

SPECIAL REPORT

DESIGNING  
*flexibility*  
INTO THE  
INDUSTRIAL  
WORKPLACE



SOCIETY OF INDUSTRIAL  
AND OFFICE REALTORS



THIS RESEARCH STUDY WAS PRODUCED BY IAMC & SIOR  
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Empty or underused industrial buildings can bloat corporate real estate portfolios and add cost to operating budgets.

Is it feasible to put these outmoded facilities to new use?

Can you design for more flexibility?

A survey of global corporate industrial facilities users reveals the opportunities and challenges in repurposing their surplus industrial buildings.

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# FOREWORD

In January 2013, the Industrial Asset Management Council (IAMC) and the Society of Industrial and Office Realtors (SIOR) commissioned a survey of corporate users of industrial space to learn more about flexibility and adaptive re-use of industrial buildings. It is a compelling issue for our collective members, who are leading industrial asset managers, corporate real estate executives, and their suppliers and service providers, as well as for economic developers and government officials.

With the survey, and this white paper that interprets the results, we set out to accomplish four goals:

- Understand the current state of industrial facilities portfolios and how they are being positioned toward a future that may well include a change of uses.
- Benchmark the performance of our own portfolios against other companies.
- Learn more about industry best practices in the areas of flexibility and adaptive re-use.
- Offer guidance on ways to build in more flexibility and overcome obstacles to re-use.

This paper also features lessons from the experiences of leading companies, shedding new light on the issues and providing insight and concrete advice on ways to enhance the flexibility of their industrial properties.

We are grateful to the members of both IAMC and SIOR who took the time to complete the survey and to those who shared their experiences with us. Their willing participation and enthusiasm for this project made possible this significant contribution to the body of research on adaptive re-use and flexibility for industrial facilities.

We also acknowledge the 2010 IAMC Health & Science Industry Group white paper “Surplus Property,” which served as a valuable resource for this research.

IAMC/SIOR Working Group

Ron Grossmann, Novartis Pharmaceuticals Corporation  
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## Box 1. FINDING THE SWEET SPOT: NOVARTIS CONVERTS OLD-SCHOOL CANDY PLANT TO NEW-SCHOOL BIO LAB

It's unlikely that the founders of the New England Confectionary Company (makers of the iconic Necco Wafers) could ever have imagined that their sugar-coated-candy plant, built in 1926, would become a nexus of leading edge bio-pharmaceutical research less than a century later.



### NOVARTIS INSTITUTES FOR BIO MEDICAL RESEARCH, CAMBRIDGE, MA.

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But that's exactly what happened. In the early 2000s, Novartis Pharma AG purchased the aging brick facility, located in the heart of Cambridge, MA, and transformed it into a state-of-the-art research headquarters for the Novartis Institutes for BioMedical Research. The shift reflects a broader change in Cambridge's economic base: once the

center of the US candy-making universe, the city is now home to the American science and technology brain trust known as Massachusetts Institute of Technology, along with a significant concentration of technology and research firms.

**Challenges in decommissioning from food manufacturing.** The \$175 million Novartis project moved forward within a tight, two-year time frame and involved an unusual decommissioning process: removing sugar residue from the building's floors and walls. It meant cleaning the old-school way—with bleach and hot water, a process documented in an article about the conversion project in the Boston Globe <sup>1</sup>.

**Community outreach and historic preservation.** While careful attention was paid to preserving the building's unique exterior—the building is listed on the National Register of Historic Places—new construction has a decidedly twenty-first century sensibility. This balance is reflected in the company's approach to the water tower that tops the former candy plant, which had been painted to look like a roll of NECCO wafers. "The tower became an instant landmark on the Cambridge skyline and has become an important part of the city's architectural fabric," notes a history of the facility compiled by Novartis <sup>2</sup>.

To preserve the landmark and demonstrate the company's reputation as a good corporate citizen while identifying the tower with the building's new uses, Novartis ran a local design competition, soliciting ideas to repaint the tower, incorporating the Novartis color and logo. The competition drew more than 500 entrants, and the winning design was painted on the tower.

Other notable adaptive re-use efforts include the conversion of the original power plant that had coal-fired boilers into a 20,000 square foot amenities building, which houses a 180-seat, fully-wired auditorium and a full-service cafeteria.

**Rebates for green upgrades.** Novartis also was awarded \$850,000 in rebates for installation of energy-efficient materials including individually air-controlled fume hoods, high performance light fixtures and high

<sup>1</sup> Boston Globe, reprinted in Pharmaceutical Online  
(<http://www.pharmaceuticalonline.com/doc/candy-coated-0001>.)

<sup>2</sup> Novartis Institutes for BioMedical Research  
([http://www.nibr.com/cs/groups/public/@nibr\\_com/documents/document/n\\_prod\\_583993.pdf](http://www.nibr.com/cs/groups/public/@nibr_com/documents/document/n_prod_583993.pdf))

# EXECUTIVE SUMMARY

**IN 2012, THE VOLUME OF VACANT COMMERCIAL AND INDUSTRIAL SPACE TOPPED 30 PERCENT IN THE UNITED STATES ALONE ACCORDING TO SOME ESTIMATES<sup>1</sup>. ANECDOTAL EVIDENCE SUGGESTS THAT THE COST TO COMPANIES TO MAINTAIN EXCESS BUILDING INVENTORY CAN REACH \$15 MILLION A YEAR—PER FACILITY.**

As firms look to improve the performance of their corporate real estate portfolios, reduce costs, and enhance efficiency, they are seeking new ways to improve the utilization of their facilities. Instead of allowing outdated or excess properties to stand vacant, they are looking for innovative ways to repurpose them.

This study, a joint project of the Industrial Asset Management Council and the Society of Industrial and Office Realtors, presents the results of a survey of more than 60 corporate real estate executives of global companies, as well as architectural and engineering experts, with the goal of understanding more about adapting the vacant or underused industrial buildings in their portfolios for different uses. The survey also explores strategies to boost the adaptability potential of their facilities and barriers to re-use.

## THIS WHITE PAPER OFFERS VALUABLE INFORMATION ABOUT:

- **THE STATE OF US INDUSTRIAL REAL ESTATE RELATIVE TO THE FLEXIBILITY AND RE-USE POTENTIAL OF A RANGE OF PROPERTY TYPES:** Find out about the average age of industrial facilities portfolio, and how adaptable they are to change.
- **THE TIME COMMITMENT:** Respondents discuss how long their adaptive re-use projects took and the ROI time frame they require to make an adaptive re-use project worthwhile.
- **THE COST COMMITMENT:** Shedding new light on the repurpose/renovate-or-start-from-scratch dilemma, our respondents offer their frank assessment of the costs of repurposing. We also provide cost comparisons for building out similar projects from a basic shell.
- **MOST-COMMON RETROFITS:** Learn which buildings lend themselves to new uses and the kinds of transitions our

respondents have found most successful.

