FUTURE
INVESTMENT
INITIATIVE
Powered by the FII Institute

8TH
EDITION

THE FUTURE OF LIVING: SMART LIVING AND CONNECTED COMMUNITIES

Priority Champions | Smart living

مجموعة روشن
ROSHN GROUP

BAIN & COMPANY

INTRODUCTION

→ **THE REAL ESTATE AND CONSTRUCTION INDUSTRY** is one of the largest in the world, with a market size of approximately $14 trillion. Despite its substantial size and impact on quality of life, the industry has been slow to adopt innovations that could make it more customer-centric, sustainable and efficient – key factors for creating smart living and connected communities.

"Smart living" involves integrating advanced technologies into everyday life to enhance comfort, convenience, efficiency and sustainability. "Connected communities" take the concept further, applying the principles of smart living to entire neighborhoods or urban areas. These communities leverage digital infrastructure, smart mobility solutions and community engagement platforms to improve social interactions, economic efficiency and environmental sustainability.

It's crucial that we understand current challenges in the industry and behavioral trends that are driving it toward the future of living. This paper explores the full potential of smart living and connected communities. It also examines the existing industry structure, transformative behavioral trends and strategies to accelerate adoption.

A PARADIGM SHIFT
IN THE REAL ESTATE INDUSTRY: SMART LIVING AND CONNECTED COMMUNITIES

THE REAL ESTATE INDUSTRY IS ONE OF THE LARGEST sectors globally, directly employing more than 220 million people and contributing approximately 13% of the world's GDP. However, it has been slow to innovate on customer-centricity or sustainability.

Slow adoption has contributed to several environmental, social, economic and physical challenges that directly affect human life *(see Figure 1)*. Studies indicate a strong link between housing quality, availability and affordability, as well as overall health and well-being.

Deficits in innovation, customer-centricity and sustainability are caused by the industry's fundamental structure and inefficiencies across the value chain. Real estate products are not sufficiently anchored in customers' needs and desires. The design process is not "intelligent" and is often seen as an art rather than a science. Compared to other industries, the real estate industry's technology use is subpar and lacks standards for compatibili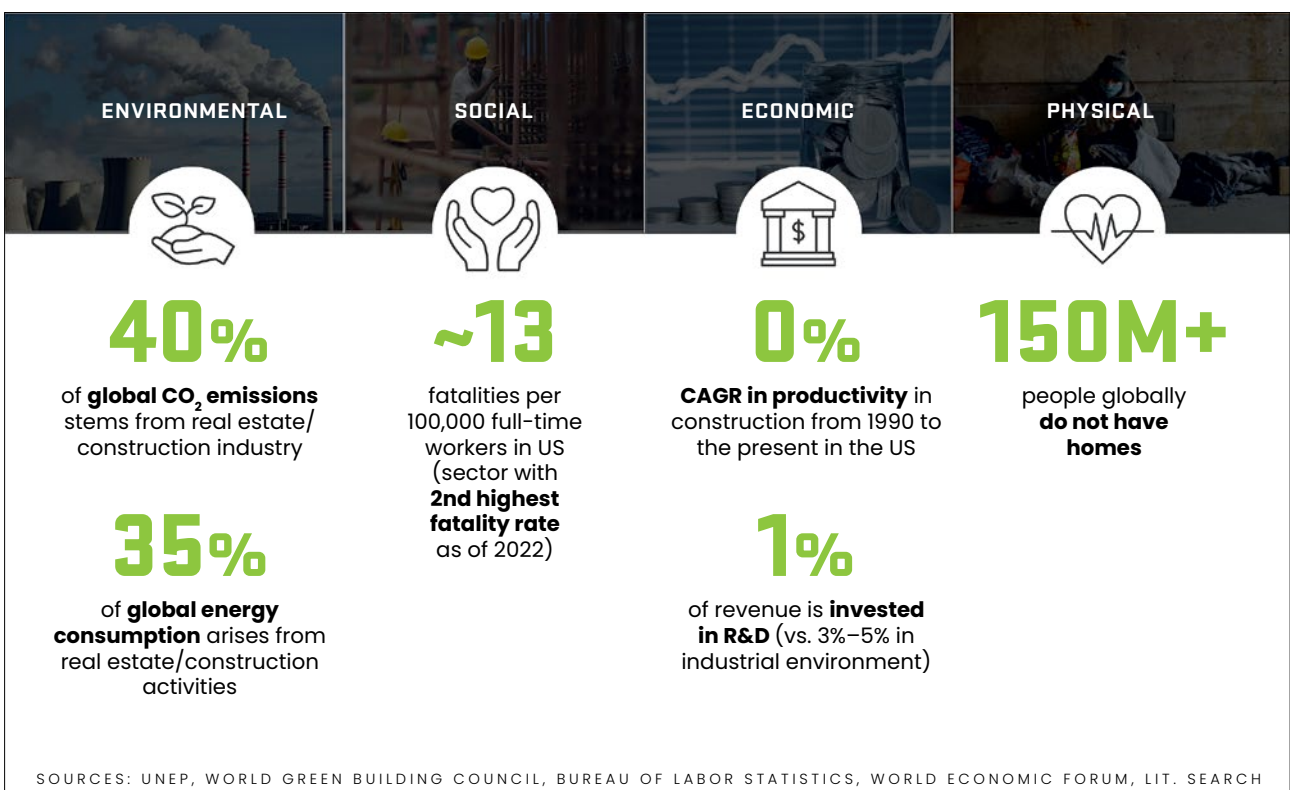ty and portability. Consequently, products are not systematically optimized to improve quality of life. However, transformative behavioral shifts are forcing the industry to change. Global research from Bain & Company identified key shifts in consumer behavior that are driving change *(see Figure 2)*.

The real estate industry will reward players who embrace and lead these shifts. Bain's analysis of the industry's profit pool dynamics predicts a shift in favor of innovators, with profits for customer-centric services, prefabricated products and software providers projected to double by 2030. *(See Figure 3.)*

STRATEGIC IMPERATIVES FOR THE FUTURE OF LIVING

Behavioral changes will transform how we live and connect and set new standards for well-being and quality of life. These fundamental behavior shifts need to be matched strategically and require the industry to act on four strategic imperatives:

Figure 1. Challenges within the real estate industry directly affect human life.

