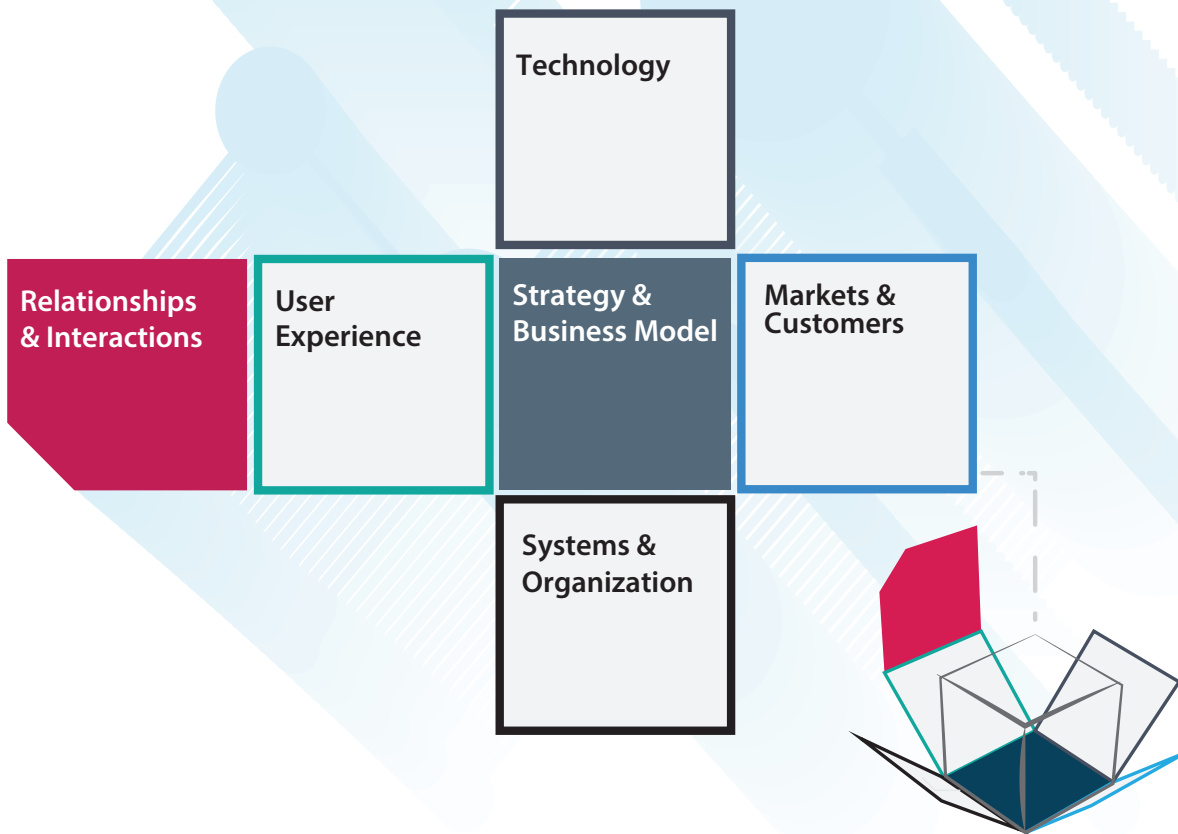


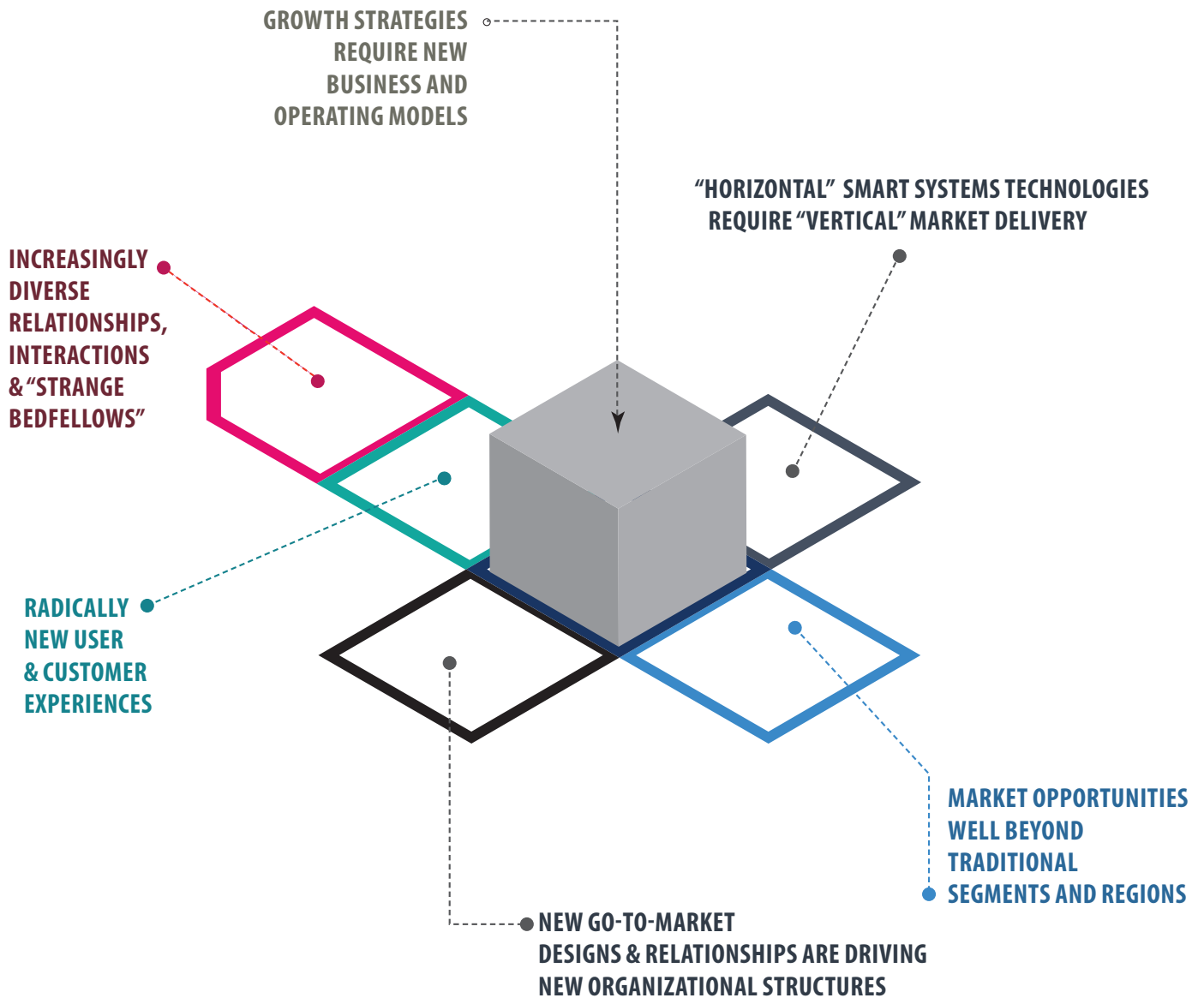
# Smart Systems and IoT Growth Themes and Technology Trends To Watch in 2018



## PART ONE: GROWTH THEMES

To stay competitive, original equipment manufacturers (OEMs) will need to sustain momentum while developing new digital and IoT capabilities, offerings, and business models. What growth themes and technology trends will OEMs seize to drive differentiation?

how should OEMs be thinking about new growth opportunities and strategies enabled by smart systems and internet of things technologies?



### WHAT ARE SMART SYSTEMS?

A new generation of computing systems and information architecture that when combined with artificial intelligence, machine learning and Internet of Things technologies are breaking away from today's information, computing and telecom (ICT) paradigms to enable intelligent real-world physical systems to be integrated onto networks and the data from machines, sensors, video streams, maps, people, news feeds and more to become an integral part of all information systems. This new paradigm is driving all information systems and, more importantly, their interactions towards real-time, state-based, context-sensitive capabilities that integrate people, processes, physical equipment and knowledge to enable collective awareness and better decision making.

## OEM GROWTH THEMES

The industrial device, equipment and machinery universe encompasses a wide range of companies that develop and supply the equipment that other companies need to run their operations. The impact of original equipment manufacturers (OEMs) on the global economy cannot be understated. The breadth of equipment and products spans from components such as semiconductors and sensors to robotics and industrial machinery as well as complex test and measurement systems.