- **WAYS TO BUILD FOR FUTURE FLEXIBILITY:** In this section, our respondents share approaches that contribute to improved workplace flexibility, to prepare for smoother future transitions to different uses. We also highlight challenges users face in building in such flexibility.
- **CASE STUDY ANALYSES:** Insider stories of real-world experiences in reusing industrial facilities offer a unique, behind-the-scenes look at benefits gained and pitfalls to avoid.

## MAJOR FINDINGS

HERE IS A SUMMARY OF OUR PRIMARY FINDINGS:

- **CORPORATE REAL ESTATE PROFESSIONALS ARE CONCERNED ABOUT FLEXIBILITY AND RE-USE OF THEIR INDUSTRIAL PORTFOLIO:** A significant 84 percent of respondents indicate that flexibility and re-use potential are issues for them.

## SURVEY SAYS: TOP 3 PROPERTIES FOR ADAPTABILITY AND RE-USE

1. Warehouse/distribution centers
2. Light manufacturing plants
3. Research facilities

- **INDUSTRIAL ASSET PORTFOLIOS ARE AGING:** Nearly 80 percent of respondents said that their facilities—including warehouses, research sites, labs, and manufacturing plants—were on average at least 11 years old. More than 70 percent said their research facilities were 11 or more years old. One hundred percent of respondents with chemical and gas and heavy manufacturing facilities in their portfolios said that these properties were 11 or more years old.

<sup>1</sup> “Adaptive Re-Use of Corporate Real Estate,” Area Development Online, Winter 2012.

<http://www.areadevelopment.com/AssetManagement/Winter2012/adaptive-re-use-corporate-real-estate-6666544.shtml>

## Box 2. KNOW WHEN TO FOLD'EM. SOMETIMES, REPURPOSING ISN'T IN THE CARDS.

For Star Industrial Gas, Inc.\*, a provider of gases and related equipment for their industrial customers, the re-use dilemma isn't really a dilemma at all. The company's real estate portfolio consists primarily of plants that remain in the portfolio only as long as the customers need them and a few special purpose facilities.

"We build out customer sites with our process equipment on property they provide. When our long-term contract ends, we remove our equipment from the site," said the company's real estate manager.

Because of this business model, the company has very few of its own facilities. These holdings tend to have such special purposes that building for future flexibility is not a priority. "We build for now. We don't repurpose our buildings because the facility has to meet the requirements for what we are doing right now," the manager says.

When the company no longer needs the facility, she says, "We often end up selling it at bargain basement prices."

*\*Not the company's real name*

- **WAREHOUSE/DISTRIBUTION FACILITIES HOLD THE TOP SPOT FOR MAKEOVERS, WITH LIGHT MANUFACTURING PLANTS TAKING A CLOSE SECOND:** Sixty percent of respondents who oversaw a re-use project said they converted aging warehouse or distribution facilities. About 58 percent of respondents with light manufacturing facilities in their portfolio have converted such plants.
- **CONVERSION TIMEFRAMES VARY, DEPENDING ON PROPERTY TYPE:** While more than 70 percent of warehouse conversions took between seven months and two years on average, respondents who converted heavy manufacturing plants into something else said the process took more than two years on average, with some reporting a 36-month time frame.
- **SPECIALTY REQUIREMENTS FOR NEW USES IS ONE OF THE MOST IMPORTANT COST FACTORS IN A CONVERSION:** Respondents reported spending between \$2 and \$750 per square foot on readying existing facilities for new uses. Costs depend on the starting point—condition of the building and existing uses—as well as on the intended new use. The type and extent of specialty requirements represents a significant cost influencer according to respondents.
- **EVEN FACTORING IN COST TO DECOMMISSION SITES FROM EARLIER USES, THERE ARE COST SAVINGS IN REPURPOSING FACILITIES COMPARED TO BUILDING OUT AN EMPTY SHELL:** Reusing existing infrastructure lowers the cost of the new build out, our respondents said. More than 70 percent reported that the cost of stripping the building of unneeded, older equipment and infrastructure ranged between \$4 and

\$25 per square foot, on average, although these figures can vary depending on factors such as age of building, former use, and extent of specialty uses to be removed.

- **TIME TO RETURN ON CONVERSION INVESTMENT IS A CRITICAL CONSIDERATION FOR CORPORATE REAL ESTATE PORTFOLIO MANAGERS:** When asked about ROI required to move ahead with a conversion project, more than 45 percent of respondents selected the 1-3 year time frame, while 29 percent said they would consider a 3-5 year time frame.
- **WORK PROCESS, TECHNOLOGY INFRASTRUCTURE, FACILITY LAYOUT AND GEOGRAPHY ARE THE MAIN CHALLENGES TO FLEXIBILITY:** Respondents reported that staffing issues and organizational structure were less of a barrier than these physical plant-related aspects.
- **LONG-TERM ADAPTABILITY IS A TOP BENEFIT OF FLEXIBLE DESIGN:** A significant 57 percent of respondents who undertook a conversion said they would deploy the same strategy again if their business needs change. Examples of successful strategies include redundant power supply, infrastructure that can accommodate heavier loads, and minimal use of embedded specialty requirements.
- **THERE ARE WAYS TO DRAMATICALLY INCREASE BUILDING FLEXIBILITY:** Respondents and architectural and engineering experts suggested a variety of options to raise the flexibility quotient of facilities.

## Box 3. EVEN WHEN YOU LEASE IT MAKES SENSE TO RE-USE.

As a manufacturer and defense contractor, Mobius Industries\* is used to rapid changes in facilities needs. The company's real estate strategy reflects this reality.

"We lease our buildings. And we always do short-term leases, because we have to be prepared to ramp down quickly if our clients no longer require something, while ramping up equally quickly to meet some new need," explains the firm's industrial real estate portfolio manager.

Despite the ability to disengage relatively painlessly from facilities that are no longer useful, this manager says that his preference when needs change is to try to convert their leased facilities for the new use—rather than building out from scratch another leased facility.

The reason? "Even when you lease your industrial buildings, and even when the leases are short term, it makes more sense to try to re-use them and build them out for the new purpose," the manager says. "It doesn't always work, of course. You might have to move to a different location because of geography, for instance. Still, I've done the math, and all things being equal, it costs less to try to re-use what you've got."