ENVIRONMENTAL

40% of **global CO$_2$ emissions** stems from real estate/construction industry

35% of **global energy consumption** arises from real estate/construction activities

SOCIAL

~13 fatalities per 100,000 full-time workers in US (sector with **2nd highest fatality rate** as of 2022)

ECONOMIC

0% **CAGR in productivity** in construction from 1990 to the present in the US

1% of revenue is **invested in R&D** (vs. 3%–5% in industrial environment)

PHYSICAL

150M+ people globally **do not have homes**

SOURCES: UNEP, WORLD GREEN BUILDING COUNCIL, BUREAU OF LABOR STATISTICS, WORLD ECONOMIC FORUM, LIT. SEARCH

50% of respondents **limit home energy use**, of which 50%+ have stated the driver as personal preference/health or environmental concerns

40% of respondents **limit purchase of disposable products**, of which ~85% have stated the driver as personal preference/health or environmental concerns

65% OF CONSUMERS GLOBALLY ARE VERY OR EXTREMELY CONCERNED ABOUT THE ENVIRONMENT

~45% of respondents **recycle**, of which 85%+ have stated the driver as personal preference/health or environmental concerns

~40% of respondents **walk/cycle/use public transport** instead of driving, of which 75%+ have stated the driver as personal preference/health or environmental concerns

SOURCE: BAIN GLOBAL ESG SURVEY 2023 (N=23,374) INCL. US, UK, BRAZIL, CHINA, FRANCE, GERMANY, INDIA, INDONESIA, ITALY, JAPAN AND THE NETHERLANDS
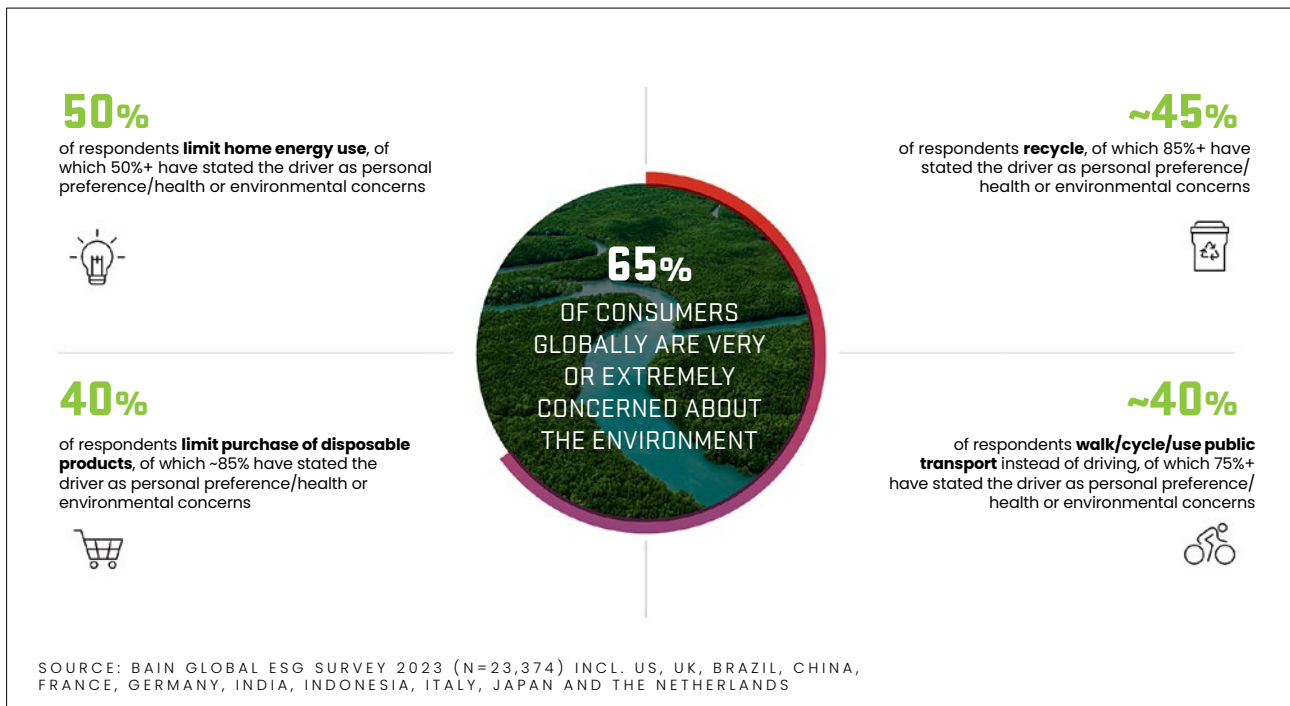
Figure 2. A global consumer survey identified behavioral shifts that could transform the future of living.

→ 1. **Product design** must be rooted in a deep, data-driven understanding of customer needs and desires.

2. **Design and construction processes** should be industrialized and intelligent, underpinned by design and construction technology.

3. **Powered by technology**, communities will become more livable, smart and sustainable.

4. **Artificial intelligence (AI) must be leveraged** to pioneer use cases for the future of living and connected communities.

IMPERATIVE 1: PRODUCT DESIGN MUST BE ROOTED IN A DEEP, DATA-DRIVEN UNDERSTANDING OF CUSTOMER NEEDS AND DESIRES

Imagine a world that adapts and evolves based on the inhabitants' desires. Where every surface of the home and workplace is interactive. Autonomous grocery shopping is available based on residents' needs. And everyone has a digital twin in the metaverse to extend the living experience beyond the physical realm.

We are already starting to see it. A "phygital" world is emerging, where physical and digital realities seamlessly converge, and it's reshaping how we live, interact and experience the world. Culdesac, a real estate company in the US, is developing communities "for people, not cars," blending technology, real estate and culture to reimagine daily life. NEOM, a megaproject in Saudi Arabia, is transforming urbanism to be people-first and nature-friendly, setting new global standards for livability. Similarly, ROSHN, a gigaproject developer in Saudi Arabia, is digitizing the entire home-buying process, transforming what has traditionally been a physical journey into a seamless digital experience from start to finish, redefining how people purchase and engage with real estate in Saudi Arabia.

