in the past decade is the recognition of industrial design as a means to significantly increase a company's value through design thinking, a process which adapts industrial design methodologies to a wide range of business problems. Design thinking is generally defined as the creative and iterative process of identifying company-wide and specific product-related problems and opportunities, analyzing possible solutions with the manufacturing process in mind, and developing answers that address all aspects of a product's usefulness to the end user.<sup>6</sup> With growing global competition, intense pressure for successful product launch, the rise of Apple and the Internet of Things, and greater demand by customers for a better user experience, industrial design has become more important for manufacturing firms than ever before.

Many large manufacturers understand industrial design and embrace the skills and capabilities of industrial designers. Large companies have the resources to employ industrial designers or engage industrial design firms, enabling them to reap the benefits of the designer's work. Manufacturers that integrate industrial design into their firms often see increases in the company's corporate value, growth of market share and penetration, acceleration in the pace of innovation, and a stronger overall company culture.

Small and medium-sized manufacturers (SMMs) can benefit from industrial design in much the same way that large manufacturers have. Yet the majority of SMMs have not done so for a variety of reasons, such as insufficient funds, lack of senior management commitment to design, and identifying qualified designers.<sup>7</sup> Often these firms are unaware of what industrial design can do, not only for creating products but also for improving business processes. They do not encounter industrial designers as part of their usual networks, and therefore do not have connections to them. Most notably, they do not appreciate the value an investment in industrial design can generate for their entire firm. For all of these reasons, SMMs may not realize the benefits that industrial design can bring to their firms, leaving them at a distinct disadvantage.

A few examples of local and regional partnerships involving SMMs and industrial designers are already occurring around the country, offering models that could be replicated. These programs inform SMMs about the value of industrial design through education, events, and challenges or competitions, they place industrial design students in internships with SMMs, and they connect industrial designers with manufacturers to better utilize manufacturing capabilities.

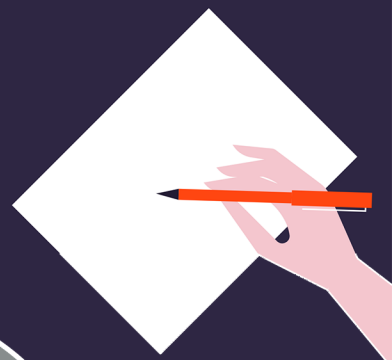
This report suggests that partnerships between manufacturers, service providers, government entities, foundations, universities, design firms, and other stakeholders could be formed to implement these kinds of initiatives more broadly in order to support SMM growth. The three core tactics that this report describes as potential actions are:

- Raise awareness about the value of industrial design
- Provide examples of how SMMs can access industrial design consulting services
- Connect designers with manufacturers

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<sup>6</sup> *Steam Engine USA Final Report – Year 1*, prepared under contract with the Rhode Island Commerce Corporation with financial support from the Office of Economic Adjustment, Department of Defense, 53.

<sup>7</sup> Margaret Bruce, Rachel Cooper and Delia Vazquez, "Effective Design Management for Small Businesses." *Design Studies* (September 3, 1999). vol. 20, no. 3, doi: 10.1016/S0142-694X(98)00022-2.



## WHY USE INDUSTRIAL DESIGN?



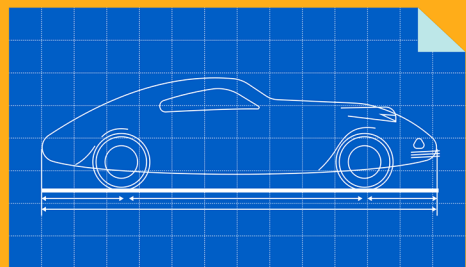
Intensifying global competition among firms



Product success heavily influenced by design thinking



Integral to user experience and satisfaction



"Awareness of the value of good design is at an all-time high. Good design is recognized as a major differentiator in ensuring product success in a crowded global market. Evidence abounds that more people in business or society understand that."

-Paul Hatch and Deana McDonagh, *Realize: Design Means Business*



## WHY IS INDUSTRIAL DESIGN SO IMPORTANT NOW?

Successful innovation is essential for a manufacturer to meet consumer expectations and demands, and industrial design is a key element in product innovation. A variety of external factors are impacting manufacturers today as they work to differentiate their products, illustrating why industrial design has become so important:

### **Global Competition and the Importance of Innovation**

#### **Design Thinking's Impact on Product Success**

#### **The Rise of Apple**

#### **Customer Demand for a Better User Experience**

#### **The Internet of Things**

The following examples illustrate how these forces are influencing large manufacturers seeking to differentiate themselves in global markets. These trends point to the evidence of design's importance for major corporations and suggest how smaller firms might benefit from engaging with these factors as well.

## Global Competition and the Importance of Innovation

The growth of global manufacturing competition has pressured companies to distinguish themselves on features other than price, volume, speed, and quality. In some industries, particularly in steel, cotton, tobacco, coal, and electronics,<sup>8,9</sup> companies outside of the U.S. are able to outcompete American firms on these criteria, which motivates U.S. firms to find other ways of increasing their market share and corporate value. The ability to innovate has become a major differentiator, with industrial design as one of the key means by which companies are innovating today.

The World Economic Forum's Global Competitiveness Report from 2014-2015 identifies the "nature of competitive advantage" as one of more than 100 factors measuring the strengths and weaknesses of a 144 national economies around the world.<sup>10</sup> The question posed to the countries surveyed in the report was, "What is the competitive advantage of your country's companies in international markets based upon?"<sup>11</sup> Countries were ranked high when they identified innovation as a strong force in their competitive advantage, while low-ranking countries based their competitive advantage on low-cost labor or natural resources. Based on the responses to this question, the highest ranked country is Japan, followed by Switzerland, Denmark, Finland, Belgium, Italy, Germany, Israel, UK, Austria, Netherlands, Singapore, Luxembourg, U.S., and beyond. The U. S. ranked 14th in the list.

Figure 1, from the European Commission Directorate's 2012 General Regional Policy Report, illustrates that innovation is a key determinant of competitive advantage. Historically, competition involved making things cheaper, faster, and better, but in today's markets, "Making better things" means authentically addressing the user's experience through design, innovation, and differentiation.

Period	Aim	Advantage	Practices
1960s -1970s	Making things cheaper	Cost	Division of labor, motion & time studies, mass production
1980s -1990s	Making things better	Quality and Delivery	Total Quality Management, just-in-time, flexible specialization, automation
2000s	Making better things	Experience and Authenticity	Design, innovation, differentiation

Figure 1: Seeking Competitive Advantage<sup>12</sup>

8 "Eight Industries the U.S. Has Lost to China." *24/7Wall St.* (January 24, 2012). <http://247wallst.com/special-report/2012/01/24/eight-industries-the-u-s-has-lost-to-china/2/>.

9 James R. Hagerty, John W. Miller and Bob Tita, "U.S. Factories Keep Losing Ground to Global Rivals." *Wall Street Journal* (August 26, 2014). <http://www.wsj.com/articles/u-s-factories-keep-losing-ground-to-global-rivals-1409009731>.

10 Klaus Schwab, *The Global Competitiveness Report 2014-2015*. World Economic Forum, Table 11.04.

11 Ranking from 1 (low-cost labor or natural resources) to 7 (unique products and processes), countries are judged on the strength of their industry's innovations in global markets. A score of 7 indicates that a country considers their competitive advantage globally to be based highly on unique products and processes, i.e. innovation.

12 Stuart Rosenfeld, *The Nexus of Innovation and Clusters in Less-Favoured Regions, Guide to Smart Cluster Strategies*. European Commission Directorate-General Regional Policy, (May 2012): 12.

