

research
proposal | ASHB Intelligent Buildings
2024 Research Service

Harbor
Research

ASHB 2024
Research
Proposal

- 1. Introduction to Harbor Research**
2. Proposed Scope of Work, Process, & Budget
3. Appendix

**Harbor
Research**

Overview of Harbor Research & Our Scope of Services

Firm History

Harbor Research was the first firm to focus on Smart Systems, Services and the Internet of Things (IoT) and first to publish groundbreaking research on new business models in the Harvard Business Review in 2004 & 2005.

Clients and Engagements

For over 30 years we have focused on identifying, analyzing and helping clients to develop or adopt emergent technologies. Every relationship we develop is enhanced by the range and depth of these experiences.

Technology Developers & Suppliers

100+ clients 400+ engagements

OEMs and Service Providers

150+ clients 600+ engagements

Offices

Denver, Colorado - USA Berlin, Germany - Europe



Overview of Harbor's Services

Research Services

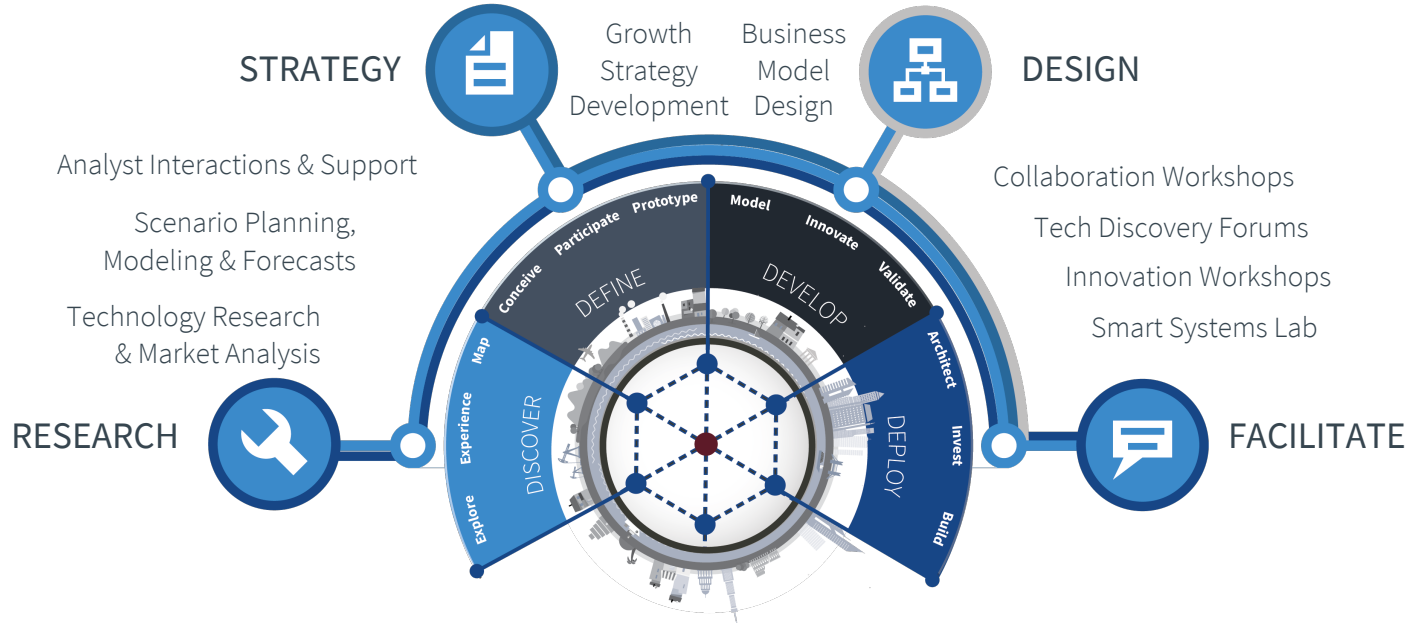
Research, tracking, market intelligence and Harbor's Smart Systems forecast

Strategy Consulting

Business development & growth strategy consulting services

Smart Systems Lab

Venture development, start-up advisory and community networking to implement strategies



We work with clients across corporate functions

- Corporate Strategy & Development
- Business Development
- Market Intelligence
- Strategic Marketing
- New Growth
- Research & Development

Flexible formats & configurations

- Research, Analysis, Modeling & Content
- Services Subscriptions & Retainers
- Bespoke Engagements & Consulting Projects

Harbor is Pleased to Have Served ASHB Several Times in Recent Years

Harbor's long-standing support for the Association for Smarter Homes & Buildings

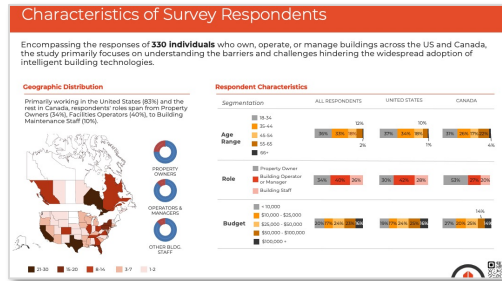
- Harbor has developed a sustaining relationship with ASHB and its constituent members conducting research and analysis into new building, facility and residential technologies
- ASHB Landmark Research Projects include a combination of quantitative surveys and qualitative interviews that inform a comprehensive report on the market opportunity for smart systems-related technologies and related digital services, including:
 - **Healthy Buildings & Indoor Environmental Quality (2023)**
analyzed equipment, software, and service opportunities to improve indoor environmental quality in commercial buildings, as well as how to make buildings more health for occupants.
 - **AI and Predictive Maintenance in Intelligent Buildings (2022)** defined and developed business opportunities within predictive maintenance and artificial intelligence technologies as they relate to intelligent buildings
 - **Intelligent Building Energy Management Systems (2021)** provided a framework, market requirements, ecosystem analysis and market sizing for the building automation systems, energy storage, and other energy management hardware, software, and service solutions including services, security, data analytics, systems.

Harbor/ASHB IBC Collaboration Examples

2023	2022	2021	2018	2017
Healthy Buildings & Indoor Environmental Quality	AI & Predictive Maintenance For Intelligent Buildings	Energy Mgmt. Systems For Intelligent Buildings	Monetization of Intelligent Buildings	Connected Multi-Dwelling Units and the IoT

2023 IBC Research Service

Building Operator Survey



Quarterly Market Tracking



Configured Research Projects

- AI in Intelligent Buildings
- Impact of Sustainability in Intelligent Buildings
- Ecosystems & Interoperability in Intelligent Buildings

Project Team Overview

Each member of the team has led or assisted on multiple intelligent buildings-related engagements, including at least one previous ASHB Landmark Research project.