In the future of living, human-centricity will be at the center of development, management and evolution. Cognitive cities are advanced urban environments that leverage data, artificial intelligence and cognitive computing to create intelligent, adaptable ecosystems with innovative living spaces, enhanced sustainability and interconnected social infrastructure. These cities will understand population dynamics before the first tenants arrive so they can optimize resources sustainably and ensure exceptional living experiences.

When tenants evaluate a real estate product, they weigh its perceived value against the asking price. Traditionally, the real estate industry has focused on managing the price side. But that's the easy part. Delivering human-centric living requires answering key questions about future tenants, their decision-making drivers and how these evolve. Traditional persona-based segmentation will no longer suffice; property owners and managers will need a more comprehensive and granular understanding of tenants to meet their values and needs.

Bain's Elements of Value® framework demonstrates how perceived value is deeply rooted in human psychology. The framework identifies 30 fundamental attributes in their most essential and discrete forms and places them into four categories: functional, emotional, life-changing and social impact *(see Figure 4)*.

By leveraging deep customer insights, the real estate industry can reduce risk while maximizing yield, influence masterplan designs, build and design at the unit level, →

→ develop construction technology and deliver high-priority services. Understanding what tenants truly value allows real estate players to actively manage value and deliver more of it.

To enable this shift toward deeper customer insights, the industry must establish and mobilize experienced, interdisciplinary teams. These teams can elevate research visibility, find links among insights, create richer human-centric research and install feedback loops for continuous improvement.

IMPERATIVE 2: DESIGN AND CONSTRUCTION PROCESSES SHOULD BE INDUSTRIALIZED AND INTELLIGENT, UNDERPINNED BY DESIGN AND CONSTRUCTION TECHNOLOGY

Technology has the potential to transform the entire real estate development process, from planning and design through development and construction, to community and property management and operations. With technology, the industry can become data-driven, smart and sustainable.

The construction side of the industry is beginning to adopt more efficient production methods, such as off-site modular construction, which offer benefits similar to assembly line efficiency in manufacturing.

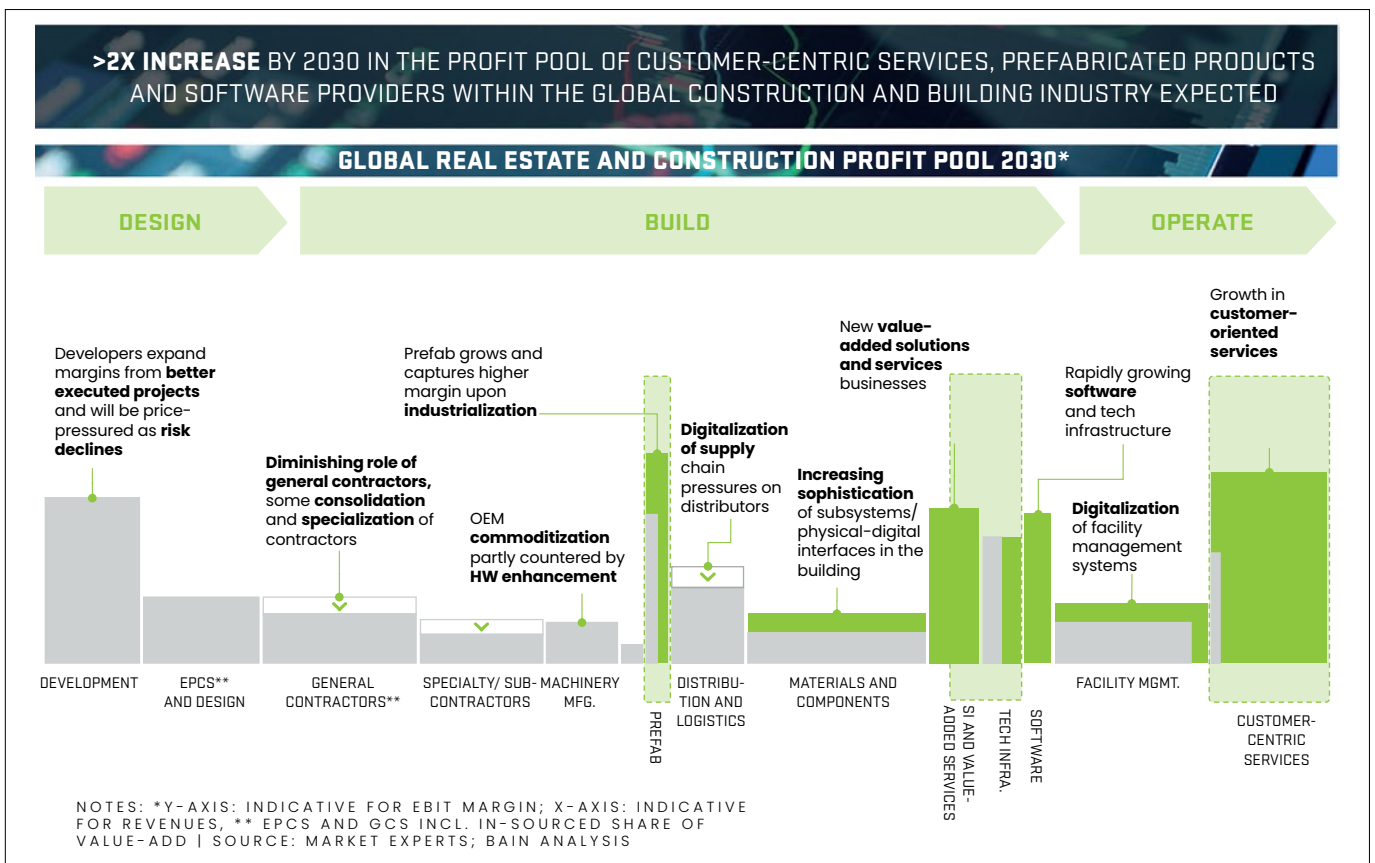Industrialized modular construction (IDC) involves designing, simulating and manufacturing building components, such as panels, sections or entire apartments, in a factory setting. With IDC, construction firms can save up to 20% in labor and material costs, reduce the need for on-site labor by up to 30%, and shorten construction timelines by 20%–50%. Additionally, IDC focuses more on residents' needs and improves construction quality. It's easier to adhere to design specifications in a controlled production environment.