The importance of intangible assets,<sup>13</sup> namely intellectual capital, in building a global competitive advantage were echoed in numerous conversations with design practitioners and educators. For example, Harry West from Frog Design noted as more nations develop the technological, transportation, and human capital infrastructure to compete, their comparative advantages turn more to creative designs that are able to command high value not only because of their function and reliability but also because of the experience or special applications they provide to their customer. Design is increasing in importance because of globalization. With the winner take all, the product needs to be better, more usable, and foster an emotional connection to the consumer — making it delightful to use.<sup>14</sup>

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<sup>13</sup> "In recent years, the U.S. Bureau of Economic Analysis has recognized the value of so-called intangible assets by starting to account for R&D and 'entertainment, literary, and artistic originals' as capital investments rather than as expenditures. From artistic/literary/entertainment originals alone, the net effect in 2013 was to realize \$75.7 billion in additional contributions to the U.S. GDP. In real dollars, that figure represents a growth of \$33 billion added to the GDP since 1998." (Source: "NEA Arts Data Profile #9: The Arts and Cultural Production Satellite Account: 1998-2013, Issue Brief #6." <https://www.arts.gov/sites/default/files/ADP%239-Brief6.pdf>.)

<sup>14</sup> Harry West (CEO, Frog Design), interview by Heidi Sheppard, June 1, 2016.

### Sustainability and the Design for Sustainability (D4S) Model

In addition to intangible assets and innovative products, environmental sustainability can be integrated into manufacturing processes by SMMs to compete globally. According to a study by MIT Sloan Management Review and the Boston Consulting Group,<sup>15</sup> a greater percentage of companies reported profiting from their sustainability efforts in 2012 than the previous year. More than 2,600 companies were part of the study, which identified a company's sustainability efforts as incorporating sustainability thinking into all of its areas of discipline — supply chain, marketing, finance and product development, as well as devising new business models and strategy grounded in sustainability. The study points out that the extent to which a company incorporates sustainability into its business model often correlates with its increase in profit.

Specifically, the Design for Sustainability (D4S) methodology has gained currency among companies such as AT&T, Campbell Soup Co., Dell, Ecover, Greif, Intel, Kimberly-Clark, Kraft Foods (Mondelez International), Marks & Spencer, Nestlé, Patagonia, PepsiCo, Sainsbury, SAP, Sprint, Timberland, UPS, and Zipcar. The D4S model includes:

...the systematic development, testing, and international diffusion of methods and tools for the design of products with superior life cycles, improved ecoefficiency and effectiveness (via intelligent materials and energy applications, integration of emerging product-technologies, and economic optimization). The focus is on modeling, actual application, and demonstration of sustainable products, departing from simply an engineering/life cycle design perspective.<sup>16</sup>

This approach is giving manufacturers a competitive edge. As noted by Terry Irwin at Carnegie Mellon School of Design, SMMs can leverage D4S and distinguish themselves as being part of an environmental solution.<sup>17</sup> Now and going forward, manufacturers that use D4S or other sustainability approaches can both comply with government regulations and meet consumer demand for sustainable products. As noted at the 12th Global Conference on Sustainable Manufacturing, "Sustainable product design and manufacturing has become an obligation to environment and society itself, enforced primarily by government regulations and customer perspective on environmental issues."<sup>18</sup>

Furthermore, per the MIT Sloan Management Review, investors are seeing a strong link between corporate sustainability performance and financial performance, and they are using sustainability-related data as rationale for investment decisions.<sup>19</sup> The Industrial Design Advantage, a report released by the British Columbia Premier's Technology Council, echoes this thought, noting "A critical advantage provided by industrial design is its ability to measure, validate and improve the environmental sustainability of a product. Sustainable product design or Design for the Environment (DfE) has become one of the most important applications of design. DfE can also improve performance in areas that are not strictly related to the environment. The principles of DfE will minimise materials, waste and energy in production and decrease the negative impact products can have to protect human health and the environment. These can be cost savers both in the short and long term."<sup>20</sup>

<sup>15</sup> "Companies Profit from Embracing Sustainability." *Sloan Management Review* (February 5, 2013).

<sup>16</sup> Garrette Clark, Justin Kosoris, Long Nguyen Hong and Marcel Crul, "Design for Sustainability: Current Trends in Sustainable Product Design and Development." *Sustainability* (September 2009): 412, doi: 10.3390/su1030409.

<sup>17</sup> Terry Irwin, (Director of Carnegie Mellon School of Design), interview by Heidi Sheppard, July 13, 2016.

<sup>18</sup> Sumit Gupta, G. S. Dangayach, Amit Kumar Singh, "Key Determinants of Sustainable Product Design and Manufacturing." *12th Global Conference on Sustainable Manufacturing* (December 2015). doi: 10.1016/j.procir.2014.07.166.

## Design Thinking’s Impact on Product Success

It is widely understood that we are living in a digital world. Our economy is based on broadly available information obtained almost instantaneously through electronic devices. The means by which we purchase items, communicate ideas, share information and opinions, and identify who we are also enables us to demand personalized products through a customized user experience at virtually any moment we want.

All of this information, so easily and instantaneously available, greatly increases a manufacturer’s risk in introducing a new product to market. Companies need to be certain that when their product is ready for launch, it is the best it can be from the outset and responsive to the user’s experience. By using the design thinking process, where the user is engaged for feedback frequently throughout the design process (see Figure 2), industrial designers play an important role in making sure that product launch is successful.

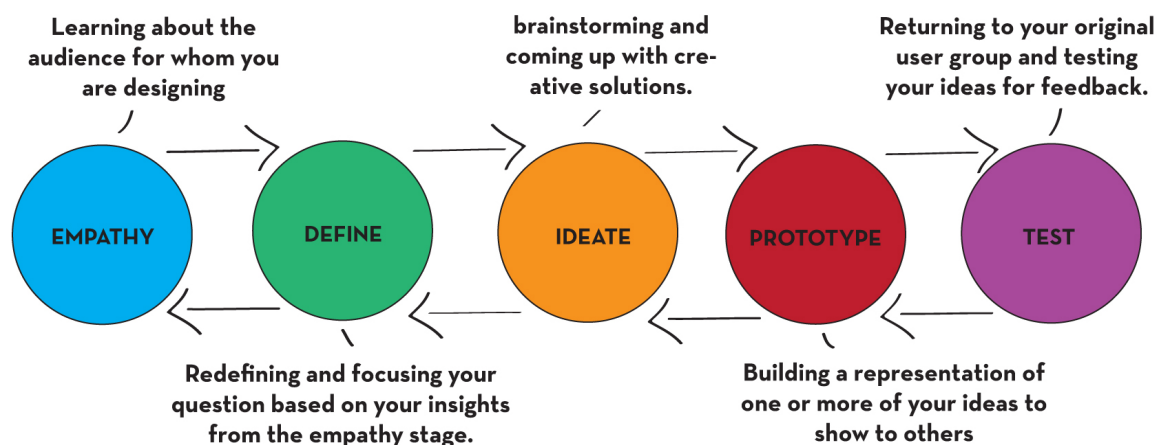


Figure 2: Design Thinking Process. Source: Principal steps of the design thinking process. Les cahiers de l’innovation.

<sup>19</sup> Gregory Unruh, David Kiron, Nina Kruschwitz, Martin Reeves, Holger Rubel, and Alexander Meyer zum Felde, “Investing for a Sustainable Future.” *MIT Sloan Management Review* (May 2016). <http://sloanreview.mit.edu/projects/investing-for-a-sustainable-future/>.

<sup>20</sup> The British Columbia Premier’s Technology Council, *The Industrial Design Advantage* (Supplement to the 11th Report, 2008): 12.

IDEO, an award-winning global design firm that pioneered the design-thinking process, uses this approach to address a variety of business challenges. IDEO's CEO Tim Brown and advisor Roger L. Martin explain the process:

In the design-oriented approach popularized by IDEO, the work to understand users was deeper and more ethnographic than quantitative and statistical. Initially, that was the significant distinction between the old and new approaches. But IDEO realized that no matter how deep the up-front understanding was, designers wouldn't really be able to predict users' reactions to the final product. So IDEO's designers began to reengage with the users sooner, going to them with a very low-resolution prototype to get early feedback. Then they kept repeating the process in short cycles, steadily improving the product until the user was delighted with it. When IDEO's client actually launched the product, it was an almost guaranteed success—a phenomenon that helped make rapid prototyping a best practice.<sup>21</sup>

Publications and interviews conducted with designers and manufacturers reiterate the importance of a successful product launch and the hazards of potential failure, illustrating how critical it is to engage an industrial designer in the manufacturing process:

To win, a product has to be launched globally and nationally and releasing it with a mistake is costly and risky — it is wasteful of tooling, machinery, etc. and it gives away to your competition your intent.<sup>22</sup>

"...it's about updating their clients for a world in which word-of-mouth (currently known as Twitter and Facebook) has an insurmountable impact on company success...a 'power shift to consumers.'"<sup>23</sup>

By going through design thinking's iterative approach, products can be launched with a decreased risk of failure, utilizing digital outlets to promote the usability of the product rather than its shortcomings.