This paper identifies new forces acting on players and markets and seven key growth themes that tie closely to future OEM competitiveness which, in turn, are tied to several technology trends we believe will enable new customer solutions and new non-traditional growth opportunities. Digitization and the continued evolution of Smart Systems technologies will impact virtually every dimension of any OEM's growth strategy and operating model and will likely make the business look and feel very different in the coming years.

## MACHINE and EQUIPMENT MANUFACTURERS FACE DRAMATIC CHANGES

















While it is difficult to generalize, most OEM segments are undergoing dramatic change due to broader forces at work in the marketplace but also because of the impacts driven by digital and Internet of Things technologies. The advent of connectivity for intelligent equipment and machines is enabling asset monitoring and tracking to ensure uptime, performance, availability, software version control, and location analysis for a wide range of applications. As networks continue to invade the physical world of sensors and machines, many OEM's have come to understand the significant value created from extracting and leveraging the machine data and usage information from their equipment.

As the Industrial OEM arena evolves past the last several turbulent years, multiple forces [such as global economic expansion] are likely to contribute to positive growth in the short to moderate term. The overall health of the global economy and global gross domestic product (GDP) growth historically tie closely to growth of equipment, machines and capital equipment. For leadership teams in OEMs, identifying and understanding key forces and trends and their potential impacts on their specific product, machine or systems segment, will be critical for sustaining growth and performance in the long run. Leadership in equipment manufacturers and machine builders will face tough trade-off decisions related to new technology and innovation investments as well as rapidly evolving business and operating models.

Technologies, markets, customer needs and competitors are all changing rapidly. Consider just a selection of the many forces at work in the marketplace today:

- » As the economy has evolved to a more service-oriented and increasingly digital state, the importance of speed and agility as well as building new skills has increased dramatically.

Exhibit 1: Industrial OEMs: Many Diverse Segments and Players

	<b>Mobile Equipment</b>	Mobile construction, agriculture, mining and material handling machines	
	<b>Medical Machines</b>	Healthcare imaging, diagnostic and patient monitoring and care equipment	
	<b>Diversified Manufacturers</b>	Portfolio players with no LoB accounting for more than 40% of revenues	
	<b>Industrial Machinery</b>	Fixed machines and machinery systems primarily used in manufacturing	
	<b>Building Equipment</b>	Sub-system equipment within buildings including HVAC, lighting, transport and safety	
	<b>Power Equipment</b>	Equipment for electrical power generation, transmission, distribution and storage	
	<b>Automation and Controls</b>	Components, products and systems for control incl electrical, flow, regulatory and pneumatics	
	<b>Test &amp; Measurement</b>	Sensors, instruments and measurement devices for testing, analyzing equip and systems	
	<b>Electrical Power Dist</b>	Low and medium voltage components utilized for power distribution and switching	
	<b>Advanced Components</b>	Diverse precision or multi-function mechanical and/or electronic devices	

- » Capital is increasingly available and abundant. The scale of financial assets are now roughly 8-10 times global GDP, making unique skills and new innovation concepts far more important than capital formation and also, are the true constraint on an OEM's ability to drive new growth.
- » Industries are consolidating into a “winner-takes-all” mode. Virtually any product or services segment likely had twenty or more significant competitors thirty years ago. Today that number is typically 3-5 globally dominant leaders in each segment collectively earning as much as 75% or more of the profit pool.
- » Wall Street demands and rewards quarterly profits and short-term performance in the name of driving shareholder value. Shorter management horizons and increased pressures from investors are what drives businesses today with less emphasis on longer term investments in new growth.

We would describe all of the above trends as “classic.” What we mean is the relationship of these trends to an OEM's core product business is predictable. For OEMs to succeed in their core product businesses they will need to continue to carefully set priorities and investments to address prevailing trends in the marketplace. Innovation for the core business is, for the most part, sustaining, incremental and continuous. Performance measurement, repeatability, risk management, continuous improvement and financial discipline are the minimum requirements to help drive a continuing cycle of improved costs and higher levels of customer support.