Despite these clear benefits, modular construction accounts for fewer than 10% of projects in many geographies. However, market triggers can increase adoption. In places like Singapore and Sweden, regulators and incentives have driven higher adoption (e.g., 30%+ adoption for newer buildings).

Currently, the industry is held back by a highly fragmented value chain and inconsistent building codes across geographies. Legacy issues among stakeholders also create disincentives, impede productivity and slow IDC adoption. However, united action among stakeholders – investors, designers, manufacturers and builders – can move the industry swiftly in this direction.

Designing buildings for IDC requires close collaboration between designers and manufacturers, and architects need to understand production systems and develop expertise in assembly processes. Firms need to adopt the principles of Integrated Product Development (IPD) to transition from a traditional delivery model to a more collaborative and integrated approach. State-of-the-art IPD platforms (IPDPs) can support the switch. →

Figure 3. Companies that deliver customer-centric, prefabricated or sustainable construction products or services could double their profits by 2030.
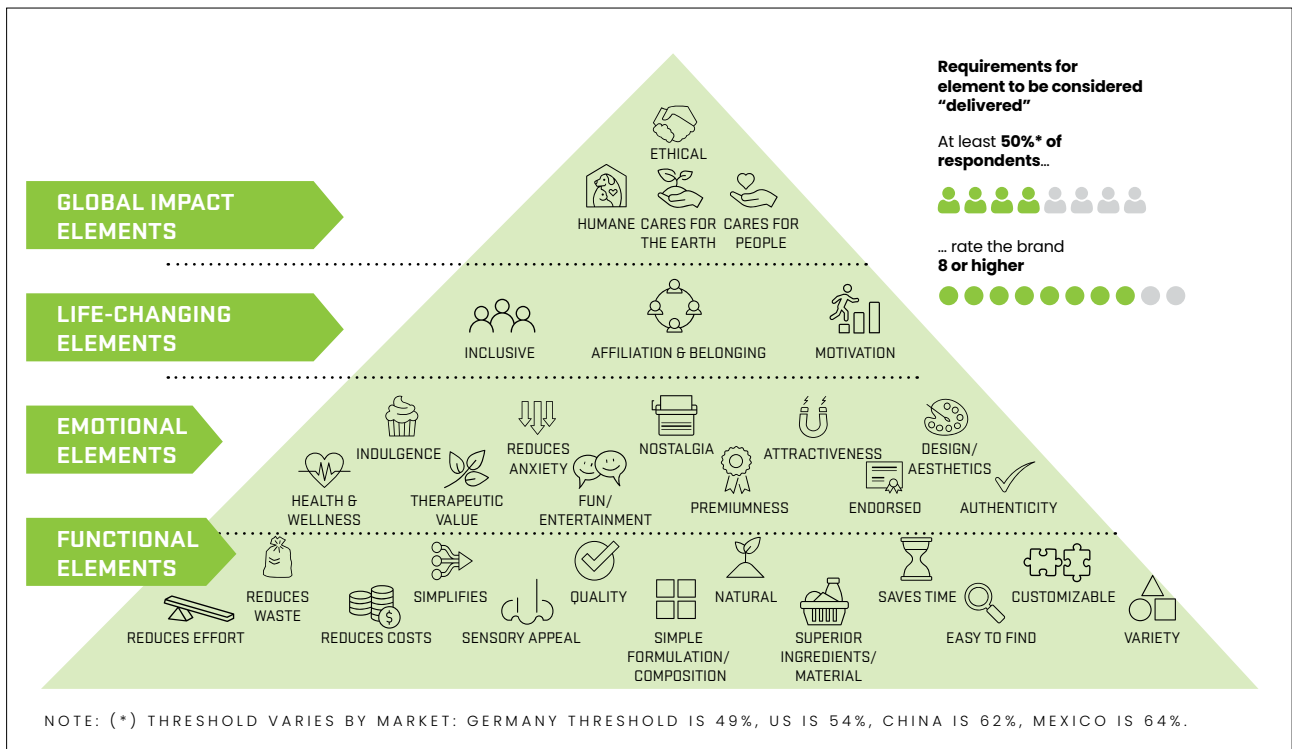

>2X INCREASE BY 2030 IN THE PROFIT POOL OF CUSTOMER-CENTRIC SERVICES, PREFABRICATED PRODUCTS AND SOFTWARE PROVIDERS WITHIN THE GLOBAL CONSTRUCTION AND BUILDING INDUSTRY EXPECTED

GLOBAL REAL ESTATE AND CONSTRUCTION PROFIT POOL 2030*

DESIGN | BUILD | OPERATE

Developers expand margins from **better executed projects** and will be price-pressured as **risk declines**

Diminishing role of general contractors, some **consolidation** and **specialization** of contractors

Prefab grows and captures higher margin upon **industrialization**

OEM **commoditization** partly countered by **HW enhancement**

Digitalization of supply chain pressures on distributors

New **value-added solutions and services** businesses

Increasing sophistication of subsystems/ physical-digital interfaces in the building

Rapidly growing **software** and tech infrastructure

Digitalization of facility management systems

Growth in **customer-oriented services**

DEVELOPMENT | EPCS** AND DESIGN | GENERAL CONTRACTORS** | SPECIALTY/ SUB-CONTRACTORS | MACHINERY MFG. | PREFAB | DISTRIBU-TION AND LOGISTICS | MATERIALS AND COMPONENTS | SI AND VALUE-ADDED SERVICES | TECH INFRA. | SOFTWARE | FACILITY MGMT. | CUSTOMER-CENTRIC SERVICES