One re-use project overseen by this manager involved repurposing a light manufacturing plant for use as an R&D center. The original cost to build out the shell for manufacturing came to about \$550 psf. The conversion project cost about \$40 psf. "I compare this to how much more it would have cost to build out an R&D facility from a shell, which I estimate to be in the \$200-\$300 psf range," the manager says.

*\*Not the company's real name*

## BASICS

The 2013 SIOR-IAMC Survey posed several questions designed to learn more about how corporate users categorize the industrial facilities in their portfolios, the types of buildings that typically make up such portfolios, and the average age of their industrial assets.

### PORTFOLIO DISTRIBUTION

▷ Respondents said that their industrial facilities fell into several distinct groups, characterized for the uses—and unique issues—associated with each type:

- ▷ Warehouse/distribution
- ▷ Research
- ▷ Laboratory
- ▷ Chemical and gas manufacturing
- ▷ Heavy manufacturing
- ▷ Light manufacturing
- ▷ Regulated manufacturing—such as pharmaceutical production and food processing

The overwhelming majority of those who responded to the question—more than 90 percent—said that warehouse and distribution facilities were a part of their portfolio mix.

Two thirds (66.66 percent) said they owned research facilities, while more than 60 percent have lab assets. About 15 percent of respondents have chemical and gas holdings.

A slight majority—52 percent—reported that light manufacturing plants represented at least a portion of their industrial holdings. Nearly 40 percent hold heavy manufacturing assets and about one third said they own regulated manufacturing facilities.

### AGE OF BUILDINGS

A significant 80 percent of respondents said their industrial facilities—including warehouses, research sites, labs, and manufacturing plants—averaged at least 11 years old. More than 70 percent said their research facilities were more than 11 years old, and 65 percent said their labs were more than 11 years old.

Manufacturing facilities are aging as well. A full 100 percent of respondents who own heavy manufacturing and chemical and gas properties reported an average time in use of more than 11 years, as did 90 percent of regulated manufacturing property owners and 62 percent of light manufacturing plant users.

Whether a longer time in use is a good thing or a not-so-good thing depends on the perspective of the user. Some studies suggest that the lease value of older industrial buildings declines by \$0.77 per square foot for every year of additional age.

But if the goal is to maximize return on a major facilities investment, then the longer the building remains usable, the better it is. On the other hand, business needs and market dynamics tend to change quickly. Older facilities

might not have enough flexibility built in to enable nimble response to rapid market shifts.

Our respondents said that age of the building does not always correlate to adaptability. The more specialized the purpose, the more difficult it can be to extend the building's lifetime for other uses, regardless of the facility's age.

Architectural and engineering experts who responded to the survey noted that specialty requirements can limit the usable lifespan of some facilities in their existing configuration—and future specialty requirements can limit the re-use potential of some facilities.

“If you’ve built out a facility according to specs for a particular manufacturing use, and then you stop manufacturing that particular product, you’re faced with a tough decision. On the other hand, it can be challenging to maintain flexibility when your needs are highly specialized,” said one respondent.

of activities, each of which comes with its own varied timetable:

- ▷ Analysis
- ▷ Evaluation of options
- ▷ Development recommendations
- ▷ Approval
- ▷ Design

## CONSTRUCTION

**NEARLY 60 PERCENT OF RESPONDENTS SAID THEY HAVE REPURPOSED WAREHOUSES.** For those who did undertake such projects, 24 percent reported completion in less than six months while just over 40 percent said it took between seven months and a year. About 29 percent of users who converted warehouse space required a 1–2 year time frame, while a few—about 6 percent said their conversions took three or more years.

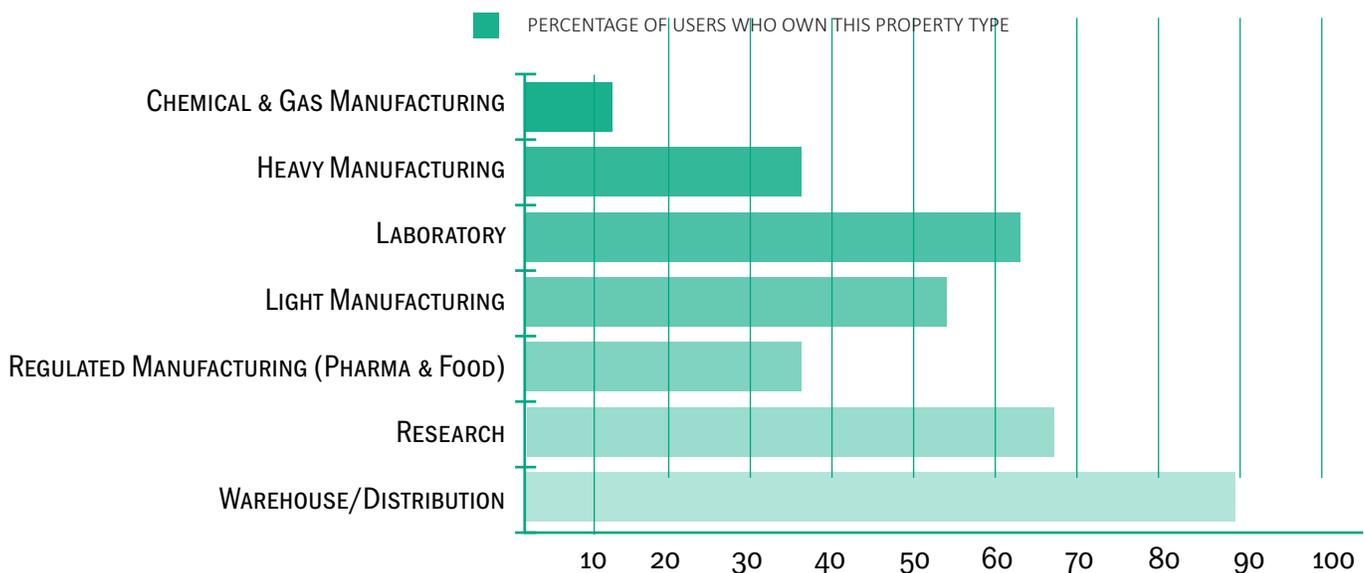
More than 80 percent of research conversion **PROJECTS WERE COMPLETED IN UNDER TWO YEARS, WITH MORE THAN 50 PERCENT TAKING BETWEEN ONE AND TWO YEARS.** For labs, 55 percent of respondents who did conversion projects said it was a 1–2 year process, while about 36 percent estimated shorter time frames. A variety of other time frames were reported as well: 17 percent of research conversions took three or more years while 9 percent of lab conversions extended beyond three years. Also of note: 40 percent of respondents said they had repurposed research facilities, and 39 percent re-used labs.