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<sup>21</sup> Tim Brown and Roger L. Martin, "Design for Action." *Harvard Business Review* (September 2015): 6.

<sup>22</sup> Harry West (CEO, Frog Design), interview by Heidi Sheppard, June 1, 2016.

<sup>23</sup> Nathan Hurst, "Big Corporations Are Buying Design Firms in Doves." *WIRED* (May 15, 2013). <https://www.wired.com/2013/05/accenture-fjord/>.



“As more nations develop the infrastructure to compete, their comparative advantages turn more to **creative designs** that are able to command high value not only because of their function and reliability but also because of the **experience** or special applications they provide to their customer. Design is increasing in importance because of globalization.”

-Harry West, CEO, Frog Design

## The Rise of Apple

Apple is among the best known design-integrated companies in the world. Their market domination and focus on design has transformed both consumer expectations and corporate culture on a global level. In the early 1980s Apple partnered with Frog Design, one of the leading design firms in the world, but design was not fully integrated into Apple's business approach. It was not until Steve Jobs returned to the company in 1997 that design was established as their competitive edge. Beginning around 2001, Apple elevated design beyond aesthetics to appeal to the user's full experience, from the product to the software to the retail environment.<sup>24</sup> As noted in WIRED magazine, "Apple's rise from floundering underdog to the most successful company in history set a powerful example."<sup>25</sup>

Following in Apple's footsteps, large corporations, and most recently management consulting firms, are hiring more industrial designers and even acquiring entire design firms. These companies know that integrating design into their corporate culture is key to their success. Design thinking becomes one of their core competencies as they integrate design methods into their corporate strategies.

Specific examples of merging design into business include the hiring of numerous industrial designers at GE and IBM, and McKinsey and Company's 2015 acquisition of design consulting firm LUNAR. "The [McKinsey-LUNAR] deal illustrates just how central design is to business today — and how design's influence is growing beyond the tech industry into the corporate world at large."<sup>26</sup>

In her report "Good Design Drives Shareholder Value," produced for the Design Management Institute (a nonprofit international membership organization), Jeneanne Rae, federal customer experience leader at Monitor Deloitte, notes:

"Developing internal design capabilities is moving higher on the strategic agendas of companies across corporate America. The integrative thinking, creative, and empathy-based skills designers bring are increasingly sought after for cracking new markets as well as providing a competitive advantage in customer experience. Although the investment in developing design capabilities can be costly, many companies believe it is well worth the effort."<sup>27</sup>

The corporate embrace of design thinking and design culture reflects the way that design itself has changed.

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24 Max Chafkin, "An Oral History of Apple Design 1992-2013." *Fast Company* (October 2013). <http://www.fastcodesign.com/3016520/an-oral-history-of-apple-design-1992-2013>.

25 Kyle Vanhermert, "Consulting Giant McKinsey Buys Itself a Top Design Firm." *WIRED* (May 14, 2015). <https://www.wired.com/2015/05/consulting-giant-mckinsey-bought-top-design-firm/>.

26 Ibid.

27 Jeneanne Rae, "Good Design Drives Shareholder Value." *Design Management Institute* (May 2015). <http://www.dmi.org/?page=DesignDrivesValue>.

## Customer Demand for a Better User Experience

User experience design, also known as UX design, encompasses all aspects of a human experience as it relates to any type of system or product. It has its roots in the relationships between humans, machines, and their contextual environments, dating back to the 1940s. With the introduction of the personal computer in the 1990s, UX became more important in order to sell computers. An entire system of interactions was needed to satisfy the user in terms of usability, accessibility, and pure pleasure.

UX design, while in the retail world is embraced primarily by online, interactive companies such as Amazon and Facebook, has become increasingly relevant for other products. Nikkel Blaase, XING's UX product and interaction designer, states that product thinking is the next big thing in UX design: "Thinking in products means thinking in specific user's problems, in jobs to be done, in goals and in revenues."<sup>28</sup> Designers in this context are creating emotional connections between a product and a user.<sup>29</sup> Innovator Jean-Claude Junqua, who started and developed research and development activities for Panasonic in Silicon Valley and others, has noted the decline in brand loyalty and increase in customer power today, and has cited Airbnb and Uber as leaders in a market where "today's most revolutionary innovations are about user and business model innovations."<sup>30</sup>

GoPro is a successful consumer product company (they make action cameras) that incorporates UX design into all aspects of their firm in order to provide the best user experience. Their designers work closely with product managers and are involved in the product definition, concept, and prototyping phases, constantly testing developments with their customers. They only move into production after they have completely validated their concept through customer feedback.

The company goes further, having codified "this commitment to UX in a set of design principles" that drive products and services. To ensure that GoPro's employees understand what their customers experience, the company instituted a "Live it, Eat it, Love it" employee program. Employees are given time off to explore their interests but have to record it using a GoPro, effectively acting like a GoPro consumer. Vanessa Cho, director of UX at GoPro, states, "We need to make sure we're capturing the undocumented and the unexpected [aspects of using the product]; only then can we deliver useful and usable — and truly delightful — experiences."<sup>31</sup>

Beyond customer experience, there is evidence that UX investments can enhance corporate performance. A post online in ForbesCommunityVoice states, "Studies show that companies that invest in UX see a lower cost of customer acquisition, lower support cost, increased customer retention and increased market share, according to a study done by Forrester. When compared to their peers, the top 10 companies leading in customer experience outperformed the S&P index with close to triple the returns. Forrester Research shows that, on average, every dollar invested in UX brings 100 dollars in return. That's an ROI of a whopping 9,900 percent."<sup>32</sup>

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<sup>28</sup> Nikkel Blaase, "Why Product Thinking Is the Next Big Thing in UX Design." *Medium.com* (July 5, 2015).  
[https://medium.com/@jaf\\_designer/why-product-thinking-is-the-next-big-thing-in-ux-design-ee7de959f3fe#.ibmarzspa](https://medium.com/@jaf_designer/why-product-thinking-is-the-next-big-thing-in-ux-design-ee7de959f3fe#.ibmarzspa).

<sup>29</sup> Jan Larsson, "The Importance of Industrial Design in Product Development." *Prime* (Spring 2014).

<sup>30</sup> Stephen Jordan, "Lean Startup, Design Thinking & Open Innovation for the Enterprise." *DMI: Design Management Institute* (August 21, 2015).  
<http://www.dmi.org/news/247277/Lean-Startup-Design-Thinking--Open-Innovation-for-the-Enterprise.htm>.

<sup>31</sup> Christian Dahlström, "UX Conversations with Vanessa Cho." *Screen Interaction* (May 21, 2015).  
<http://screeninteraction.com/news/ux-intervju-vanessa.html>.

<sup>32</sup> Andrew Kucheriavy, "Good UX Is Good Business: How to Reap Its Benefits." *Forbes Technology Council* (November 19, 2015).  
<http://www.forbes.com/sites/forbestechcouncil/2015/11/19/good-ux-is-good-business-how-to-reap-its-benefits/#528db45e3c53>.