Glen Allmendinger - President and Founder (40 years experience)

Glen is the founder and president of Harbor Research, a strategy consulting firm with offices in Boulder, Colorado and Berlin, Germany. Since the firm's inception in 1983, Allmendinger has worked closely with a broad spectrum of telecommunications, information systems, security, electronics, and automation and equipment manufacturing companies in North America, Europe, and the Far East. These companies range in scope from small, entrepreneurial start-ups to major multi-national corporations. His project direction and consulting has assisted these firms in the development of corporate and business unit strategies, new product, market and service opportunities, and new core capabilities. Glen has consulted to the National Research Council on technology and competitiveness as well as emerging technologies for social wellbeing. He is a member of IEEE, ASME, and ACM and has worked closely with several industry trade associations including ASHB. He has worked on DARPA-funded research focused on advanced analytics and sensing systems technology and was a key participant in the planning and development of the National Center for Manufacturing Sciences. Allmendinger received his BA from New York University, and completed graduate studies at MIT's Center for Advanced Media Studies.

Harry Pascarella - Vice President (10 years experience)

Harry specializes in Industrial and Commercial IoT with a focus on manufacturing, natural resources, and mission critical B2B markets. Harry works with clients across a variety of industries to validate and dimension their growth strategies and advise on industry segment and application target selections. Recently, Harry conducted several studies in smart buildings including a deep dive into energy management as well as a market study on the larger market that looked at usage behavior. Harry also worked with the largest LED lighting manufacturer in the United States to develop a business case for connected lighting platforms. Harry received his bachelor's degree in Economics with Honors from the University of Colorado - Boulder.

Daniel Intolubbe-Chmil - Research Director (8 years experience)

As Harbor's Research Director, Daniel has led research initiatives shaping critical insight around the evolution of high-performance networks across industrial, commercial and enterprise verticals. Daniel also helps keep a pulse on the market, providing curated content and updates to Harbor's real-time market tracking across all sectors of the economy. Dan has helped lead two previous ASHB Council engagements, and has deep expertise across networking technologies within buildings and homes. Prior to Harbor, Daniel has conducted economic research to complete his Honors thesis regarding Education Policy, entailing policy/market research and econometric analysis. He graduated from CU Boulder with a degree in Economics with Honors and a minor in Humanities.

Pablo Cruz - Senior Associate (3 years experience)

As a senior associate at Harbor Research, Pablo drives client success across various industries. His experience spans industrial manufacturing and process software, R&D processes, life sciences technologies, AI/ML operations, among other emerging technology areas. His experience includes guiding clients through the selection and delivery of emerging technologies, leveraging quantitative and qualitative inputs to create holistic value creation strategies. Prior to joining Harbor, Pablo worked in Deloitte's global trade division, where he helped streamline client responses to complex global trade regulations, optimize their trade practices and develop effective strategies for regulatory compliance. Pablo graduated from The University of Chicago with a BA in public policy with a specialization in statistics, stemming from a keen interest in the intersection of policy analysis, strategic decision-making, and data-driven solutions

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2024 Intelligent Buildings Research Service: Overview of Proposed Approach

Instead of one, long-form landmark research report each year, ASHB would like to pursue a more configured set of research activities that focuses on multiple topics of interest to funders throughout the year. With significant experience in providing such services and supporting ASHB over the years, Harbor can support ASHB and the Board of Directors well in this endeavor.

Intelligent Buildings Research Service: Overview of Components

- 1 Annual Building Operator Trends Survey**
 - Survey covering key topics/opportunities to gain annual perspective of operator needs/outlook
 - 20-30-page survey highlights report
 - Raw data in Excel
 - 2-3-page executive summary in Word
 - Summary infographic
- 2 Intelligent Buildings Market Sizing & Forecast**
 - Worldwide, configured market sizing and forecast model for intelligent buildings devices, systems, technologies with breakouts for US/CAN and other major regions
 - Excel-based market sizing and forecast model with summary portrayals in PowerPoint
- 3 Quarterly Market & Technology Tracking (x3)**
 - Intelligent buildings-related M&A, key funding rounds, and similar maneuvers from prior quarter
 - Other key tech/market news, such as policy and regulatory updates from prior quarter
- 4 Configured Research Project (x2)**
 - Based on Q1 discussions and activities, determine 2 configured research projects to complete following survey
 - Incorporate topics into the survey to ensure data availability
 - 100 hours of analyst time per project
 - 15-25-page PowerPoint research brief
 - One summary infographic per research project (x2 total)
- 5 Steering Committee Meetings and Other Interactions**
 - 6-7x Steering Committee Meetings
 - 1:1 introduction calls with each Steering Committee org
 - Final webinar (2 hours)
 - Organization webinars for each SC organization covering summary of all research following final webinar
 - Think Tank for ASHB community

Proposed Research Timeline: March Through October 2024

Harbor will support ASHB and the funders over the course of 8 months in 2024, from March through October. The work steps will be executed in parallel, with regular steering committee meetings to update on progress and interim outputs



Key Interactions



Work Steps



1 Annual Building Owner/Operator Intelligent Buildings Survey

Harbor will develop and conduct an annual survey for intelligent buildings with the goal of staying up to date on owner/operator perceptions, adoption trends, and needs related to intelligent buildings.

Intelligent Buildings Survey & Report

Target Audience

~300 Commercial Buildings Owner/Operators in Canada and USA

Proposed Scope

Annual survey to understand current perceptions and future priorities related to intelligent buildings

Key Topics to Cover (starting point):

- Current state of intelligent building adoption
- Key trends impacting investment and priorities
- Next 12 months investment priorities
- Preferred suppliers
- Other topics as appropriate, as informed by initial discussions and configured research selections

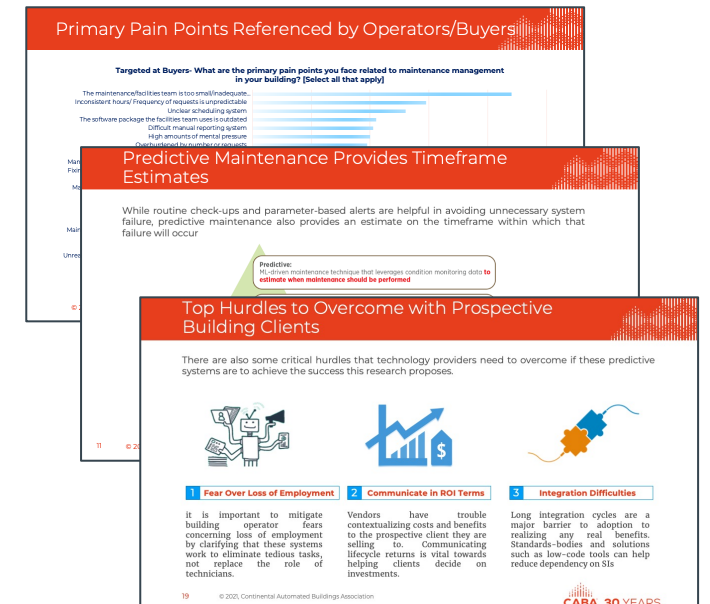
Draft starting point for Annual Survey scope, to be refined via steering committee meetings

Deliverables

- Survey questionnaire
- Raw data and summary charts in Excel and PPT
- 20-30-page survey PPT ebook and trends report
- 2-page long-form executive summary (Word doc)
- 1 summary infographic

Benefits & Values

- Stay up-to-date on customer perceptions, adoption, and needs related to intelligent buildings
- Understand the impact of recent market developments on users
- Leverage graphics and charts from PPT-based trends report in key external presentations
- Focus on topic areas for further research in configured research projects 4



2 Intelligent Buildings Market Sizing & Forecast Overview

Harbor Research has an extensive market sizing and forecast model that analyzes the market opportunity for Smart Systems and IoT. Harbor will develop a configured and in-depth market sizing model and 10-year forecast for Intelligent Buildings.