**LIGHT MANUFACTURING CONVERSION PROJECT COMPLETIONS RANGED FROM UNDER SIX MONTHS TO MORE THAN THREE YEARS, WITH MOST TAKING ABOUT 1–2 YEARS.** More than half of

# TIME FOR REPURPOSING

When we asked respondents how long it took to repurpose a building in their portfolio, their answers were all over the map. It’s not a surprise, given the diversity of uses and property types. Respondents said that the timeframe depended on a number of factors, the most important of which are the type of building to be re-used and the new purpose intended. Respondents also noted that repurposing typically includes several distinct subsets

**FIGURE 1.** Corporate users hold various types of industrial property



## Box 4. SIEMENS OVERHAULS AGING BERLIN FACTORY

Sometimes a conversion project can mean re-making an outdated manufacturing plant into a gleaming, modern production center that remains, at its core, a manufacturing plant. That's what Siemens is doing with its complete overhaul of an aging switchgear manufacturing plant in Berlin. The company is spending \$132 million to build new shop floors and replace existing production lines with modern, clean, and energy-efficient machinery to produce innovative switchgear products.

The project also involves new construction, with an add-on to the old facility that will house a new global research and development center for high-voltage switchgear engineering.

Company officials explained the rationale: full-scale modernization will enable the plant to meet the challenges of the future as a flagship despite tough global competition.

The conversion effort is part of a carefully calibrated, strategic plan to align Siemens' massive global real estate portfolio—3,000 facilities, spanning 190 million square feet in 40 countries around the world—with the sustainability DNA of the products it sells.

To date, the company has invested in green upgrades to 90 of its older industrial facilities: modernizing heating and ventilation controls, replacing electric motors with more efficient models and retrofitting ventilators and pumps with frequency converters, in addition to the complete overhaul of the Berlin facility.

*\*Portions of this profile originally appeared in the January 2011 issue of Site Selection magazine under the title "Global Commitment: Siemens Talks the Talk and Walks the Walk"*

respondents (58 percent) said they had undertaken a project involving re-use of a light manufacturing plant. Of those who reported doing such projects, 43 percent said the project took more than one year but less than two. Thirty percent said their projects took up to a year to complete, while 17 percent reported a project timeframe of three years or more. About 9 percent said the project lasted six months or less.

**REPURPOSING HEAVY MANUFACTURING FACILITIES TYPICALLY TAKES THREE YEARS OR MORE.** Of the respondents who took on such projects, more than 60 percent said this timeframe was the norm. Another 23 percent reported a 1–2 year time period, while 16 percent reported project completions within one year or less.

**IT IS POSSIBLE TO RE-USE PHARMACEUTICAL OR FOOD PRODUCTION FACILITIES.** Of the 13 survey respondents who said they had repurposed regulated manufacturing facilities, most(seven) said that the average time to completion of such projects fell in the 1–2 year time frame.

Two respondents reported projects that averaged three years or more, while three said their projects took between six months and a year. One respondent reported an efficient, less-than-six-month completion time.

**Table 1. Examples of industrial property conversion costs**

Original use	New use	Cost to convert (\$ psf)
Heavy manufacturing	Laboratory	200
Heavy manufacturing	Light manufacturing	40
Laboratory or research	Classified facility (SCIF)	150–250
Laboratory or Research	Office	200
Laboratory or research	Upgrades for new uses in same category	400–750
Light manufacturing	Heavy manufacturing	55
Regulated manufacturing	Data center	200–500
Warehouse/distribution center	Light manufacturing	15–40
Warehouse/distribution center	Office	45-300

# Box 5. HEAVY MANUFACTURER CONVERTS EXCESS INDUSTRIAL RE FOR TENANTS

Fairleigh Industries\* has extensive real estate holdings in a prime location—near a major deep-water port and extensive rail and highway networks. But some of the facilities within the expansive footprint had become outdated and no longer served the company’s heavy manufacturing purposes.

What could they do with these facilities? They required maintenance and upkeep. They were a drain on company’s resources. They were a bit of an eyesore.

The company explored several options. They didn’t need the buildings for themselves, so there was no thought given to repurposing them for internal uses. Selling them wasn’t a viable option either, according to the company’s real estate portfolio manager. “It didn’t make sense to try to sell them, given that many of the buildings in question were attached to others that we were still using. A sale would not have been easy,” he says.

**A third way.** In seeking ways to recoup the carryings costs for these buildings, the company came up with a third alternative: become a landlord. “We repurposed these buildings and leased them out to other industrial users.” The manager notes that the facilities’ proximity to the port and access to the extended site’s transportation infrastructure were strong selling points for other companies in need of space. Another advantage for potential tenants: the appropriate zoning was already in place for industrial uses.

The manager says that his company exercised tight control over the costs associated with the repurposing projects. This was critical to the success of the approach. “We didn’t put in any money up front. We waited until we had a user, and then we made basic modifications for the user, to ensure that the building was up to code,” he notes. “We didn’t invest in additional modifications or retrofits unless we had a business case to justify the improvements.” The effort yielded a strong return on the company’s investment as a result. Meanwhile, it helped other firms find space in an ideal location—likely for less than what they might have paid elsewhere.

**The takeaway.** This approach requires an entrepreneurial mindset in the C-suite. Many firms today may be so focused on their core businesses that they may overlook opportunities with strong potential for a new income stream. There’s another benefit, experts say: avoiding costs associated with either maintaining a vacant building or tearing it down.

*\*Not the company’s real name*

## COST OF REPURPOSING

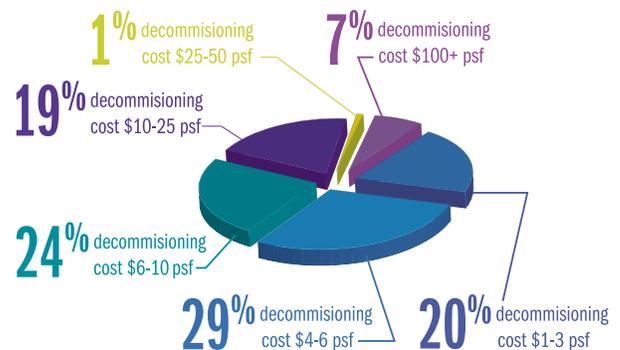
With some corporate users suggesting costs that run nearly \$15 million a year just to maintain excess building inventory—including security and basic upkeep—there’s a strong incentive to examine alternatives such as adapting unused buildings for other purposes.

We asked several cost-related questions to understand more about the financial realities of repurposing industrial facilities.

### COST TO IMPROVE FROM CURRENT CONDITION TO REPLANNED, REBUILT, AND-IN-USE

We began by asking about the per-square-foot cost to convert properties from one use to another. Responses

FIGURE 2. Decommissioning factors into overall repurposing costs\*



\*Responses from corporate users to: “Within the following property types, please specify average cost (on a per square foot basis) to decommission property (prepare for re-use). Calculations exclude respondents who answered “Never Done.”