### Good Design Drives Shareholder Value

In her research for the Design Management Institute, Jeneanne Rae uncovered three corporate trends which reinforce why UX design is driving changes in business:

1. UX Design Dominating Growth of the Design Profession – Given the proliferation of software, apps, games, web design, and other types of digital interfaces that support every imaginable product, service, and solution being created today, user experience (UX) design is now a dominant and growing force in the design profession, outpacing the growth seen in other design disciplines. This trend is also leading to the development of more extensive in-house design capabilities in industries such as financial services, where design-embedded initiatives were unheard of prior to the age of the omni-channel experience.
2. Significant Investments in Design Transform Business as Usual – The integrative thinking, creative, and empathy-based skills designers bring are increasingly sought after for cracking new markets as well as providing a competitive advantage in customer experience.
3. New Design Exemplars on the Horizon – 3M, Amazon, Capital One, GE, Google, Honeywell, eBay, Fidelity, Pepsi, and SAP (among others) should be recognized for the significant progress each has made in building internal design capabilities in recent years.

Source: "Good Design Drives Shareholder Value"

## The Internet of Things

The Internet of Things (IoT) is the interconnection of devices (also referred to as smart devices), vehicles, buildings, and other objects embedded with software, electronics, sensors, actuators, and network connectivity that enable these items to collect and exchange data.<sup>33</sup> IoT allows objects to be detected or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy, and economic benefit in addition to reduced human intervention.<sup>34</sup>

IoT in industrial production allows for more connectivity and transparency throughout the manufacturing process. Smart machines are able to communicate with each other without human interference which leads to more efficiency in production, and manufacturers can see what is happening throughout the process to more easily make changes. Following production, IoT can also help a manufacturer track the sales of a product, connect products to each other, and understand the inventory of products to maximize machine efficiency.<sup>35</sup>

UX designers are working with manufacturers to hone the value of IoT, particularly in the realm of end products such as home automation systems that allow you to monitor and control all of your electrical outlets and light switches from your cell phone and home security systems that include a video camera and sensors for air quality, motion, sound, temperature, and vibration all in one unit. IoT in end products is seeing the greatest investment currently, as it can provide large quantities of data about a product and its users. UX designers can help these products create quality data that allows a company to understand the users' preferences. For example, beyond only exploring peak times a user turns on a product, UX design can provide various options of how to turn on a product and measure which choice is preferred. According to Paul Hatch, as IoT makes lots of data available about a product, UX designers can help focus in on which data is important. This allows a company to reinvent the whole experience around an end result, rather than merely upgrading an existing product.<sup>36</sup>

A prime example of the potential for design to influence IoT is the Amazin Apartments concept by the British design firm Future Facility. This conceptual project featured in the *NEW OLD* exhibition at the Design Museum in London uses IoT to streamline home life for the elderly. The modular wall system features easy to use appliances facing what would be the interior of an apartment. A service corridor on the opposite side of the wall features a live feed and LCD screen monitoring the appliances. This allows maintenance teams to fill up the refrigerator with food, the drinking tap with bottled water, and the washing machine with soap, all without entering the apartment. The data gathered by the system would be stored by the owner of the building to be used for their own growth in revenue and quality. While this data collection is primarily aimed toward easing life for seniors, it also reflects "a fundamental tension between access to a comfortable life and the exploitation of personal data produced through smart technologies."<sup>37</sup>

With these factors influencing manufacturers right now, it is obvious that industrial design is a foremost consideration for major corporations seeking to differentiate themselves in global markets. With all of the evidence pointing to design's importance for large company success, is it important for smaller firms' success as well? Are SMMs embracing it? If not, why not?

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<sup>33</sup> Eric Brown, "Who Needs the Internet of Things?" *Linux.com* (13 September 2016).

<sup>34</sup> "Internet of Things: Science Fiction or Business Fact?" (PDF). *Harvard Business Review*. November 2014.

<sup>35</sup> Paul Hatch (DesignHouse), interview by Katryna Carter, March 16, 2017.

<sup>36</sup> Ibid.

<sup>37</sup> George Kafka, "Amazin Apartments: How the Internet of Things Will Alter Our Homes." *Metropolis* (March 15, 2017). <http://www.metropolismag.com/ideas/amazin-apartments-how-internet-things-will-alter-homes/>.

## BENEFITS OF INDUSTRIAL DESIGN TO MANUFACTURERS

Lowered cost through improved manufacturing and minimized product-to-market time

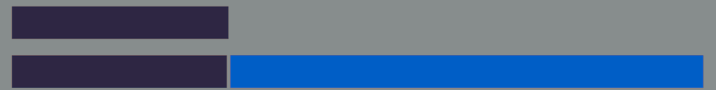
**UP TO 95%** of production costs occur at the design stage

### INCREASED REVENUE AMONG SMALL MANUFACTURERS

**17.5%**

average sales on improved goods and services

### INCREASED CORPORATE VALUE



Some design-led companies outperformed the S&P by **219%** between 2004 and 2014

### INCREASED INTEREST IN INNOVATION

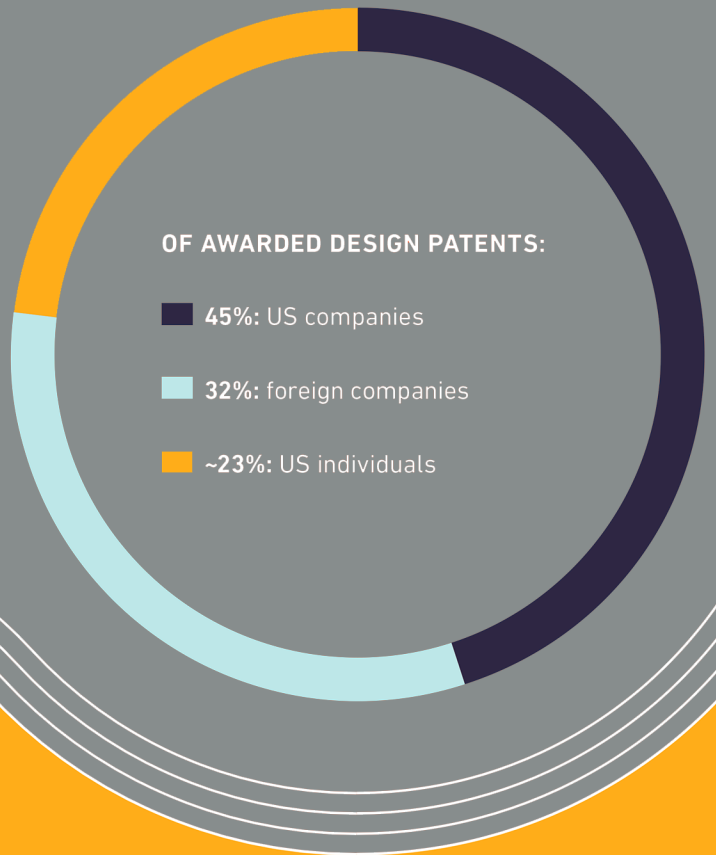
**165,108**

design patents awarded by the US Patent and Trademark Office between 1998 and 2012



### OF AWARDED DESIGN PATENTS:

- 45%: US companies
- 32%: foreign companies
- ~23%: US individuals



## THE CASE FOR SMMs TO INTEGRATE INDUSTRIAL DESIGN

There is notable data to support the value of integrating industrial design into the manufacturing process. Over the past several years, the Design Management Institute has produced the Design Value Index, a market capitalization-weighted study comprised of design-driven companies. These U.S.-based, publicly held companies were tracked and monitored over a ten-year period to understand the impact of their investments in design on stock value relative to the overall S&P Index. The results are remarkable: 219 percent greater returns than non-design S&P companies over a ten-year period. Figure 3 illustrates the value that industrial design contributes to overall company performance for these large manufacturers.