Intelligent Buildings Segmentation



Commercial

- Office Buildings



Retail & Hospitality

- Retail
- Hotels
- Restaurants



Medical

- Hospitals
- Clinics
- Care Facilities
- Labs



Public Venues

- Transport (Airports, Transit Facilities)
- Stadiums
- Other Public Venues



Institutional

- Educational Institutions
- Government



Mission Critical

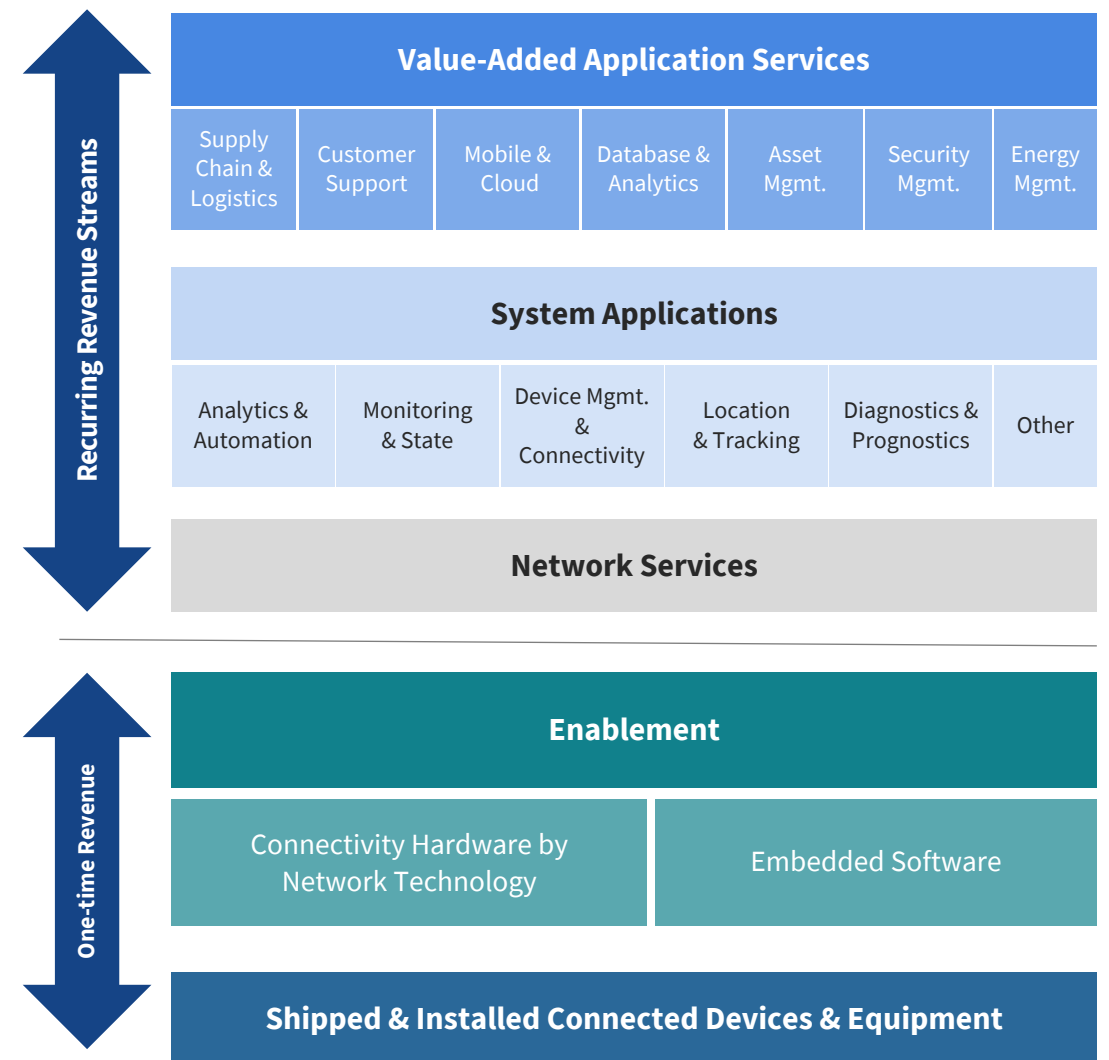
- Factories & Plants
- Warehouses
- Data Centers

Smart Systems Revenues Overview

Our forecast model looks at four main revenue streams reflecting Harbor's tech stack: Enablement, Network Services, System Applications and Value-Added Applications.

- Enablement revenue is determined by the cost of the embedded or aftermarket chip that enables connectivity in a device
- Network services revenue is the annual service costs associated with connecting a device to the internet
- System applications revenue consists of functions that really enable these devices to share data to help inform the value-added applications. This revenue stream goes all the way down to the value that these devices deliver in the marketplace
- Value added applications are the higher order view that brings value back into the Enterprise by utilizing a set of system applications to drive device and application integration

As clients are looking to increase business profits around opportunities within smart systems, once you enable the system, it is using the data derived from these systems that drives new insights, increases efficiencies, and reduces downtime.



2 Intelligent Buildings Market Sizing & Forecast Methodology Overview

Harbor will work with the steering committee to ensure alignment on the scope and methodology of the 10-year forecast for devices, equipment, software and services in intelligent buildings

Intelligent Building & Device Demographics

Key Input Variables

- Number of buildings by segment
- Additional market sizing inputs:
 - Floorspace (sq ft)
 - Employee density
 - Climate region
 - Operating hours (weekly avg.)
 - Ownership type (non-government, government)
- Devices/equipment per building
- The Commercial Building segmentation will be analyzed in the context of building use or enterprise function, which in part will be characterized by the building type

Smart Systems Forecast Frameworks

Forecast Alignment

- Integrating building and device demographics to triangulate the market opportunity for connected, intelligent devices for commercial building environments in North America
- Building and device demographics will be integrated into the following HRI frameworks:
 - SSF Venue Map: Commercial Buildings
 - SSF Technology Stack
 - SSF Use Case and Application Framework