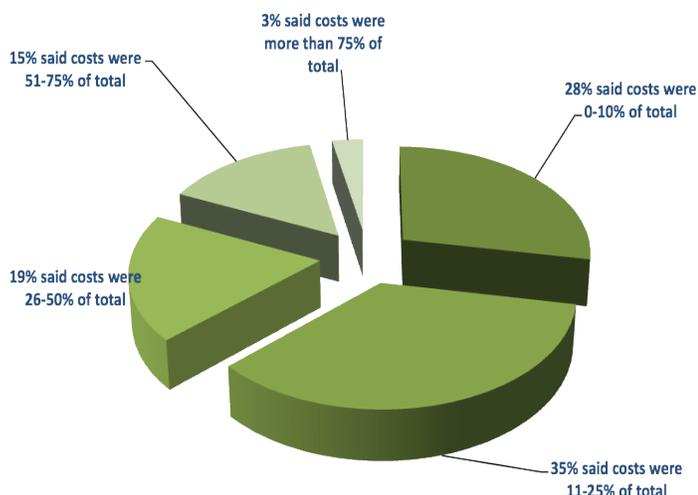
varied widely—from as little as \$2 per square foot up to \$750 per square foot. The responses indicate a direct correlation between conversion costs and type of facility being converted. For example, it cost one firm about \$750 psf to upgrade an existing lab for different lab uses. Another respondent estimated a \$40 psf cost to convert a warehouse into a light manufacturing plant—about the same as it cost to build the original facility.

Table 1 shows some typical conversion projects undertaken by survey respondents, with a range of per square foot conversion costs. Respondents also provided information on the original construction costs of the industrial properties they planned to repurpose. This information is shown in Table 2.

## PREPARATION FOR NEW USE INCLUDES DECONSTRUCTING FROM OLD USE

Decommissioning sites—removing unwanted equipment, technology, and infrastructure—to ready them for a different use can cost upwards of \$100 per square foot, particularly for manufacturing and chemical and gas facilities, survey respondents with decommissioning experience said. Unusual or challenging features—such as the presence of a tank farm on the site—could require a remediation effort that adds significant cost to the decommissioning process. On the other hand, 13 of the 25 respondents (52 percent) who decommissioned warehouse facilities in preparation for other uses said that their decommissioning costs added only \$1-3 per square foot to the overall repurposing project. Fifty-five percent of respondents with experience decommissioning manufacturing sites estimated a \$10–25 per square foot decommissioning cost.

**FIGURE 3.** Percent of occupancy costs for decommissioning and installing specialty uses, across all industrial property types\*



Overall, more than 70 percent of respondents across all industrial use types estimated that their decommissioning costs fell within the \$4–\$25 per square foot range.

We asked our architectural and engineering experts a similar question about the cost of decommissioning old specialty uses and the cost of installing new specialty uses associated with the re-use project. Their responses also varied, depending on the type of building use. Across all building types, most (35 percent) said that the combination of decommissioning and new installation represented 11-25 percent of total occupancy costs for the new use.

Figures 2 and 3 offer a breakdown of these results.

**Table 2. Original construction costs for selected facilities types**

Property type	Original construction cost (\$ psf)
Light Manufacturing	125-550
Laboratory	300-350
Research	250-350
Warehouse/distribution center	20-90

\*Responses from A&E experts to the question: "Within each of the following property types, please specify estimated percentage of total occupancy cost related to installation and decommissioning of specialty improvements."

**Table 3. Build out from shell or convert from prior use—a cost comparison**

Property type	Avg cost to build from shell (\$ psf)	Avg cost to convert to this use from a different use(\$ psf)
Heavy Manufacturing	\$200-300	\$55
Laboratory*	\$200-300	\$200
Light Manufacturing	\$100-200	\$15-40

\*Excludes respondents who upgraded existing lab facilities to different lab uses. These respondents reported that lab upgrades—from older lab uses to new lab uses—can cost up to \$750 psf, depending on the specialty requirements.

## COST TO BUILD AN INDUSTRIAL PROPERTY FROM A PLAIN SHELL

We asked survey participants how much they typically spend to build out an industrial facility from a basic shell ( see Figure 4). Their responses reveal opportunities for significant cost savings by converting properties from one

use to another, compared to, say, a build-to-suit project—depending on intended use. Table 3 highlights these cost differentials for a few industrial properties, with calculations based on responses to our cost estimate questions.

## COSTS RELATED TO SPECIALTY USES

Respondents also said that specialty requirements associated with the new uses, such as installation of specialized infrastructure, represented a key cost factor when repurposing existing properties. And sometimes, these specialized requirements prevent users from re-using existing facilities. “We always start from scratch because our equipment and infrastructure is so specialized that it wouldn’t make sense to try to re-use something that’s there,” says one corporate owner. “Besides, the building itself is the least expensive aspect of our plant. The cost is in our infrastructure and equipment, and that wouldn’t be any different if we were using an existing facility or if we were doing something greenfield.”

We turned to the experts—our architectural and engineering survey participants—for their take on such improvements and how much they contribute to the overall occupancy costs.

Again, the responses varied, depending on the intended use. Specialty improvements associated with manufacturing projects—including light, heavy, and regulated—represented between 11 and 25 percent of the overall occupancy costs for about half of the A&E survey participants.

Not surprising, the majority of A&E experts who have worked on chemical and gas facilities projects responded that specialty improvements represented up to 75 percent of occupancy costs.

Such facilities can require massive capital costs, even when they are being repurposed from a related use. In one recent study commissioned by the Delaware County (PA) Industrial Development Authority, re-use options for the massive Sunoco Marcus Hook industrial refinery near Philadelphia were explored. The study’s authors estimated conversion costs ranging from a low of \$300 million, for a natural gas liquids processing facility that could use existing plant infrastructure, to \$2.5 billion for a liquefied natural gas export terminal, to a high of \$6 billion for conversion to a gas-to-liquids production and storage facility<sup>1</sup>.

## RETURNS ON INVESTMENT

When we asked survey participants about the required return on their conversion investment to make it worthwhile, nearly half—46 percent—said they were looking for a 1–3 year time to ROI, regardless of facility type. Another 30 percent said they required a 3–5 year ROI to move forward with a conversion project. And about 20 percent said they would be willing to extend the ROI

horizon beyond five years, depending on the strategic nature of the investment itself.