NOTES: *Y-AXIS: INDICATIVE FOR EBIT MARGIN; X-AXIS: INDICATIVE FOR REVENUES, ** EPCS AND GCS INCL. IN-SOURCED SHARE OF VALUE-ADD | SOURCE: MARKET EXPERTS; BAIN ANALYSIS
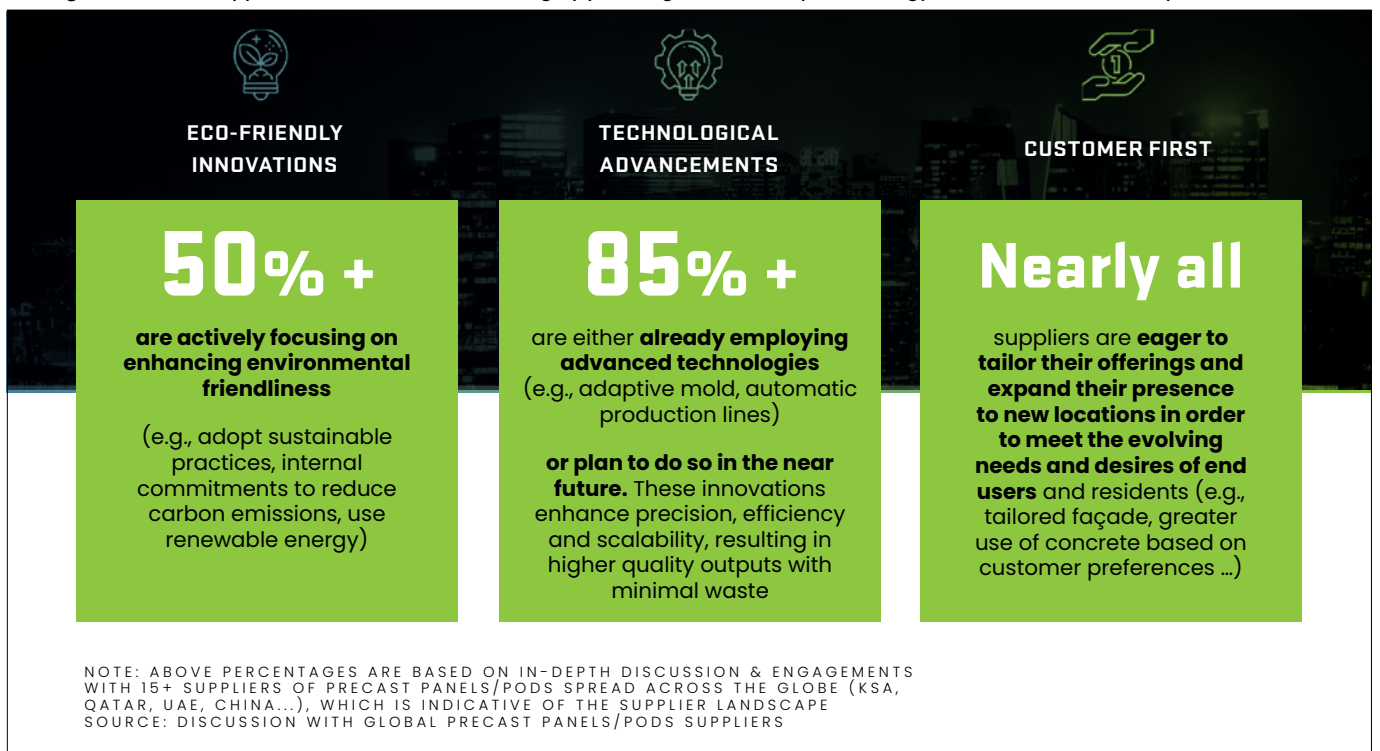
Figure 4. Bain's Elements of Value® framework helps companies understand consumers' values and anticipate their needs.

Figure 5. Global suppliers enable the future of living by pursuing sustainability, technology and customer-centricity.

ECO-FRIENDLY INNOVATIONS

50%+

are actively focusing on enhancing environmental friendliness

(e.g., adopt sustainable practices, internal commitments to reduce carbon emissions, use renewable energy)

TECHNOLOGICAL ADVANCEMENTS

85%+

are either **already employing advanced technologies** (e.g., adaptive mold, automatic production lines)

or plan to do so in the near future. These innovations enhance precision, efficiency and scalability, resulting in higher quality outputs with minimal waste

CUSTOMER FIRST

Nearly all

suppliers are **eager to tailor their offerings and expand their presence to new locations in order to meet the evolving needs and desires of end users** and residents (e.g., tailored façade, greater use of concrete based on customer preferences …)

NOTE: ABOVE PERCENTAGES ARE BASED ON IN-DEPTH DISCUSSION & ENGAGEMENTS WITH 15+ SUPPLIERS OF PRECAST PANELS/PODS SPREAD ACROSS THE GLOBE (KSA, QATAR, UAE, CHINA…), WHICH IS INDICATIVE OF THE SUPPLIER LANDSCAPE
SOURCE: DISCUSSION WITH GLOBAL PRECAST PANELS/PODS SUPPLIERS

→ IPDPs establish a common data element to manage siloed product information across multidisciplinary teams. They use AI and machine learning to generate and process data into usable and integrative forms. IPDPs act as a single operating platform that integrates the entire supply chain (for both internal and external stakeholders) and delivers a range of solutions and benefits in design, supply chain management, collaboration, transparency and data consistency. They also enable information sharing and digital twins for manufacturing and assembly.

Kit-of-Parts (KoP) is a module within IPDPs that contains a library of standardized parts and configurable features, which makes design and construction processes more efficient. KoP complements customer insights so firms can revise product design based on data about evolving customer needs while ensuring personalization at scale.

In Bain's work with global suppliers, their focus has been on environmental friendliness, technological advancements and tailoring offerings to meet evolving end-user needs (*see Figure 5*).