Intelligent Building Market Opportunity

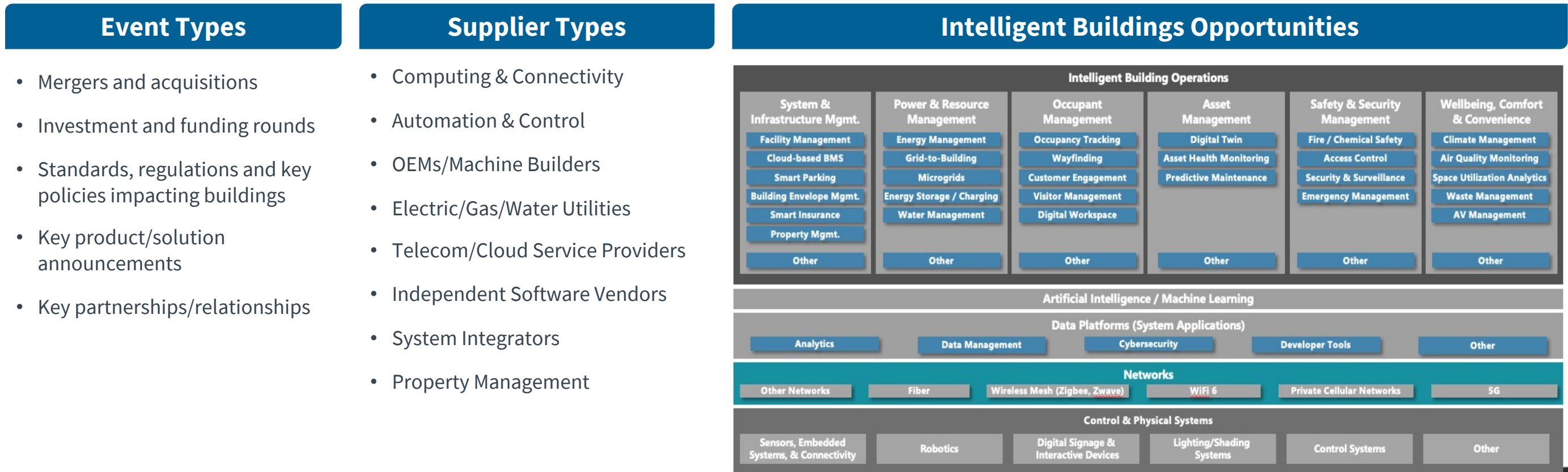
Resulting Key Output

- **Devices Shipped & Installed by Segment:** Harbor will segment the device opportunity in terms of the volume of shipped and installed units and value of integrated Smart Systems
- **Revenue Stack:** Smart Systems Forecast revenue includes Enablement, Network Services, System Applications and Value Added Applications
- **Use Case Revenue:** Commercial Building SSF revenue opportunity will be further segmented across the HRI Use Case framework
- **Regional Analysis:** regional breakouts for Canada and the US will be applied to device volume and value

3 Quarterly Market & Technology Tracking Overview

Harbor will develop a quarterly tracking report for Intelligent Buildings focused on news and events of interest from the prior quarter. Each report includes an overview of key events, analysis from Harbor analysts and key opportunity takeaways.

Draft starting point for tracking categories and dimensions, to be refined via steering committee meetings



Key Deliverables
(see more on next page)

15-20-page quarterly tracking report in PPT (x3, one for each quarter), for Intelligent Buildings

3 Quarterly Market & Technology Tracking Outputs & Benefits

Quarterly tracking reports will include a summary of key events, as well as highlights and analysis of the most important events from that quarter

Summaries of Key Events & Macro Trends

Acquisitions, Investments & Competitor Announcements Summary

Top Announcements of Q2 - 2022: M&A and Investments

M&A Announcements
Siemens made headlines this quarter with acquisitions of Brightly and Senseye, which add to Siemens' asset management & predictive maintenance capabilities. Other notable acquisitions are in the domains of industrial asset management (Aurgy - Seelco), cybersecurity (Sabanci - Radflow, XM Cyber - Cyber Observer), and supply chain management (Lineage - Turvo).

Funding Announcements
Q2 saw strong inflow of capital into robotics companies, specifically those in China & Japan, with the case of XYZ Robotics, Baga Robotics, and MegaRobo. Robotic company GreyOrange also raised \$120 through growth financing after securing \$340m in the previous Series C funding round. Other notable investments are in the domains of industrial & supply chain automation (Kinexon, Symbotic).

Continued Interest in Robotics
Strong investments into robotic OEMs across different global geographies.

Partnerships, Product Announcements & Regulations Summary

Top Announcements of Q2 - 2022

Partnership Announcements
Schneider partnered with Claroty & Intel to strengthen cybersecurity & SW-defined control systems for EcoStruxure. Realtime Robotics also partnered with Japanese OEMs Mitsubishi & Kawasaki (separately) to speed up the process of robot automation programming. Other notable partnerships include GreyOrange - Bluebird on warehouse automation & Danfoss - RSE Robotics on heavy machinery electrification.

Product Announcements
Q2 had a few OEMs launching products that integrate machine vision to augment use cases such as infrastructure inspection (Eposha), factory automation (Cogne), robotic motion control (ABB), Other OEMs such as Festo, Epson, Universal Robots, and Comau also introduced newer versions of co-bots for application in factory automation. Another notable announcement involved National Instruments launching its first Maintenance-as-a-Service solution.

Standard/Regulation Announcements
Q2 did not see an immense additions of standard and regulatory announcements from various legal & standards bodies. Most of the relevant announcements are work-in-progress with regards to standardization of emerging technologies such as 5G, 3D Printing, AI/ML, and Cybersecurity.

Significant Activity Occurring Across Many Opportunities in Q2 2022

Robotics & Machine Vision continue to be the focus of multiple investment rounds, partnerships and product announcements (Hardware & Software). Supply Chain Management & Process Optimization sees high level of traction, with large investment rounds for Stord, GreyOrange, and KINEXON as well as partnerships from Schneider, Intel, Mitsubishi, and Realtime Robotics. Large footprint of activities in industrial System/Asset Inspection & Management with the acquisitions of Brightly & Senseye from Siemens and of Seelco from Augury and product launches from Toshiba and Cognex. Secure Remote Access & Cybersecurity still popularity continues with a couple of large partnership announcements.

Opportunity Map: Supply vs. Demand*

Established & Consolidated: Robotics, Machine Vision, Supply Chain, Process Optimization, High Perf. Wireless, TSN, Augmented Reality, 3D Printing, Co-bots.

Mixed/In Transition: Digital Twins (Process), Digital Twins (Machine), Digital Mobile Operator, Process Optimization, Adaptive Robots, Connectivity Blending, SW defined Control, Hybrid Net Management, Embedded Logic, Virtual Reality.

Nascent & Fragmented: Cybersecurity, Central Hardware, OERs, Environment monitoring, Energy management, Asset management, AGV/AMRs, Digital Sensors, Supply Chain Vis., Machine Vision, Data Mgmt. Platform, Product/System Inspection, AI/App Dev Tools, Adaptive Energy & Grid, Secure Remote Access, Hybrid Net Management, Embedded Logic, Virtual Reality.

Customer Demand & Adoption: Pre-Emergent, Emergent, Growth.

*Opportunities and placement to be validated & expanded through research and tracking. Placement is approximate & could change.