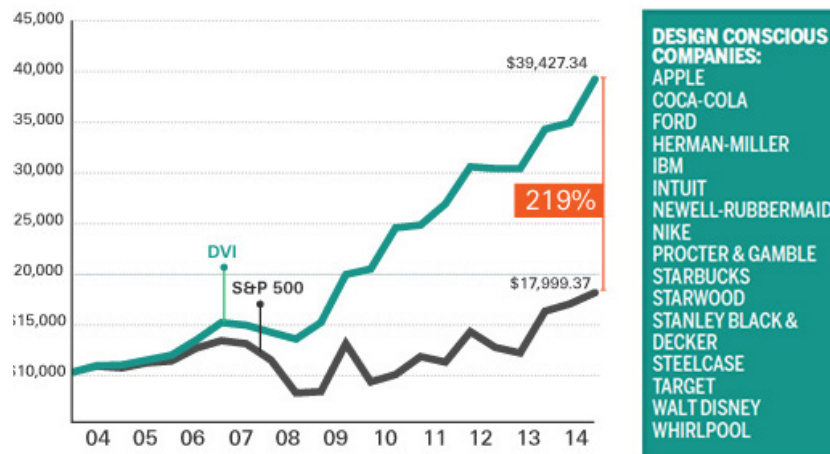


Figure 3. Source: "Good Design Drives Shareholder Value," sponsored by the Design Management Institute <sup>38</sup>

While the evidence points to the power of industrial design for these large manufacturing firms, SMMs may not embrace it for several reasons. They sometimes do not know what industrial design is, how it works, or when to use it, and often they lack an understanding and appreciation for the value of industrial design for their firms.

<sup>38</sup>Jeanne Rae, "Good Design Drives Shareholder Value." *Design Management Institute* (May 2015). <http://www.dmi.org/?page=DesignDrivesValue>.

### Design Value Index

DMI and Motiv Strategies, funded by Microsoft, began analyzing the performance of U.S. companies committed to design as an integral part of their business strategy in 2013. The reports can be found on [www.dmi.org](http://www.dmi.org) with a search for Value of Design.

Qualifying to be part of DMI's Design Value Index isn't easy. The following criteria must have been met over the ten-year research period:

- To ensure consistency of financial reporting standards, corporations must be publicly traded in the U.S. over the last ten years.
- Design must have been represented in the corporate hierarchy for the period through a central design function led by an executive as well as in the broad deployment of design staff and practices over all major business units.
- Over time, these companies must show that they have increased design-related investments in the form of head count, infrastructure investments, and volume of projects.
- There must be a distinct and recognized operating model for design that promotes cooperation and integration with other corporate functions such as marketing, R&D, and operations.
- Design leadership must be present at the senior and divisional levels.
- Finally, the senior management of the corporation must show a deep commitment to design as a key strategic enabler and a resource for innovation and change.



## Understanding Industrial Design, How It Works, and When to Use It

Many SMM leaders believe that industrial design is limited to aesthetics and product design, and are not aware of how it can integrate into their business or when is the best time to engage an industrial designer in their manufacturing process. In a survey administered to directors of 23 centers around the country that provide expert and business services to SMMs, only 13% were familiar with industrial design. What's more, 72% said a lack of knowledge about industrial designers' value prevents their center from engaging with designers, and over 56% do not have access to industrial designers at all.<sup>39</sup> One SMM consultant stated that what these small companies need most is education and knowledge about industrial design, and consultants need to communicate about design with them. Another said their firm uses industrial designers sparingly because their work is mostly business-to-business suppliers, not consumer-oriented manufacturers, illustrating a clear misconception about what design can offer.<sup>40</sup>

Generally speaking, members of the National Association of Manufacturers (NAM) do not have industrial design as their primary concern. They cite the Internet of Things, 3D printing, new technologies, the value of the dollar, corporate tax structure, trade, energy, and sustainability as more important issues.<sup>41</sup>

It is clear that there is a wide disparity in knowledge among SMMs about industrial design and what it can do. Entities that provide services to help SMMs grow would benefit from a better understanding of industrial design and its value, and clarity on the difference between industrial design and other traditional design approaches such as design for manufacturing,<sup>42</sup> which they can then communicate to their clients. The following general points are important for service providers and SMMs to understand.

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<sup>39</sup> MEP center director interviews and survey conducted by Heidi Sheppard, 2016.

<sup>40</sup> Ibid.

<sup>41</sup> Jennifer McNelly (President, the Manufacturing Institute), interview by Heidi Sheppard, June 17, 2016.

<sup>42</sup> Industrial design (ID) is the professional service of creating products and systems that optimize function, value and appearance for the mutual benefit of user and manufacturer. Design for manufacturability (also sometimes known as design for manufacturing or DFM) is the general engineering art of designing products in such a way that they are easy to manufacture.

**Industrial design can be useful beyond the development of a product.**

The integration of design thinking into a company such as Apple, and the acquisition of design firms by consultants like McKinsey, illustrate the value of design to improve internal processes as well as manufacturing operations. In “How Can Design Thinking Help Your Business,” author Kaan Turali notes that industrial design “...can be as effective in technology or education as it may be in services or manufacturing. It could result in new products and services for customers or improved processes and productivity gains for internal operations. If applied with equal fervor, it can even transform HR, finance, marketing, or operations teams — turning them into lean and agile profit centers.”<sup>43</sup>

**Industrial designers have a diverse skill set.**

Industrial designers often are skilled in manufacturability, business models, research, observation, anthropology, ergonomics, marketing, and design principles. They focus on the user experience, they design with empathy, utilize iteration techniques, and solve problems. The diversity of an industrial designer’s skills makes them uniquely qualified to work across disciplines. Industrial designers improve as well as create, and they often work within multi-disciplinary groups that include management, marketing, engineering and manufacturing specialists.<sup>44</sup> An industrial designer’s wide range of skills and flexibility makes their involvement in the manufacturing process an essential component of product and business success.

**Industrial design is most effective when incorporated early on and integrated throughout the entire manufacturing process.**

In *Prime*, Microsoft’s technology magazine for the manufacturing sector, the essay “The Importance of Industrial Design in Product Development” highlights the importance of designer engagement early and often in order to achieve market success:

In order to deliver innovative designs that are functional, manufacturable, and affordable, it is critical that industrial designers work with and satisfy the needs of all of the major stakeholders across the product lifecycle, including executive management, marketing, engineering and manufacturing. An industrial designer also has to be able to offer a lot of options and flexibility, working closely with the engineers to determine how to manage costs through the use of different manufacturing techniques, materials or functions.

To achieve this, industrial design and styling needs to be performed early in the product development process. It must be able to accommodate frequent change, as new opportunities and new requirements arise.<sup>45</sup>

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<sup>43</sup> Kaan Turali, “How Can Design Thinking Help Your Business?” *World Economic Forum* (May 12, 2015). <https://www.weforum.org/agenda/2015/05/how-can-design-thinking-help-your-business/>.

<sup>44</sup> “What Is Industrial Design?” Industrial Designers Society of America. <http://http://www.idsa.org/events/what-id>.

<sup>45</sup> Jan Larsson, “The Importance of Industrial Design in Product Development.” *Prime* (Spring 2014).

## Understanding Industrial Design's Value and Return on Investment

While the previous section explains a few key points that SMMs need to understand about industrial design in order to consider using it, it is the financial value that industrial design can add during the manufacturing process that makes it a compelling prospect.

### Industrial design provides cost savings.

Abundant evidence exists that the decisions made during the design process determine 70-90 percent of a product's production cost.<sup>46</sup> "Cost savings can be achieved through improving the manufacturing of the product, developing new solutions to achieve specific functionality, and seeking high-quality and low-cost materials. Use of design can also decrease the amount of time needed to bring a product to market."<sup>47</sup>

In "What is the Real Value of Design," Jeneanne Rae discusses the deeper cost savings that can be achieved through industrial design, noting that:

Design can also make great strides to help get the cost out of manufactured goods through rethinking the ways and means products come together. Procter & Gamble, best known for its household brands such as Tide and Pampers, has recently developed a process to develop plastics that are thinner, cheaper, and more environmentally friendly than the industry standard. It is estimated that this new technology could save the company up to \$1B a year. Companies that harness design to curb costs can thus double design's financial impacts by managing the bottom line while simultaneously growing the top line.<sup>48</sup>

### Industrial design promotes company growth.

Industrial design can help companies develop new and innovative products and processes, resulting in greater economic gains. In "Measuring Design and its Role in Innovation," authors Fernando Galindo-Rueda and Valentine Millot explain: "The use of design as an integrated element is highly correlated with innovation outcomes, particularly product and marketing innovations, including new-to-market innovations. Controlling for observed firm characteristics, the probability of introducing a product innovation is 24% higher for firms where design is integrated."<sup>49</sup> Additional data from their report shows that firms with integrated design have a higher employment growth rate (9.1 percent), higher value-added growth rate (18.7 percent), and higher productivity growth rate (10.4 percent) than similar-sized firms that don't incorporate design.<sup>50</sup>

<sup>46</sup> Mick Broadbent, John Cullen, *Managing Financial Resources*. (Routledge, June 2, 2003); Daniel E. Whitney, "Manufacturing by Design." *Harvard Business Review* (July 1988); The British Columbia Premier's Technology Council, *The Industrial Design Advantage* (Supplement to the 11th Report, 2008): 10.