Furthermore, technologies like 3D printing can accelerate IDC adoption. The construction 3D printing market is expected to grow rapidly over the next few years, driven by improved sustainability (lower waste) and increased affordability. Moreover, new building materials, including green and advanced materials, also con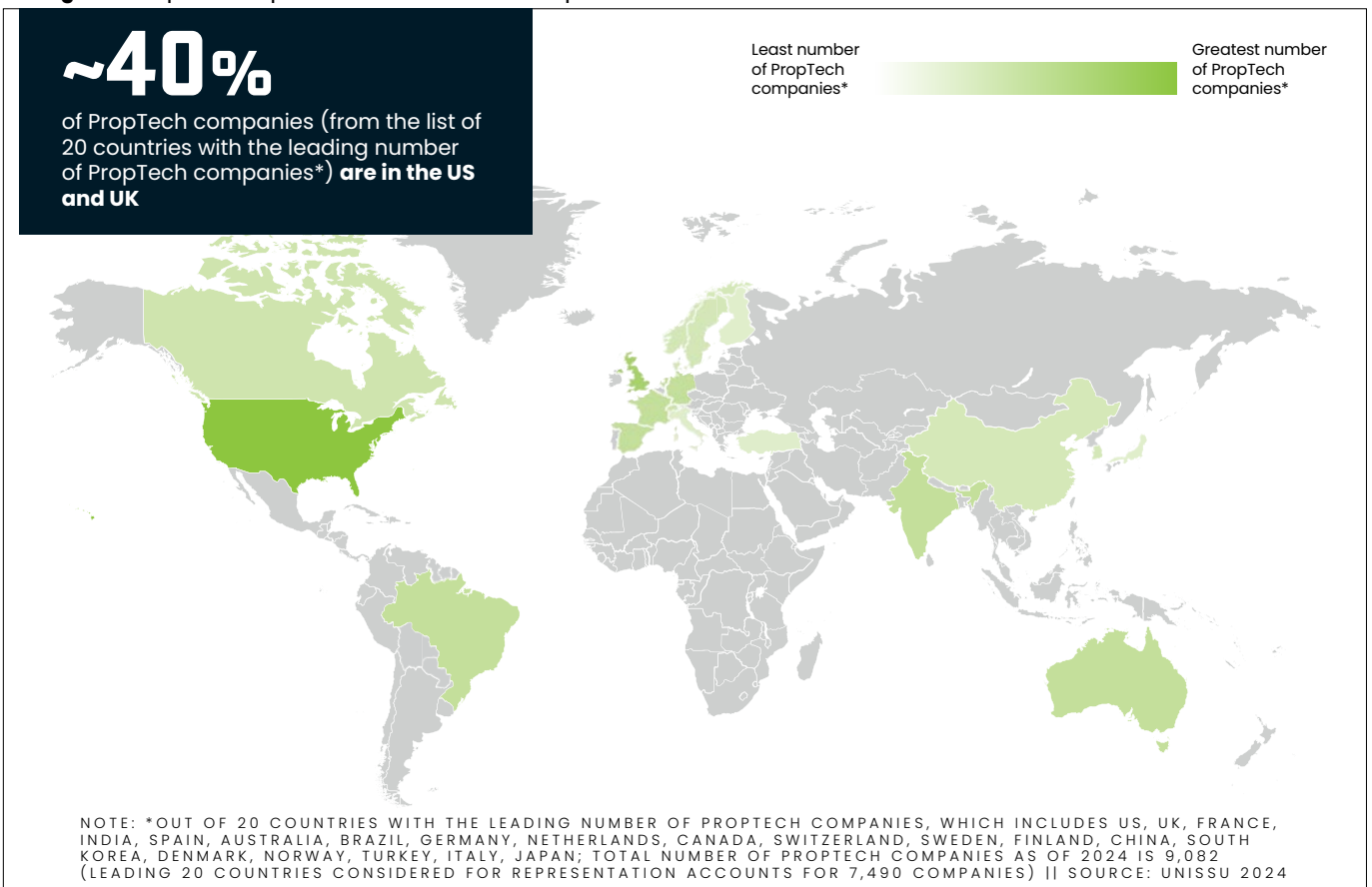tribute to accelerated IDC adoption thanks to their higher recyclability, lower production costs and superior product qualities.

IMPERATIVE 3: POWERED BY TECHNOLOGY, COMMUNITIES WILL BECOME MORE LIVABLE, SMART AND SUSTAINABLE

PropTech is key to addressing the needs and opportunities of community stakeholders and unlocking the future of living in smart real estate, fintech for real estate, and the shared economy. PropTech has evolved as digitalization and customer demands have increased.

· During the foundational phase (1900–2000), digital milestones were achieved with Autodesk's CAD (1982), analytics from Argus Software (2002) and Yardi (1984), and CoStar's data services (1986).

· The digital integration phase (2000–2020) was marked by deeper technology integrations, listing platforms such as Trulia (2005) and Zillow (2006), and shared economy platforms such as Airbnb (2008) and WeWork (2010).

· The current phase (2020–present) has been defined by increased penetration and adoption due to remote working and health and safety concerns. Digital growth and adoption accelerated notably during the COVID-19 pandemic. →

Figure 6. PropTech adoption is concentrated in a few parts of the world.

~40% of PropTech companies (from the list of 20 countries with the leading number of PropTech companies*) **are in the US and UK**

Least number of PropTech companies*   Greatest number of PropTech companies*

NOTE: *OUT OF 20 COUNTRIES WITH THE LEADING NUMBER OF PROPTECH COMPANIES, WHICH INCLUDES US, UK, FRANCE, INDIA, SPAIN, AUSTRALIA, BRAZIL, GERMANY, NETHERLANDS, CANADA, SWITZERLAND, SWEDEN, FINLAND, CHINA, SOUTH KOREA, DENMARK, NORWAY, TURKEY, ITALY, JAPAN; TOTAL NUMBER OF PROPTECH COMPANIES AS OF 2024 IS 9,082 (LEADING 20 COUNTRIES CONSIDERED FOR REPRESENTATION ACCOUNTS FOR 7,490 COMPANIES) || SOURCE: UNISSU 2024

PropTech offers holistic well-being benefits for stakeholders, simplifying and enhancing their lives. However, PropTech's growth has been limited to a few global hubs, necessitating initiatives to drive adoption in other regions (*see Figure 6*). Closer engagement between disruptors and real estate developers is imperative to scale and sustain long-term adoption, as is stronger cost-benefit alignment.