Individual Event Highlights with Analysis

Summary & Takeaways: Industrial Mergers, Acquisitions & Investments

Key Takeaways: Q2 2022
\$4.96B in M&A (56 deals; 71.4% of transaction amounts undisclosed)
\$7.8B in Investments (42 deals; 0 transaction amounts undisclosed)
Continued Interest in Robotics: Strong investments into robotic OEMs across different global geographies.

Date	Acquiree	Acquirer	Opportunity	Amount	Details/Analysis
27 Jun 2022	Brightly	SIEMENS	Asset & Energy Management	\$1.97B	A provider of cloud-based asset management software, Brightly perfectly complements Siemens' digital offerings for buildings through seamless data integration, which helps increase building efficiency, lower asset downtime & maintenance costs, shorten lifecycle, and improve data-driven decisions.
08 Jun 2022	senseye	SIEMENS	Asset Management, System Inspection	Undisclosed	An industrial analytics software company with a focus on AI-powered predictive maintenance & asset management for industrial machines. Senseye strengthens Siemens' digital services portfolio and helps the latter's OEM base strengthen and more integrated offerings for clients in the industrial segment.

Industrial Mergers & Acquisition Highlights

Siemens' acquisition of Brightly is the most notable M&A deal of Q2; however, there was action across the landscape, specifically within Cybersecurity, Supply Chain Management, Industrial AI, and Machine Vision.

Date	Acquiree	Acquiree Type	Acquirer	Acquirer Type	Amount	Details/Analysis
10 May 2022	SEEBOT	ISV	ANENT	ISV	\$140m	Aurgy, the leading provider of IoT and Industrial AI solutions that improve health and reliability of machines for manufacturing and industry, signed a definitive agreement to acquire Seebot, a leader in AI-based process intelligence. The deal is a combination of cash and stock.
29 Apr 2022	Radflow	ISV (Cybersecurity)	Q-BANCI	Industrial Firm	\$45m	Radflow, an Israeli OT cybersecurity startup announced that it is being acquired in a two-phase process by Q-BanCI Group, market leaders in the financial services, energy, and industrial sectors. By leveraging the extensive industrial footprint of the Sabanci Group, Radflow plans to further optimize its OT security offering.
01 Jun 2022	TURVO	ISV (Supply Chain)	Lineage	Industrial Firm	Undisclosed	Lineage Logistics, a leading temperature-controlled industrial REIT and logistics solutions provider, announced the acquisition of Turvo, a provider of supply chain management, collaboration, and visibility software. The

Industrial Funding Announcement Highlights

Q2 had multiple investments in robotics and software-defined supply chain & inventory management. The biggest round tracked was life sciences robotic company MegaRobo, with the second being Stord, a cloud supply chain software provider.

Date	Company	Company Type	Opportunity	Amount	Participants	Details/Analysis
20 Jun 2022	MegaRobo	Specialist OEM	Supply Chain Automation, AGV/AMRs	\$40m, Series B (\$30m total)	Capital Today, Gaojing Capital, OTC Capital, Source Code Capital	Founded in Shanghai in 2018, XYZ provides turnkey solutions based on 3D computer vision, motion planning, and no-code user interface to automate logistics in manufacturing. With the completion of this round, XYZ has so far raised \$500m from venture investors.
15 Jun 2022	MegaRobo	Specialist OEM	Robotics (Life Sciences)	\$30m, Series C (\$425m total)	Goldman Sachs, Asia Investment Capital, GVV Capital, Singapore Ventures, Pavilion Capital, I-Member Capital, Redbox Capital	MegaRobo Technology Ltd. announced that it has closed a \$300mm Series C financing, led by Goldman Sachs Asset Management, Asia Investment Capital, and GVV Capital. The proceeds will help MegaRobo continue its R&D investment, capacity increasing and product expansion.
08 Jun 2022	Symbotic	Specialist OEM	Supply Chain Visibility	\$405m, Post-IPO Equity	SVI Investment Corp. (IPO-ed via SPAC), SoftBank	The transaction is expected to raise \$75m in gross proceeds, including \$20m from SoftBank Vision Fund 2 and \$20m from a select group of leading strategic and institutional investors, including Walmart, to support Symbotic's modernization of global supply chain via its product movement technology platform.
10 May 2022	Stord	Independent Software Vendor	Inventory Management, Supply Chain Visibility	\$120m, Series D (\$22m total)	Franklin Templeton, Sigo Ventures, Stite Capital, I37 Ventures, River Partners, Founders Fund, BOND, Sosa, Dignity Ventures, Saleforce	Stord, the cloud supply chain leader, announced today that it has raised an additional \$100m in Series D financing led by Franklin Templeton, bringing the total round to \$200m. Now valued at roughly \$1.5B, Stord recently crossed \$200m in annualized revenue run-rate and has raised \$325m in total funding.
26 Apr 2022	xyrobotics	Specialist OEM	Collaborative Robots, Supply Chain Management	\$51m, Series C (\$81m total)	Goldman Sachs	xyrobotics, a leading developer of collaborative pick-assist robots (xybots PA-AMRs), or warehouse robots, and pioneers of Cloud Robotics, announced \$51m (up to \$81m) in Series C funding led by Goldman Sachs to accelerate expansion of robotics solutions and artificial intelligence technologies.

Deliverables

- Tracking framework (event types, company types, technologies, etc.)
- 15-20-page powerpoint deck (x3, one for each quarter)
- Excel database of tracked events and related information as available

Benefits & Values

- Stay up-to-date on ecosystem maneuvers, trends, and investments in the intelligent buildings space
- Track key technology innovations through analysis of M&A and investments
- Leverage graphics and charts from PPT-based trends report in key external presentations
- Focus on topic areas for further research in configured research projects

4 Configured Research Project Overview, Deliverables & Benefits

Through close collaboration with the Steering Committee, Harbor will analyze key topics of interest, producing a PPT-based report that includes re-usable outputs and key recommendations for steering committee members

Example Research Topics

- **Data Analytics & Predictive Maintenance:** How data, analytics, AI, and other technologies can optimize maintenance and prevent downtime
- **Enhanced Security & Access Control:** Opportunity for technology-enabled security systems including biometrics, facial recognition and AI-power video analytics
- **Smart Grid Integration:** Collaboration with local utility grids and smart grid technology to optimize energy consumption, enable demand response, and support the integration of electric vehicle charging infrastructure.
- **Flexible Spaces & Workplace Experience:** Technology-enabled and management of flexible and collaborative workspaces to enhance user experience
- **Building-as-a-Service (BaaS) Models:** Emergence of innovative business models where building services are offered as a subscription or service, providing scalability and flexibility for occupants.
- **Digital Twins and Building Simulation:** Implementation of digital twin technology for real-time simulation, monitoring, and management of building operations, allowing for predictive modeling and optimization.