<sup>47</sup> The British Columbia Premier's Technology Council, *The Industrial Design Advantage* (Supplement to the 11th Report, 2008): 10

<sup>48</sup> Jeneanne Rae, "What Is the Real Value of Design." *Design Management Review* (Winter 2013).

<sup>49</sup> Fernando Galindo-Rueda and Valentine Millot, "Measuring Design and Its Role in Innovation." *OECD Science, Technology and Industry Working Papers*. OECD Publishing, (2015): 8, <http://dx.doi.org/10.1787/5js7p6lj6zq6-en>.

<sup>50</sup> Ibid.

“Design can also make great strides to help get the cost out of manufactured goods through **rethinking** the ways and means products come together.”

-Jeneanne Rae, federal customer experience leader, Monitor Deloitte

Findings derived from a report-in-progress authored by the National Endowment for the Arts with the Economic Research Service of the U.S. Department of Agriculture show that SMMs using design generate greater sales from new or improved products by seven percentage points than non-design-using SMMs. This difference could demonstrate that design-using SMMs are more innovative.<sup>51</sup>

Research shows that SMMs are more risk-averse for a variety of reasons, but despite their reservations about investing their financial resources in something new and untested<sup>52</sup> the literature shows that there are indeed measureable and timely positive investment returns after incorporating industrial design into the manufacturing process. *The Industrial Design Advantage* report notes: "The return on design investment was reasonably swift. A study among UK SMMs in the manufacturing sector showed that the average payback time for design projects was 15 months from the product launch. Some 48% of the implemented projects recovered total costs within a year or less after the market launch. Almost 90% of the projects achieved payback within three years."<sup>53</sup>

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<sup>51</sup> report-in-progress authored by the National Endowment for the Arts with the Economic Research Service of the U.S. Department of Agriculture

<sup>52</sup> Many SMMs are family owned. Research has shown that family participation in management tends to make the firm more risk-averse in considering the range of choices for new product development and in R&D intensity. Second, these businesses tend to take less risk if most of the family's wealth is invested in the business.

<sup>53</sup> The British Columbia Premier's Technology Council, *The Industrial Design Advantage* (Supplement to the 11th Report, 2008): 18.

## EXAMPLE RESOURCES FOR SMALL TO MEDIUM-SIZED MANUFACTURERS



### ACADEMIC DESIGN INTERNSHIP PROGRAMS

Cleveland Institute of Art; University of Cincinnati College of Design, Architecture, Art, and Planning; Rochester Institute of Technology College of Imaging Arts and Sciences; University of Texas at Austin Center for Integrated Design; Arizona State University Herberger Institute for Design and the Arts

### UNIVERSITY PRODUCT-DEVELOPMENT LABS

Labs at Boise State University and Oklahoma State University

### NETWORKING/EDUCATION EVENTS

DesignHouse Jams

## MODELS OF PRACTICE

Initiatives underway across the country are connecting industrial design with manufacturing firms. Including some creative public/private partnerships and a wide variety of scales of impact, the following four models are offered as examples that could be replicated in other parts of the country.

## Grant Funding Model

This case study illustrates how the federal government can partner with state entities and local or regional design institutions to support SMMs and the manufacturing sector in general.

In 2013, Rhode Island was awarded a \$100k planning grant from the U.S. Economic Development Administration, in order to assess and identify assets that might boost the state's economy. The grant was matched with funds from the Rhode Island Foundation and the state economic development agency, Commerce RI, and identified the Rhode Island School of Design (RISD) as a unique asset.

Subsequent to that initial grant, Commerce RI recognized that the state's economy was being adversely affected by the downturn in the defense industry, impacting the SMMs that supply products to the Department of Defense (DOD). In 2015 they received a two-year, \$2.9M grant from the DOD's Office of Economic Adjustment (OEA) to help Rhode Island's SMMs diversify their product lines, enabling them to continue to generate revenue and be ready to supply the DOD when necessary.

One goal of this project is to integrate industrial design and design processes into these firms. In order to do so, Commerce RI and their collaborators, Polaris MEP,<sup>54</sup> RISD Executive Education, and the Rhode Island Manufacturing Association, developed a multi-phased approach to the project.

In the initial phase, 20 defense-related SMMs received \$15k for a Design Readiness Assessment (DRA).<sup>55</sup> In order to qualify for these assessments, DOD mandated that 10 percent of the SMM's revenue had to be defense-related. In identifying SMMs that met the DOD's criteria, Polaris MEP found that 60-70 percent of the firms were business-to-business, not business-to-consumer. This meant that they were a perfect match for the OEA grant project, since one of the grant's objectives is to help these DOD suppliers diversify into a business-to-consumer market with new products.

The first phase was completed in four to six weeks and included approximately 100 hours of consulting time. The DRA assessed the company's knowledge of industrial design thinking and their propensity to accept it as a paradigm shift for their company. Subsequent to this initial phase, another 30 companies were granted \$15k each for a DRA, totaling 50 DOD supply chain SMMs that benefitted from the assessments.

In the second phase, 20 of the SMMs were selected to receive an additional \$35k to implement the DRA recommendations. Out of these 20 firms, three were then selected to receive another \$100k to work with RISD and Brown University faculty and Polaris MEP to successfully integrate design into their companies and launch a new product.

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<sup>54</sup> The Manufacturing Extension Partnership (MEP) is a network comprised of centers around the country that provide services to SMMs through teams of experts and business professionals who are accessible to any manufacturer. Polaris MEP is Rhode Island's official MEP Center.

<sup>55</sup> The DRA uses design thinking to assess a manufacturer's current operations, markets, products and capabilities, and identifies opportunities to shift the manufacturer into new areas of diversification. Through an exploration study of the company by a diverse team of experts, participating SMEs received a high level of strategic thinking and recommendations to address challenges, opportunities, and actions.



### Design for Manufacturing Innovation Course at the Rhode Island School of Design Executive Education

The certificate program introduces design thinking, tools and methodologies, integrated with entrepreneurial thinking, innovation leadership and the deep manufacturing knowledge and experience.

It helps executives in Rhode Island create new business by:

- Developing new solutions to complex problems that arise in their own work, organization, and client relationships by utilizing design thinking, tools and methodologies
- Realizing the sustainable business and innovation potential of developing entrepreneurial, design-driven cultures
- Using design to translate future trends into stronger manufacturing growth and breadth, with opportunities for business advancement, diversification and resilience
- Leading manufacturing innovation in Rhode Island by having the knowledge and network to accelerate design thinking, processes, strategy, and management

© 2016 Rhode Island School of Design Executive Education <http://exed.risd.edu/>

In working with the SMMs, Polaris MEP found that company management teams did not know the core tenets of industrial design or how industrial design could help their firms. In response to this lack of knowledge, RISD Executive Education developed the Design for Manufacturing Innovation certificate course.<sup>56</sup> RISD Executive Education faculty and staff created the curriculum in collaboration with the Rhode Island Manufacturers Association and Polaris MEP and in consultation with national manufacturers and designers.

The nine-month certificate program educates mid-senior level managers on the value of design and the design-thinking process, how to incorporate industrial design into their companies, and how to advocate for creative innovation and the inclusion of designers at the strategic level. Participants are selected from an applicant pool of RI firms focused on defense-related manufacturing, with the grant funds paying their tuition. Executives outside of the OEA grant projects' parameters are able to enroll in the course but have to pay the full tuition fee.

Since the DRA tool and the RISD Design for Manufacturing Innovation certificate were developed using public funds, there is the potential that this model may be able to benefit others.