IMPERATIVE 4: AI MUST BE LEVERAGED TO PIONEER USE CASES FOR THE FUTURE OF LIVING AND CONNECTED COMMUNITIES

AI will be a transformative force as livable, smart and sustainable communities evolve. AI's increasing importance within the real estate industry is evident from its wide array of use cases across the value chain, from investment and project delivery to asset and property management.

Imagine being able to analyze large sets of structured and unstructured data to understand and predict property prices and rental yields, or develop a local attractiveness index to inform investment decisions. Imagine generating multiple designs at once based on a few conceptual keywords – and bringing those concepts to life through automatically generated renderings. Imagine analyzing market data in real time, such as payables received from contractors and suppliers, to uncover cost trends and mitigate supply chain risks. For example, ROSHN uses AI tools and 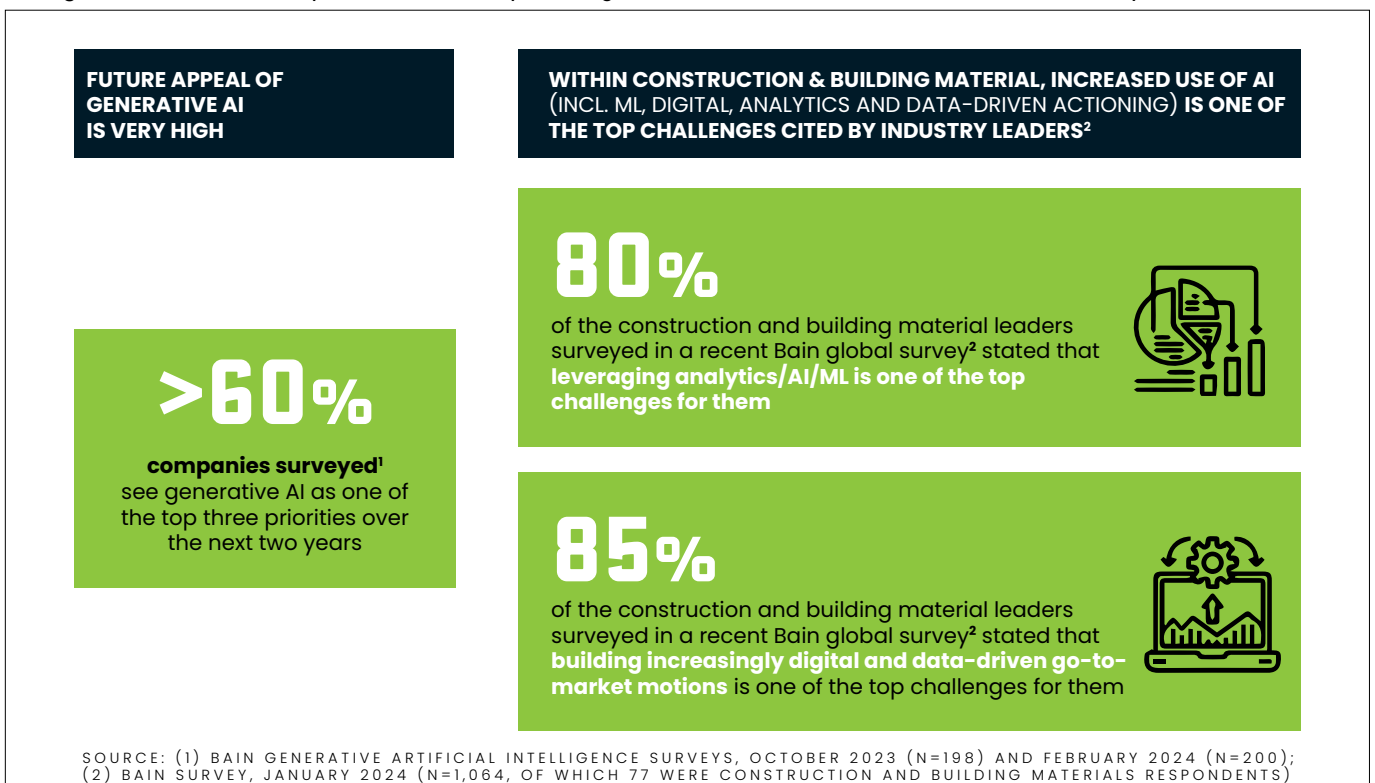data sets to make informed decisions on selecting prime locations for developments, while its proprietary AI platform integrates with third-party construction project management software to optimize processes, drive efficiency and provide data-driven insights.

AI can help us see on-site progress with greater accuracy and in real time by synthesizing data collected from drones and satellite imagery with project management data – all while ensuring people's safety. AI offers us a detailed, personalized view of each prospective buyer based on their touchpoints with real estate companies and public data. The Elements of Value® framework can come to life at the individual level. Within asset management, AI can help us see and measure asset performance in real time, which makes it possible to proactively suggest portfolio improvement opportunities.

AI is progressing rapidly and delivering tangible results, in part thanks to significant developments in generative AI. According to Bain research, generative AI is top of mind for leaders around the globe who see its potential to shape the future (*see Figure 7*).

By leveraging AI, real estate developers and community and asset managers can become more efficient, responsive and resilient, directly enhancing residents' quality of life while simultaneously addressing environmental and economic challenges. For example, Qbiq is a platform that integrates generative AI into business processes to drive efficiency and innovation in real estate design. And Takenaka, a major Japanese construction and architecture firm, uses AI for project feasibility analysis.