Deliverables (x2 configured research reports)

- 15-25-page powerpoint report on the topic agreed to and as scoped with the steering committee, which could include the following types of output:
 - Market dynamics, trends and forces
 - Technology architecture & landscape
 - Customer needs and buying behaviors
 - Ecosystem, value chain & competitive landscape
 - Market sizing and forecast
 - Strategy recommendations
- Summary infographic for each report

Benefits & Values

- Receive data and analysis on multiple topics of interest throughout the year
- Focus on the topics and workstreams that matter most, and have the flexibility to decide on each topic before it is analyzed
- Short time to value—receive research and analysis inputs within 8-10 weeks after agreeing to scope
- Leverage PPT-based material in external presentations

Topics Covered in 2023

AI Opportunities

Moving from Advanced Analytics to Autonomous Artificial Intelligence

The more advanced analytics becomes, the more beneficial for data scientists to implement automation. Automated ML models can solve more complex problems than traditional analytics and data analysts can solve.

Data Science is the overarching umbrella that covers a wide range of tasks performed to find patterns in large datasets, structure data for use, train machine learning models, and develop artificial intelligence (AI) applications.

Data Analytics includes:

- Descriptive
- Diagnostic
- Predictive
- Prescriptive

Artificial Intelligence Enable computers to perform complex tasks like humans, including decision making, problem-solving, perception and understanding human communication.

Machine Learning, or "applied AI", is one of the paths to realizing AI and focuses on how humans can train machines to learn from multiple data sources to solve complex problems on their behalf. In other words, machine learning is where a machine can learn from data on its own without being explicitly programmed by a software engineer, developer or computer scientist. ML. Provide a way for systems to synthesize data, learn from it and use the insights to improve over time.

to many big systems, with increasing AI functionality integrated

Single | Conceptual | Complex
Intelligent Building Application Evolution

Sustainability Impact

The Need for Sustainability in the Built Environment

Buildings and construction are significant users of energy and resources, and we spend most of our time interacting with the built environment. How can we ensure the built environment is operated and managed in a sustainable way?

Sustainability investments and impacts are enabled by a flywheel of tenant needs, government policies and owner/operator investments. Sustainability goals include:

- **37%** Buildings and construction are responsible for 37% of global carbon emissions
- **76%** The building sector accounts for about 76% of primary electricity use in the US
- **17%** Commercial and institutional buildings use 17% of publicly-supplied water in the US
- **\$1.5B** The IIA allocates \$1.5B to sustainable redevelopment of brownfield sites
- **25-35%** "Green" buildings consume 25-35% less energy than non-green buildings

Reduce Carbon Footprint
Improve Occupant Experience
Reduce Operational Costs

Smart building management and automation, energy optimization, and data-driven insights for better building performance and tenant satisfaction.

Ecosystems & Interoperability

The Promise of Truly Interoperable Intelligent Buildings

While there is value in networking and collecting data from each building system individually, connections between building systems enable new use cases and compound value for multiple stakeholders

Intelligent Buildings Use Cases Enabled by Integration & Data Sharing Across Systems

- **Energy** - AI/ML algorithms optimize energy usage while optimizing indoor environmental quality
- **Occupancy** - Occupancy-based control of HVAC and lighting reduce energy usage while optimizing indoor environmental quality
- **Security** - Security systems allow easy access to badge employees, detect visitors to restricted areas and prevent unauthorized access
- **Smart parking systems** - Smart parking systems detect vacant spaces, provide real-time data on parking availability, and reduce the time and cost of visitor arrival for optimized entry

Benefits of Interoperable Complex Adaptive Building Systems Include:

- Cheaper design, installation and integration of hardware & software
- Greater visibility, control and automation across building systems
- Single data repository to enable higher-value analytics and AI
- Improve efficiency/productivity of operations staff and reduce cost associated with contractors
- Achieve sustainability targets and easier compliance reporting

suppliers' platform fully

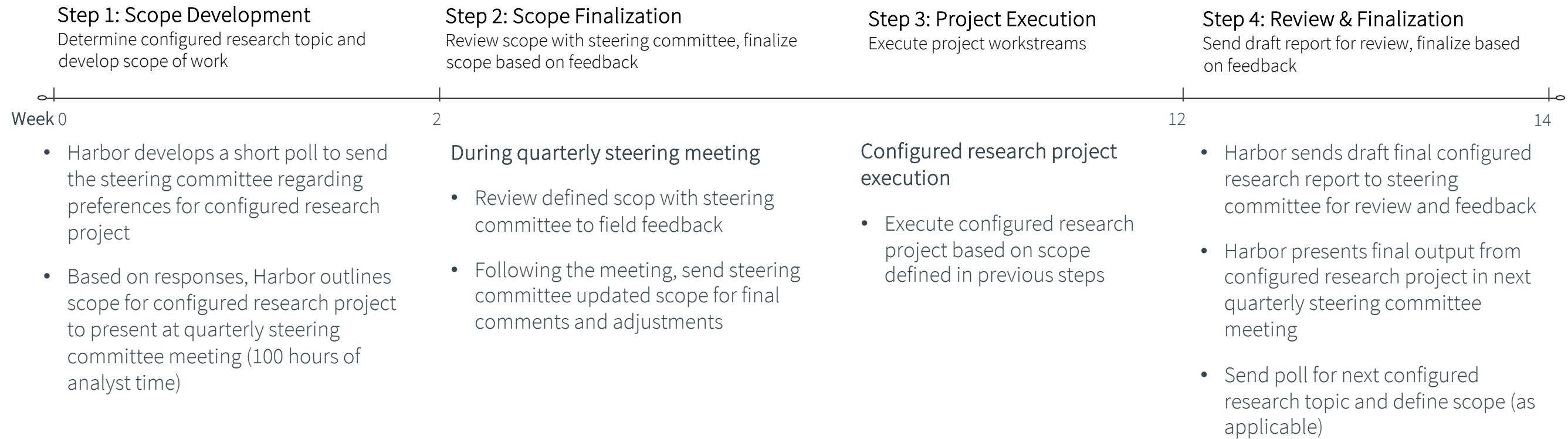
Smart building management and automation, energy optimization, and data-driven insights for better building performance and tenant satisfaction.

Partners include: JACO, CRACK, JACO, CRACK, AVNET

4 Configured Research Project Process

Harbor will conduct 2x configured research projects on topics of interest to the steering committee.

Draft starting point for Configured Research Process/Approach, to be refined via steering committee meetings



Key Deliverables

2x configured research projects, 15-25-page PPT report with 1 summary infographic per report

5 Steering Committee Meetings, Interactions, & Example Timeline

With the shortened year, Harbor will hold a total of 6-7 steering committee meetings (1 per month) for Intelligent Buildings, including a kickoff meeting, with the funders of the research engagement. Additional interactions will be provided as well.

Purpose: Maintain alignment on scope of work, review completed deliverables, and discuss upcoming activities.