<sup>56</sup> While the program name is Design for Manufacturing Innovation, the focus of the program is to educate manufacturing executives about industrial design, not Design for manufacturability (also sometimes known as design for manufacturing or DFM), which is the general engineering art of designing products in such a way that they are easy to manufacture.

## Internship Model

SMMs can access the skills and capabilities of industrial designers by employing interns. Many design schools, including Cleveland Institute of Art, Arizona State University, Rochester Institute of Technology, Connecticut College, and Kean University in New Jersey, require an internship experience for students as part of their degree requirements. The students benefit from the hands-on experience — solving real problems through design thinking — and are often given significant responsibility, interacting directly with companies at the leadership level and building their portfolios with new work. SMEs gain valuable understanding of an industrial designer's capabilities via this short term engagement; they subsequently may engage industrial designers for future projects or even hire the intern that worked with them.

A successful and long-standing partnership between the Cleveland Institute of Art's (CIA) industrial design program and MAGNET, the MEP Center in Cleveland, has proven to be beneficial to both the design students and MAGNET's small and medium-sized manufacturing clients (see footnote 54 for an explanation of MEP Centers). Each year, MAGNET hires two part-time industrial design student interns from the CIA's design program to work with their engineering staff. Since MAGNET does not have enough demand for a full-time designer, the part-time interns enable the Center to offer design services for their SMM clients when needed. Industrial design skills are usually required in the new product development process, typically for business-to-consumer manufacturers. The interns provide ethnographic and usability studies, assist with ideation sessions for new products, and often are involved in tweaking existing products.

## Referral Model

If an SMM service provider or consultant does not have industrial design capabilities, they can refer their clients to a design firm. Design firms can help SMMs when launching a new product or improving an existing one, helping the SMM understand the market opportunity, sharing insight into the user experience, and working with the SMM to maximize their existing capabilities and minimize changes to their process, materials, and machinery. The industrial design engagement can encompass an entire product development cycle or focus on a discrete task. Referrals can be an easy and inexpensive model to implement.

Design firms with the ability to quickly make prototypes are useful to SMMs when they are in the product development process. For example, High Tech Rochester, one of the MEP Centers in New York, makes referrals to a local, independent design firm that uses a 3D printer to quickly make product prototypes. This enables the SMM to get their product into the hands of the user/customer quickly, test its usability, and iterate the design until it is ready for launch.

A staff member at High Tech Rochester who was interviewed for this report emphasized, it is important for the design firm to be in at the beginning of a project because it helps develop the interface with the user and makes it more attractive for saleability. Industrial design has to be early in the process, before tooling of manufacturing equipment is in place.<sup>57</sup> This is consistent with the evidence that 70-90 percent of product cost is determined during the design phase.

SMM service providers can also refer clients to design firms that utilize virtual prototyping techniques. Virtual prototyping, often known as VP, is a software-based engineering discipline which involves modelling a system, simulating and visualizing its behavior under real-world operating conditions, and refining its design through an iterative process. It allows teams to build and test virtual prototypes and realistically simulate them, thus refining the system and reducing the time and cost of new product development.<sup>58</sup>

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<sup>57</sup> Annette Brenner, (Client Development Manager, High Tech Rochester), interview by Heidi Sheppard, May 24, 2016.

<sup>58</sup> "What Is Virtual Prototyping? Frequently Asked Questions." *TWI Global*. <http://www.twi-global.com/technical-knowledge/faqs/process-faqs/faq-what-is-virtual-prototyping/>.

## Networking/Education Model

As noted above, knowing what industrial design is, how it works, and appreciating its value are first steps towards integrating industrial design into SMM firms. Networking and educational events can be effective and efficient ways to communicate its value. These events can be informal gatherings, meetings, conferences, webinars, and any other form of connecting SMMs to industrial designers.

The Made in Chicago program, funded by a grant from Citi Community Development to the City of Chicago and supported by the Illinois Manufacturing Excellence Center (IL MEP), the Urban Manufacturing Alliance, and BriteHub, focuses on promoting local manufacturers and their products. Activity takes place through an interactive online portal where manufacturers and designers connect. Designers post an idea, prototype, or product they want to create while local manufacturers can respond to these calls to produce them. Manufacturers, in turn, list their manufacturing processes, materials, production size, funding status, and more for designers to view. They are then able to select a designer to design their product. Made in Chicago also holds local events — Manufacturing Matchmaking or Designer Roundtables — to generate design and production matches.

A Design Jam is another unique type of networking and innovation activity being staged in cities across the country. Implemented by DesignHouse, a Chicago-based, nonprofit firm, Design Jams are initiated by identifying local manufacturer's capabilities and facilities, then engaging teams of local designers, students, and entrepreneurs. The manufacturer's facilities are highlighted for the entrepreneurs and the manufacturers are exposed to possible new products.

At the Jams, the attendees come up with potential products that could be produced on the manufacturer's existing machinery. This inspires local manufacturing innovation in those involved in product and process development. Through the hands-on experience of the Jams, manufacturers learn how industrial designers work and designers, students, and entrepreneurs seeking to generate their own products benefit by learning how to work with a manufacturer.

The DesignHouse model also includes education at the university level. In the Design for Local program, university-level industrial design students take the best of the ideas from the Design Jam and bring them to a more complete iteration, either a rendering or a prototype. All along the way, the students work with the local manufacturer, so that both sides — designer and manufacturer — can better understand how to work together to create new and innovative products locally.

## SUCCESSFUL INDUSTRIAL DESIGN PARTNERSHIPS



### HEALTHCARE:

D-Rev and worldwide manufacturers

**PRODUCT:** ReMotion Knee, a prosthetic knee joint



### ECONOMIC DEVELOPMENT:

Rhode Island Department of Economic Development, Department of Defense, and Rhode Island School of Design

**PRODUCT:** Defense supply-chain enhancements



### ENTERTAINMENT:

Frog Design and TouchTunes

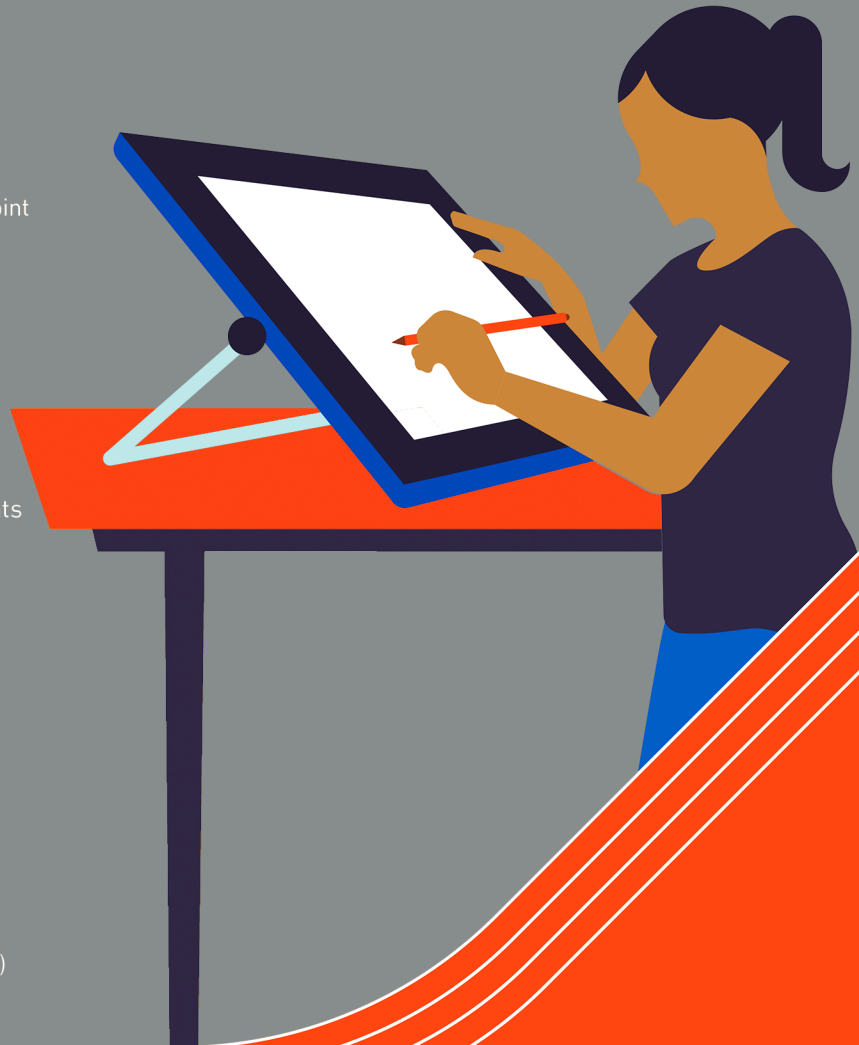
**PRODUCT:** Virtuo, an interactive jukebox



### TRANSPORTATION:

TechHelp and Bob Trailers

**PRODUCT:** Bike trailers (now owned by Britax)



## CONCLUSION

A robust manufacturing sector is important to the U.S. economy. Manufacturing drives broad prosperity and opportunity, sustains well-paying jobs, and expands the middle class. Healthy manufacturers can contribute to economic growth by accelerating the innovation of products, processes, materials, and business models.