Figure 7. Generative AI is top of mind – and a top challenge – for leaders in the real estate/construction industry

FUTURE APPEAL OF GENERATIVE AI IS VERY HIGH

>60%

companies surveyed[1] see generative AI as one of the top three priorities over the next two years

WITHIN CONSTRUCTION & BUILDING MATERIAL, INCREASED USE OF AI (INCL. ML, DIGITAL, ANALYTICS AND DATA-DRIVEN ACTIONING) **IS ONE OF THE TOP CHALLENGES CITED BY INDUSTRY LEADERS[2]**

80% of the construction and building material leaders surveyed in a recent Bain global survey[2] stated that **leveraging analytics/AI/ML is one of the top challenges for them**

85% of the construction and building material leaders surveyed in a recent Bain global survey[2] stated that **building increasingly digital and data-driven go-to-market motions** is one of the top challenges for them

SOURCE: (1) BAIN GENERATIVE ARTIFICIAL INTELLIGENCE SURVEYS, OCTOBER 2023 (N=198) AND FEBRUARY 2024 (N=200); (2) BAIN SURVEY, JANUARY 2024 (N=1,064, OF WHICH 77 WERE CONSTRUCTION AND BUILDING MATERIALS RESPONDENTS)

BRIDGING THE GAP: A CALL TO ACTION TO SHAPE THE FUTURE OF LIVING

The future of living is taking shape through these trends. However, the overall structure of the real estate market is reinforcing the status quo and impeding the transition (*see Figure 8*). Hence, a proactive and collaborative approach is needed across the ecosystem to accelerate a win-win transition toward smart living and connected communities.

The industry is beginning to move toward the future of living by empowering the ecosystem with digital technology and AI. Global summits and conclaves, such as MIPIM NY, Smart City Expo World Congress, Kingdom Digital Twin and the Saudi PropTech Summit, are examples of efforts to drive innovation and adoption.

However, we need to go further. To accelerate change and drive adoption at scale, we must create a conducive, collaborative and incentivized environment for key stakeholders. Five strategic actions can fuel the transformation:

1. **Foster innovation.** Establish frameworks, programs, funding and sandboxes to stimulate new-age disruptors, propel the innovation flywheel, and attract investors and innovators.

2. **Prioritize standardization and interoperability.** Develop industry standards for smart technologies to address compatibility issues and promote seamless integration.

3. **Launch open-ecosystem education.** Global educational programs and workshop series for all stakeholders, including end users, can increase understanding and adoption of smart living solutions. This includes disseminating information on demand pipelines and consumer trends to foster stronger confidence in underlying trends.

4. **Harmonize and modernize regulations.** Advocate for modern and consistent regulations that support the adoption of smart living technologies to reduce bureaucratic complexities.

5. **Create integrated workgroups.** Form multidisciplinary workgroups and sector governance models that include representatives from key stakeholder groups across the private and public sectors. An integrated approach can enhance communication and streamline decision-making.

Other sectors have benefited from embracing technology standards and smart, connected innovations. In the technology and automotive sectors, The Open Group and the Open Automotive Alliance are respective champions. Transportation and logistics are being driven forward by the Blockchain in Transport Alliance.

Real estate and construction can find similar success. Harmonized, ecosystem-wide action can be the catalyst for at-scale, win-win adoption. Together, we can usher in a smarter, more connected future of living.

Figure 8. Barriers in the real estate industry's structure are impeding the transition to the future of living.

BUILDERS/MANUFACTURERS
1. Fragmented manufacturer/contractor landscape
2. Lack of visibility on long-term demand pipeline, leading to low investment in productivity improvements/R&D/innovation

GOVERNMENT/LEGAL AUTHORITIES
1. Lack of standardization in building codes across geographies
2. Limited visibility into smart living technologies, leading to delays in approvals and permits.

INNOVATORS
1. Lack of opportunities/controlled environment to test out new innovations in real life and scale innovations

CUSTOMER/PROPERTY MANAGERS
1. Lack of awareness and education leading to slow adoption of new technologies
2. Heightened concerns about data privacy

DESIGNERS/ARCHITECTS
1. Limited know-how about emerging technologies, building codes leading to slow/limited adoption of smart living
2. Lack of DfMA principles leading to misalignments

DEVELOPERS
1. Lack of unified language and interoperability to collaborate with designers/architects/manufacturers
2. Misaligned goals leading to lack of customer-centricity and underinvestment in long-term efficiencies

INVESTORS/FINANCIAL INSTITUTIONS
1. Long capital commitment timelines with high-risk opportunities leading to search for alternative opportunities

TECHNOLOGY
1. Incompatibility between systems provided by different vendors leading to functionality issues

TALENT
1. Lack of skilled talent pool availability with know-how about latest software and hardware technologies

FUTURE INVESTMENT INITIATIVE (FII) INSTITUTE is a global non-profit foundation with an investment arm and one agenda: Impact on Humanity. Global, inclusive, and driven by data, we foster great minds from around the world and turn ideas into tangible solutions and actions in four critical areas: Artificial Intelligence (AI) and Robotics, Education, Healthcare and Sustainability. We are in the right place at the right time, when decision-makers, investors and an engaged generation of youth come together in aspiration, energized and ready for change.

We harness that energy into three pillars: THINK, XCHANGE, ACT. Our THINK pillar empowers the world's brightest minds to identify technological solutions to the most pressing issues facing humanity. Our XCHANGE pillar builds inclusive platforms for international dialogue, knowledge-sharing and partnership. Our ACT pillar curates and invests directly in the technologies of the future to secure sustainable real-world solutions. Join us to own, cocreate and actualize a brighter, more sustainable future for humanity. ←

THE FII INSTITUTE

is guided in all it does by a strong purpose, vision and mission.

PURPOSE
"Enabling a brighter future for humanity"

VISION
"Bringing together the brightest minds and most promising solutions to serve humanity"

MISSION
"Creating a purposeful present, promising future"

**FII-I has three pillars to
deliver its mission:
THINK, ACT and XCHANGE**

1 FII-I THINK
Identify societal
challenges and current
inhibitors. Curate the brightest
ideas to address societal issues

2 FII-I ACT
Catalyze innovation
and initiatives by mobilizing
partners and resources

3 FII-I XCHANGE
Create platforms for live
discussions on the future of
humanity. Share knowledge,
stories and publications with
different stakeholders

For details on how to become
a member, please visit
fii-institute.org/membership/