Agenda (1-1.5 hours depending on the scope of work activities occurring)

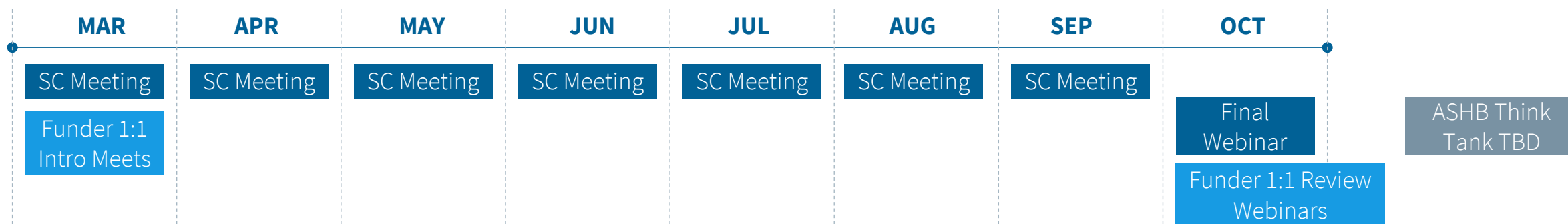
- Introduction, attendance, review of agenda, (5min)
- Review and discuss annual survey (Q1 only, 30min)
- Review current Quarterly Tracking Report (30min)
- Review current Configured Research Project progress (30min)
- Review poll results and proposed scope for upcoming configured research report (20min)
- Wrap-up, actions & Next steps (5min)



- **6-7 Steering Committee** meetings, with minutes and recordings
- **1:1 meetings with funders** to understand needs and priorities
- **Final webinar** to review research findings
- **Organization webinars** for each funder to review research findings
- **Think Tank** for ASHB community

Draft starting point for Steering Committee Meeting agenda and timeline to be refined via steering committee meetings

Interaction Timeline

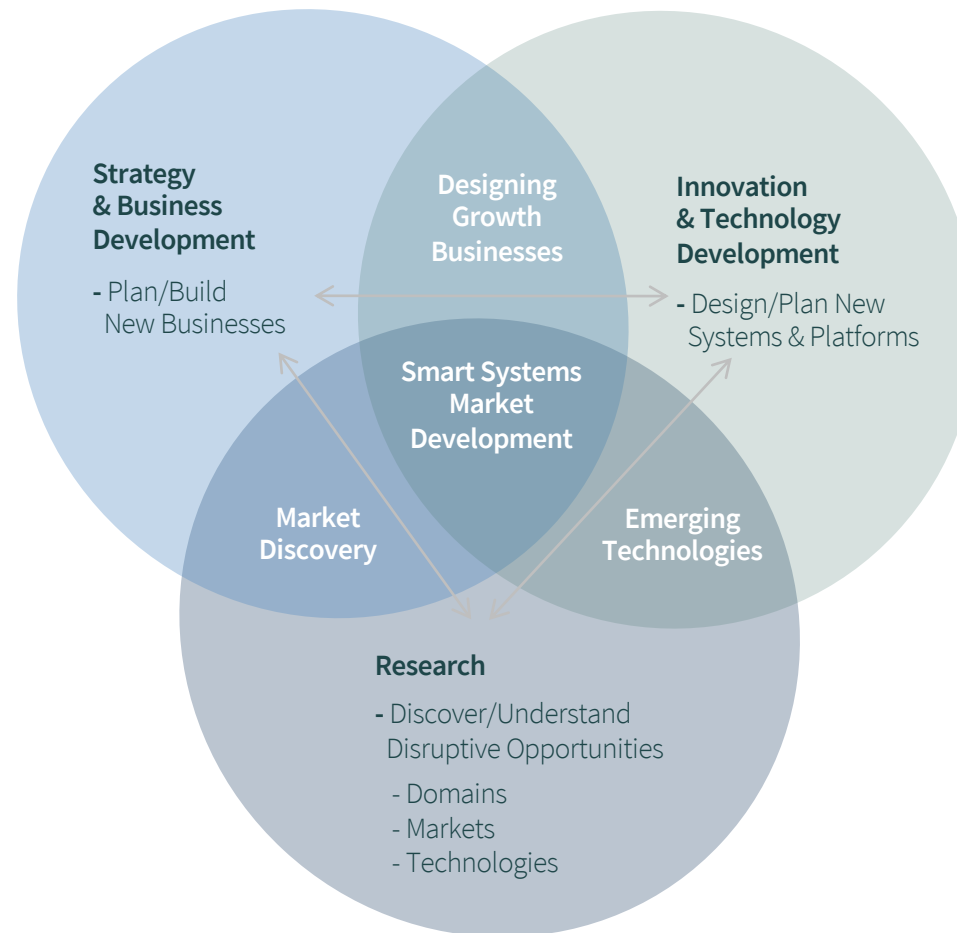


2024 Intelligent Buildings Research Arrangements & Budget

TEAM & EXPERIENCE: Harry Pascarella, Vice President, and Dan Chmil, Director of Research, would directly manage these projects. They would be assisted by one of Harbor’s research staff. The entire staff has significant experience analyzing intelligent buildings and connected home opportunities

TIMELINE: Based on the scope described, the engagement would take the form of an extended, ~8-month contract through October 2024. We will work with the funders through steering committee meetings to set and adjust priorities throughout the year.

NEXT STEPS: Once this statement of work is agreed to by both parties, we will require 2 weeks to organize our project team ahead of a project kickoff and related work activities. The arrangements for this proposal are valid for 60 days, after which we reserve the right to adjust the arrangements or terms based on the availability of resources and other potential conflicts. We look forward to the opportunity to work together.



Who Are We?

Harbor Research is a consulting, research & venture development firm – we bring together a unique combination of knowledge, processes & skills that enable our clients to succeed in a connected economy

What Do We Do?

The firm partners with clients to design, validate and develop new smart systems and services businesses. Our primary focus is on helping clients develop strategy, define new business models, assist with business and market development plans as well as address the organizational challenges driven by new disruptive growth opportunities

What Do We Serve?

Harbor services the community of emerging technology ventures, diversified product and services companies, global IT and network infrastructure players and capital market constituents

ASHB 2024
Research
Proposal

1. Introduction to Harbor Research
2. Proposed Scope of Work, Process, & Budget
- 3. Appendix: Examples of Previous Research Experience**

Harbor
Research

Harbor Research Serves Technology Innovators, OEMs & Services Providers

Illustrative Technology Supplier Clients

Computing & Connectivity	
Network Infrastructure & Services	
Software, Apps, Platforms & Infrastructure	



































Ecosystem Participants: Private Equity & Associations

Illustrative OEMs, Service Providers & Vertical-specific Software Clients

<h3>Energy & Resources</h3>	<h3>Industrial & Manufacturing</h3>	<h3>Buildings & Facilities</h3>	<h3>Transportation & Logistics</h3>	<h3>Retail, Healthcare & Consumer</h3>	<h3>Diversified</h3>
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Reference Assignments for the Leaders in HVAC, Buildings, Energy & Facilities

Over the last decade, Harbor has executed assignments for a broad cross section of players in the energy, HVAC and facilities arena — below is a representative range of clients we have worked closely with in recent years