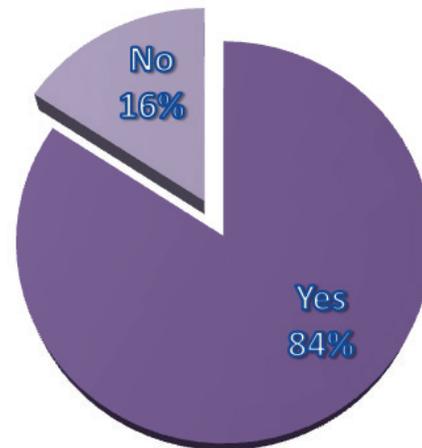
Other factors impacting time to ROI include specialty requirements associated with the new use and the complexity of build out.

These time frames compare favorably with required ROI on greenfield investments. One corporate owner in the pharmaceutical industry reported that his company’s best-case ROI benchmark for greenfield projects is three years. Five years is the company’s worst-case time to ROI for new industrial facilities construction.

## BARRIERS TO FLEXIBILITY

Clearly, corporate real estate professionals are concerned about flexibility and re-use of their industrial portfolios. The very first question in our survey asked corporate users and A&E experts if flexibility and re-use potential were issues for them. An overwhelming majority of corporate users—84 percent—said yes.

### Flexibility is an issue in my industrial portfolio



An even larger percentage of A&E experts (92 percent) agreed.

Perhaps one reason that flexibility is such a compelling issue is that several factors often conspire to get in the way of building with a greater emphasis on adaptability. Our survey participants identified a number of specific obstacles to building for more flexibility.

**WORK PROCESS, TECHNOLOGY INFRASTRUCTURE, FACILITY LAYOUT AND GEOGRAPHY REPRESENT THE GREATEST BARRIERS TO INCREASED FLEXIBILITY.** Across all facilities types, 85 percent of respondents cited these issues as the main obstacles to building more flexible industrial workplaces. Respondents with experience trying to build flexibility into chemical and gas, heavy manufacturing and regulated manufacturing plants cited workflow as the biggest challenge for them. For light manufacturing, close to 40 percent said that

<sup>1</sup> “New IHS Study Offers Potential Options for Re-use of Sunoco Marcus Hook Industrial Complex Near Philadelphia” (<http://www.ihs.com/info/ecc/a/marcus-hook-resuse-study.aspx>)

## Box 6. BUILDING FOR A MORE FLEXIBLE FUTURE

Once upon a time, companies built their manufacturing plants assuming that in 20 years, they'd still be doing the same things—making the same products, using the same equipment, deploying the same processes.

“We used to go into a new construction project assuming that what we were building for now would remain the building’s purpose for a long time to come. So, we only built for now,” says one long-time senior executive of a major consumer goods company

Not anymore.

“Our approach to our industrial real estate is different today, because our overall business assumptions are fundamentally different than they were 20 years ago,” he notes.

What’s different?

Product life cycles are shorter. Near-constant technology innovations keep disrupting the status quo. And business strategies continue to change.

“Today, when we build a new building, we go into it assuming that something will change,” this executive says. “So, if you take the position going in that the uses in all likelihood will change over time, then your design and construction approach is going to be different from the old way, when the assumption was that nothing was going to change.”

As he guides his team on new projects today, he encourages them to keep in mind ways to maximize the future re-use potential of the facility.

Among the most effective ways to retain flexibility, he says: keep the building itself constant and look for ways to minimize permanent specialty use requirements by shifting the specialty requirements to replaceable equipment.

“Try to resist the pressure from your user groups to build in a high level of customization, because it’s the permanence of specialized uses that can reduce the adaptive potential of the facility.” He adds that customization can come with the equipment that gets installed. “Specialty uses can be added in or changed out with relative ease as needs change. The manufacturing lines themselves can be changed out as your product lines change.”

facility layout represented the number one obstacle.

**BUILDING FOR FUTURE FLEXIBILITY CAN COME WITH A HIGHER UPFRONT COST.** Respondents noted that long-range planning for future heavy manufacturing uses might include building in a heavier roof structure than is required for the current use. However, this would likely add cost to the project—an investment that might not see a return for a number of years. Similarly, building in a more flexible utilities infrastructure can be more expensive, and it might not prove useful down the road, they said. Others noted that gaining buy-in from senior management for higher initial costs can be tough, especially if future returns on investment are difficult to quantify.

**BUILDING TO MEET CURRENT NEEDS MIGHT REDUCE FUTURE FLEXIBILITY.** For example, one respondent indicated that changes in business levels could lead to a change in square footage requirements. While the company may require a certain size facility now, going forward, it might not need as much space. Or, it might need more space but lack the

## 7 BARRIERS TO FLEXIBILITY

1. Higher upfront costs
2. Longer time-to-completion
3. Hard-to-quantify ROI
4. Location and layout constraints
5. Utilities limitations
6. Uncertainty over future business needs
7. Regulatory/environmental issues

# ADAPTABILITY CHECKLIST

## Technical guidance from A&E experts and industrial RE professionals on how to increase flexibility of your industrial sites

### For chemical & gas manufacturing plants:

- ✓ Incorporate planning for flexibility in campus-wide design considerations
- ✓ Outside utility access and raw materials flows should allow for:
  - ▷ Broad facility interface
  - ▷ Utility expansions
  - ▷ Replacement over time

### For heavy manufacturing plants:

- ✓ Build structural components to accommodate heavier loads
- ✓ Build in raised floor and movable walls
- ✓ Use below-the-floor quick connect modular electrical and data cabling
- ✓ Focus on convertibility in addition to expandability

### For laboratories and research facilities:

- ✓ Build in raised floors, movable partitions, and sink units that can be relocated
- ✓ Reconfigure floor plan based on existing utility infrastructure
- ✓ Centralize glass wash/freezer farms to free space
- ✓ Add more services to modular utility grid, exhaust path, and process loops
- ✓ Use “plug-and-play” technology infrastructure, pre-assembled testing and movable casework and equipment

### For light manufacturing plants:

- ✓ Factor in additional acreage for more employee parking over time

- ✓ Build in power redundancy for ability to increase power supply
- ✓ Design scalable layouts
- ✓ Plan sufficient building clear height to allow for multi-level platforms
- ✓ Plan for future expansions up front during planning phase
- ✓ Follow guidance for heavy manufacturing plant

### For regulated manufacturing plants:

- ✓ Build in raised floors and movable partitions
- ✓ Use below-the-floor quick connect modular electrical and data cabling
- ✓ Ensure that zoning and economic development plans support uses into the future
- ✓ Use bus duct and fabric duct to accommodate product line changes
- ✓ Build in additional freezer and cooler capacity for future expansion
- ✓ Plan for multi-product capacity
- ✓ Use modular design and centralized services

### For warehouses:

- ✓ Reconfigure building footprint to accommodate more truck bays
- ✓ Reconfigure site plan for uniform access and improved truck maneuverability
- ✓ Plan for additional column and beam capacity for roof top and mezzanine equipment locations
- ✓ Design rectangular footprint with minimum 2:1 length-to-depth ratio and standard bay sizes and clear heights
- ✓ Use column spacing to accommodate multiple rack layout
- ✓ Add punch outs for windows in tilt-up walls
- ✓ Build in multi-temperature capabilities

acreage to expand. Specialty requirements and infrastructure also can make it more difficult to repurpose the facility in the future.