This report concludes that industrial design is a key element driving manufacturing success. It can generate an increase in innovation across all facets of a firm, can lower manufacturing costs, grow revenues, enhance market diversification, and increase the overall value of a company. It also points out that many SMMs do not fully appreciate industrial design's potential role in their operations nor do they have the resources to invest in industrial designers' skills and capabilities.

The models explained in this report are meant to illustrate ways by which stakeholders can advance the integration of industrial design into SMM processes. To that end, the following could be implemented by government entities, nonprofits, design firms, and designers.

- Raise awareness and educate SMMs nationally and locally through executive education courses, formal presentations, webinars, and social media.
- Facilitate access to expert consulting services to enable SMMs to utilize and benefit from industrial design skills and capabilities. Potential mechanisms could include multiagency partnerships, design school internships, and support from private philanthropy.
- Connect designers with manufacturers, formally and informally, through design and manufacturing gatherings and workshops that benefit both groups.

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**Design House Chicago** <http://www.designhousechicago.org/>

**Future Works NYC** <http://www.futureworks.nyc/about/>

## Interviews

Conducted by Heidi Sheppard, Advisor for Technology Collaborations, NIST Manufacturing Extension Partnership and Katryna Carter, Design Consultant, Office of Programs and Partnerships, NEA

### Design Firms

**Jonas Damon**, (Executive Creative Director, Frog), May 31, 2016.

**Krista Donaldson**, (Chief Executive Officer, D-Rev), June 22, 2016.

**Mark Dzersk**, (Managing Director, LUNAR), May 27, 2016.

**Dan Harden**, (President & CEO, Whipsaw, Inc.), September 14, 2016.

**Kevin Hively**, (Founder, Ninegret Partners), June 2, 2016.

**Kelly Murphy**, (Strategic Partnerships Director, Design that Matters), May 11, 2016.

**Rene Polin**, (President and Founder, Balance Product Development, Inc.), May 24, 2016.

**Adam Reineck**, (Design Director and Co-Lead, IDEO.org), June 14, 2016.

**Harry West**, (Chief Executive Officer, Frog), June 1, 2016.

### Universities

**Prasad Boradkar**, (Professor of Industrial Design and Director of InnovationSpace, Arizona State University), June 1, 2016.

**Charlie Cannon**, (Associate Professor, The Rhode Island School of Design), June 10, 2016.

**Allan Chochinov**, (Chair, MFA Products of Design, School of Visual Arts, New York City and Partner, Core77), May 19, 2016.

**Daniel F. Cuffaro**, (Associate Professor/Chair of Industrial Design, Cleveland Institute of Art, and Principal Designer, Abeo Design, LLC), May 25, 2016.

**Terry Irwin**, (Professor and Head of the School of Design, Carnegie Mellon School of Design), July 13, 2016.

**Efe Kutuk**, (Lecturer, Michael Graves College at Kean University), May 26, 2016.

**Doreen Lorenzo**, (Director, Center for Integrated Design, University of Texas at Austin), June 15, 2016.

**Josh Owen**, (Program Chair, Professor/Design, College of Imaging Arts & Sciences, Rochester Institute of Technology), May 31, 2016.

**Lizzi Ross**, (Associate Director, Rhode Island School of Design Executive Education), June 10, 2016.

**Greg Victory**, (Executive Director, Continuing Education, Rhode Island School of Design), June 1, 2016.

**Craig Vogel**, (Director, Center for Design Research and Innovation, College of Design, Art, Architecture and Planning, University of Cincinnati), May 12, 2016.

**Andrea Wollensak**, (Professor of Art, Ammerman Center for Arts and Technology, Connecticut College), June 1, 2016.

### **Manufacturing Extension Partnership Centers and Associations**

**Stefane Barbeau**, (Acting Director, Design Industry Group of Massachusetts) June 14, 2016.

**Annette Brenner**, (Client Development Manager, NY High Tech Rochester), May 24, 2016.

**Scott Broughton**, (Center Director, Advantage Kentucky Alliance), June 23, 2016.

**Christian Cowan**, (Center Director, Polaris MEP), May 12, 2016.

**Steve Hatten**, (Executive Director, Idaho TechHelp), May 16, 2016.

**Carrie Hines**, (Executive Director, American Small Manufacturers Coalition and President & CEO, Foundation for Manufacturing Excellence), May 25, 2016.

**Ethan Karp**, (CEO, Ohio MAGNET), May 17, 2016.

**Peter Russo**, (Director of Growth & Innovation, Massachusetts MEP), May 4, 2016.

**Daniel Martinage**, (Executive Director, Industrial Designers Society of America), June 15, 2016.

**Jennifer McNelly**, (Executive Director, the Manufacturing Institute, National Association of Manufacturers), June 17, 2016.

**Ed Nolan**, (VP Product Development and Engineering, Ohio MAGNET), May 19, 2016.

**Don Pital**, (Group Manager, Growth Services, Georgia MEP), May 27, 2016.

**Dave Snow**, (Director, Indiana MEP Purdue Technical Assistance Program), May 25, 2016.

## Other Sources Consulted

**Matt Anthony**, (Director, Cincinnati Made and Program Manager, First Batch), May 5, 2016.

**Nepal Asatthawasi**, (Director of Development, Pratt Center), June 2, 2016.

**Carole Bilson**, (President, the Design Management Institute), June 2015.

**Jonathon Bowles**, (Executive Director, the Center for an Urban Future), May 5, 2016.

**Jannell Canerday**, (Industrial Designer and Consultant, Universal Woods), June 2015.

**Susan Page Estes**, (Founding Partner, DesignHouse), May 4, 2016.

**Jordan French**, (Industrial Designer, Blue Clover Studios), June 2015.

**Warren Ginn**, (Industrial Designer and Consultant, GinnDesign), June 2015.

**Josh Haldeman**, (Industrial Designer and Professor, Bullard and UCDAAP), June 2015.

**Paul Hatch**, (Founding Partner and CEO, DesignHouse), April 30, 2016 and March 16, 2017.

**Debera Johnson**, (Founder and Executive Director, Brooklyn Fashion + Design Accelerator), May 24, 2016.

**Chris Kasabach**, (Executive Director, Watson Foundation), June 10, 2016.

**John Riendeau**, (Client Services Executive, CommerceRI), June 10, 2016.

**Stuart Rosenfeld**, (Senior Associate, Regional Tehcnology Strategies), June 2, 2016.

**Michael Rowe**, (Industrial Designer, ACCO Brands), June 2015.

**Beth Siegel**, (President, Mount Auburn Associates), June 2, 2016.

**Justin Sirotin**, (Industrial Designer and Professor), June 2015.

**David Van der Leer**, (Executive Director, Van Alen Institute), July 13, 2016.

**Steve Warden**, (Industrial Designer, Jones Plastic), June 2015.

**Jacklyn Woniger**, (Industrial Designer, Escalade Sports), June 2015.





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