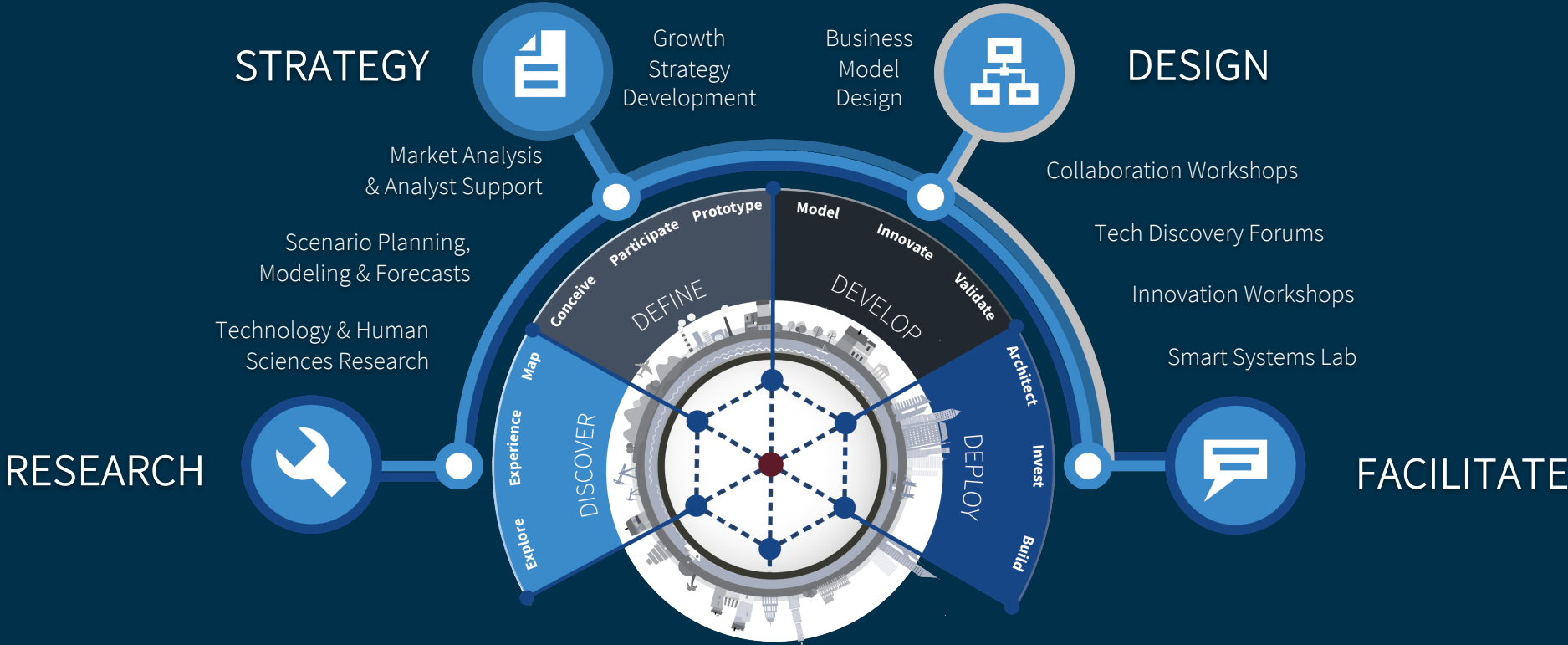
Energy Services	HVAC Manufacturers	Building Controls	Power Equipment	Software & New Tech.
       	   	   	      	          

Additional Intelligent Buildings & Related Experience

- For a multinational provider of cleaning and hygiene products in the hospitality, healthcare, food and beverage, food service, retail, and facility management sectors, we provided a comprehensive analysis of the 'Internet of Clean' sector including key market dynamics, current competitor and peer supplier strategies and maneuvers, as well as competitor solution features & packaging, use cases and services delivery models
- For the largest social media and networking company in the US, we conducted a demographic research study on a consumer-device prototype to understand the use cases, applications and target constituents in support of a Market Requirements Document.
- For the largest manufacturer of electrical products in North America, we conducted user survey research as well as competitor, peer and alliance candidate direct interviews to uncover unmet customer and user needs for new and evolving "connected" energy management and services opportunities.
- For the global leader in network infrastructure equipment, Harbor conducted an analysis of managed services opportunities in connected residential multi-dwelling and commercial properties, including market sizing, competitor analysis, alliance development analysis and go-to-market design.
- For the world's largest semiconductor and processor manufacturer, Harbor conducted an analysis of IoT opportunities within the residential sector. Primary emphasis was placed on opportunities where media and content were dominant values to determine core computing and network bandwidth requirements.
- For a venture-backed startup, conducted an analysis of consumer energy services offerings to help target candidate developer alliances as well as partnership opportunities with utilities and related services providers.
- Worked with CABA to develop an opportunity assessment within Connected MDUs, conducting a survey of 1,500 MDU owners, technology suppliers and service providers in the space, including 60 in-depth interviews to validate research findings. The engagement summarized the top IoT application and use case opportunities among primary buyers of technologies in the space, supported by a 5-year smart systems forecast model.
- For a large silicon player, Harbor defined and developed a software architecture for competitive analysis of IoT platforms. This research examined twenty-five supplier and OEM platform providers in the IT, Telco and OEM markets to validate and segment monetization and pricing models.
- For a leading connected lighting solution provider, Harbor defined new and expanded smart services and IoT solutions as well as building the business case required to support this critical growth initiative. Harbor clearly articulated alternative strategies and solutions available to the company and defined clear steps and a program of actions to fully prosecute the market opportunity.
- For the software branch of a leading industrial and energy OEM, Harbor analyzed of the costs and economics of asset performance management in support of asset health, productivity, optimization, and compliance and integrity. Harbor developed a market model that broke down the costs of data management and analytics tools, and located gaps the company's software may not address currently and can be added to the product roadmap.
- For the largest manufacturer of electrical products in North America, Harbor conducted user survey research as well as competitor, peer and alliance candidate direct interviews to uncover unmet customer and user needs for new and evolving "connected" energy management and services opportunities.
- For the global leader in network infrastructure equipment, Harbor conducted an analysis of managed services opportunities in connected residential multi-dwelling and commercial properties, including market sizing, competitor analysis, alliance development analysis and go-to-market design.
- For a venture-backed startup, conducted an analysis of consumer energy services offerings to help target candidate developer alliances as well as partnership opportunities with utilities and related services providers

CONTACT US FOR IN-DEPTH RESEARCH & CONSULTING

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Harbor Research has over thirty years of experience working with clients on growth strategy and new business creation. At the core of Harbor's approach is a deep understanding of the core technologies, markets and business characteristics as well as the management and organizational challenges companies face adopting and developing digital and smart systems technologies. We strive to generate deep insight into how emergent technologies drive value creation and competitive advantage in our clients' businesses and the economy as a whole.