### THERE IS A GENERAL LACK OF CERTAINTY ABOUT FUTURE STRATEGIC BUSINESS DIRECTIONS AND A LACK OF ALIGNMENT BETWEEN CORPORATE REAL ESTATE PORTFOLIO STRATEGY AND OVERALL BUSINESS STRATEGY.

Users of all industrial facilities cited uncertainty as a significant barrier to dramatic increases in the flexibility of properties. For instance, a company could alter its location strategy with new mandates requiring proximity to emerging customer or supplier markets. In fact, the entire mission could change some respondents said. Such factors make it more difficult to plan up front for longer-term flexibility.

### OLDER BUILDINGS MIGHT NOT WORK WELL FOR SOME NEW USES.

Respondents indicated that older buildings with low clearance heights may have limited re-use potential, especially for manufacturing. One survey participant who has supervised several adaptive re-use projects for a pharmaceutical company said that some conversion projects simply aren't feasible, such as transforming aging manufacturing plants for new office uses. "We did study converting manufacturing space to office space, and we found that it absolutely didn't make sense. The new uses were too incompatible, and the costs involved would have been too high, so we didn't move forward," he said.

### ENVIRONMENTAL ISSUES CAN CREATE OBSTACLES TO RE-USE.

Environmental factors can make it more difficult to repurpose facilities. "If you've got to do remediation, or if there's a tank farm on the property, it's going to make your re-use project a lot more challenging," commented one respondent. On the other hand, "Even if you don't re-use it, you still have to do the mitigation in order to sell the building," noted another respondent.

## STRATEGIES AND RECOMMENDATIONS TO ENHANCE FLEXIBILITY

We wanted to understand the approaches being used to enhance flexibility by those who've actually overseen such projects and whether the approaches used were successful. Here are some of the most frequently cited conversions undertaken by survey respondents.

Heavy manufacturing → light manufacturing and office space

Light manufacturing → engineering lab

Light manufacturing → warehouse

Laboratory → expanded laboratory

Research → SCIF facility

Lab/research/warehouse → office

We also asked whether they would use the same strategy again.

Significantly, 96 percent said, "Yes, I'd use it again."

## HOW TO DRAMATICALLY RAISE THE FLEXIBILITY QUOTIENT

Survey participants also shared their thoughts on additional ways to enhance flexibility and adaptability.

Their responses can be divided into two key areas: **physical plant enhancements** and **people**.

**Yes! I would use the same flexibility strategy again.**  
**96%**

### In their own words

Survey participants are focused on flexibility

"For added flexibility in our heavy manufacturing plant we build core processes in close proximity to each other."

"Roof raising is a very effective way to increase warehouse capacity."

"Re-tasking existing manufacturing sites for new products is the most cost effective path to use."

"We repurposed a heavy manufacturing plant for light manufacturing and office uses, which increased the utilization of our owned, legacy properties."

"Making use of existing electrical capabilities helps the conversion process."

"We successfully converted outdated lab space for offices"

"Modular design adds to re-use potential."

"We're designing for now while keeping future business needs in mind."

# Box 7. BUILDING FOR FINDING THE BALANCE BETWEEN PHYSICAL PLANT FLEXIBILITY AND WORK FORCE CULTURE A MORE FLEXIBLE FUTURE

When the facilities team of a biotech company unveiled their plans for a new lab/R&D complex, they told the scientists who would work there that the focus was on openness, with a goal to encourage collaboration while enabling an easier conversion to other types of uses in the future.

“Some of the scientists expressed strong reservations,” recalls the firm’s facilities director. “Many of them consider themselves introverts by nature, so when we talked about working in open spaces, they got kind of nervous.”

The team faced a multi-pronged challenge, the director says. “We wanted an approach that would enable maximum adaptability into the future. We wanted a physical plant that would encourage collaboration. But we also wanted a layout that would nurture the individual creativity and intelligence of the scientists, and help them do what they do best.”

**Not your father’s open plan.** The design envisioned reflected the latest thinking on the notion of open plans. “Of course, an open space is inherently conducive to flexibility and redesign. But what we have designed is more than just a wide open landscape, with lots of benches and no walls,” the director says. In fact, the phrase “open plan” is a bit of a misnomer in describing the approach that’s gaining traction today.

A more apt description might be “varied plan,” the director says. There are open areas, along with private spaces—nooks and crannies, as he calls them—where one or two people can hide away or small groups can huddle for a quick meeting. The team is making use of movable interior walls and innovative furniture, such as Steelcase’s “Mediascape” to create small, collaborative workspaces that can be moved as layout needs change.

Utilities and services such as dishwashing are centralized and shared. A “freezer farm” features several commercial grade freezers where samples can be stored at extremely cold temperatures, but smaller freezers are located near scientists’ individual workspaces for convenience.

**Know your limitations.** Still, there are limits to the facility’s flexibility, the director says. In addition to the workforce culture issues, fire code requirements, permitting, and the nature of the activities taking place all add to the complexity of the project. Work with solvents—a commonplace activity in a lab setting—comes with significant restrictions. “These activities have to remain anchored on the lower floors due to these restrictions, so that does constrain your flexibility,” the director notes.

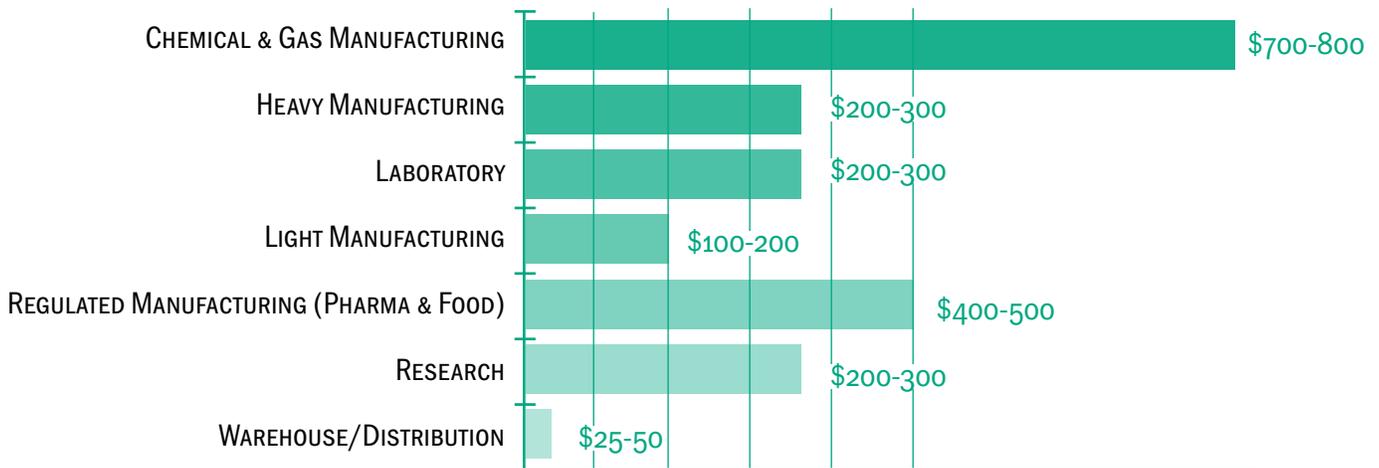
On balance, though, this director believes that flexibility—while taking into account the needs of the people who will be using the building—is the way to go. “Designing for maximum flexibility will pay off in the long run,” he says.

## STEELCASE’S MOVABLE MEDIASCAPE LOUNGE



(Credit:<http://www.steelcase.com/en/products/category/integrated/collaborative/media-scape/pages/overview.aspx>)

FIGURE 4. Average cost to build out a shell for industrial uses, \$psf



Among the physical plant enhancements suggested:

- ▷ Plan for redundant power supply
- ▷ Design to meet regulatory criteria of global markets
- ▷ Build in heavier roof structure
- ▷ Minimize customized aspects of the building structure—shift specialty requirements to equipment that can be changed out
- ▷ Centralize services

(For more, see the Adaptability Checklist)

Respondents said that the non-technical, people-oriented aspects of an adaptive re-use project are as important as the technical considerations. These include:

- ▷ Attention to change management and communication is key.
- ▷ Take into consideration the comfort and satisfaction of internal “customers”—like the scientists who will be actually using the lab space.
- ▷ Focus on both short-term conversion goals and longer-term adaptability from the very beginning of the project.
- ▷ Work closely with local economic development authorities and planners on zoning to reduce the risk that future changes in use will require a costly, time-consuming and extensive re-zoning and permitting process.
- ▷ Have an exit strategy. Identify factors and decision points for moving the property out of the portfolio.

## SURVEY METHODOLOGY

The data gathering for this white paper followed three tracks. We surveyed corporate real estate executives (CREs) of major US-based manufacturing companies. We surveyed architecture and engineering firm executives who had experience working with the CREs who were surveyed. And we interviewed a number of the CREs about specific buildings in their portfolios.

The survey of IAMC active members (all corporate end-users) consisted of 15 questions delving into deep detail about a range of industrial facilities. Descriptive information was requested on the following facility types: distribution, research, laboratory, chemicals, heavy and light manufacturing, and regulated manufacturing. Some of the questions were quite dense and involved. The median amount of time spent on the survey by each CRE was almost 10 minutes. With 63 completed returns, the survey achieved an impressive 37 percent response rate. This figure is even more remarkable given that companies are often reluctant to share internal information of any kind, much less potentially sensitive information on facilities that are mostly in operation to produce and distribute the goods whose sale produces the companies’ revenue.

The Survey of IAMC architecture and engineering (A&E) firms was a shorter version of the end-user instrument, consisting of 7 questions. Respondents were asked to consider facilities their companies had worked on for IAMC active-member companies. With 12 completed returns, the survey achieved a 31 percent response rate.

The strong response rates from both groups are a clear indication of the tremendous interest in this topic.

## CONCLUSIONS AND NEXT STEPS

Today, following years of shrinking their industrial portfolios, companies around the world are looking to make the most out of the buildings that remain in these

portfolios. There is a growing body of evidence that adaptive re-use of industrial facilities isn't just possible, it is—in some circumstances—optimal.

In fact, tangible progress is being made on the absorption and re-use of surplus industrial facilities.

For example, of the 267 automotive production facilities in the US that have shut down since 1979, 128 have been repurposed—nearly 48 percent—typically for other industrial uses, according to the Center for Automotive Research<sup>1</sup>. More than 40 percent of this activity has occurred since 2008.

As interest grows and the repurposing approach gains traction—due to a combination of factors including cost considerations, increased focus on sustainability, and rapidly changing product mixes requiring more nimble production facilities—corporate users are seeking guidance on how to implement such projects.

This first-of-its-kind survey makes an important contribution to the flexibility and adaptive re-use issue, offered by those who understand the challenges and opportunities best—the corporate real estate professionals who work for and with some of the world's most prominent companies and who are charged with the responsibility of making building-related decisions for their firms.

The study reveals that there are limits to re-use of existing facilities, with constraints including cost, infrastructure, technology, and uncertainty about future business directions. It also offers forward-looking, hands-on guidance as firms think about construction of new facilities, on how to amplify the flexibility quotient and how to turn a theoretical commitment to re-use into the tangible reality of a flexible facility that can be adapted and repurposed as business needs change.

As often occurs with any endeavor of this type, the responses to this survey have provoked additional questions as yet unanswered. Clearly, additional work needs to be done, to delve even more deeply into these flexibility and adaptability issues, as well as barriers to improvement. Can you continue to use the building while it's being repurposed? What are the practical workplace considerations when seeking to build in future flexibility to enable yet-to-determined uses? What are some of the unique industry-specific considerations?

Going forward, a Phase 2 IAMC/SIOR study will aim to address some of these unanswered questions. This study also will identify scenarios for selected facility types that could dramatically increase their flexibility in use and reduce the time and investment needed to ready them for their next use.

<sup>1</sup> <http://www.dol.gov/autocommunities/Repurposing/executive.pdf>



## PARTICIPATING COMPANIES

3M Company

AbbVie

Air Products Inc.

Alcoa

Amway

Andersen Windows Corporation

Anixter

BASF

Bristol-Myers Squibb

Caris Life Sciences

Catalent

Caterpillar Inc.

Celgene

Dal Tile

Delphi Automotive

Donaldson Company, Inc.

Endo Pharmaceuticals

Genco ATC

General Electric

Ghafari

GlaxoSmithKline

Greif

H.B. Fuller

Henningsen

Ingram Micro

Integrated Project Services

Johnson & Johnson

Kinder Morgan

Maersk

MeadWestvaco

Medline Industries

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