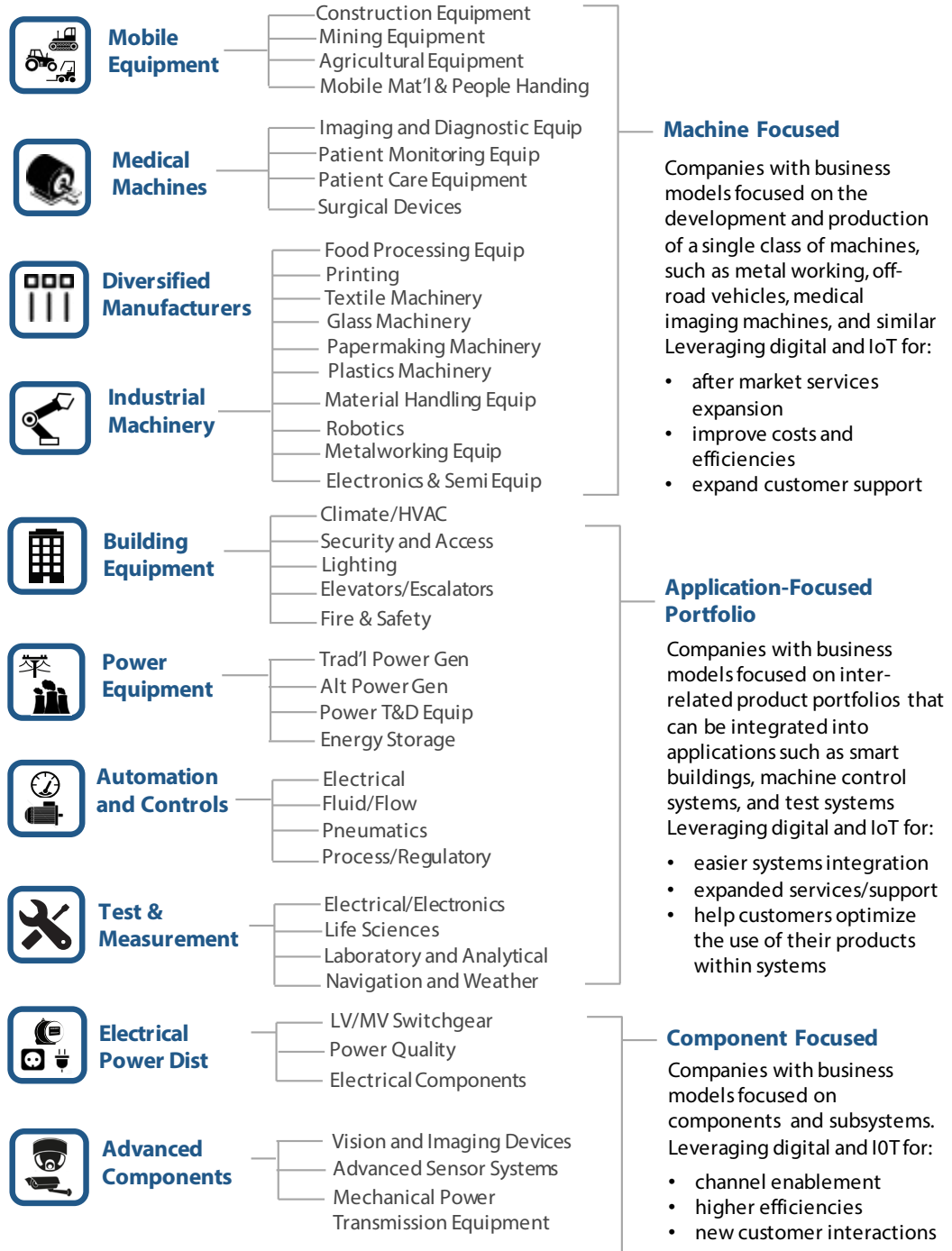
However, we believe new digital and Smart Systems technologies will have an out sized impact on OEM's strategy and begin to turn long held beliefs upside down. For example, there's been a very long held belief that you can be big and low cost, or you can be focused and differentiated—but not both. Today's Smart Systems and IoT technologies are enabling new modes of services delivery and creating new opportunities with data and analytics capabilities that either significantly reduce, if not eliminate, this classic strategic trade-off. This, we believe, is but one example of the extraordinary effects new systems technology will have on OEMs.

## EVOLVING OEM GROWTH THEMES

The business environment for OEMs has entered a new chapter with new challenges and unfamiliar technologies impacting virtually all of the diverse players and segments across the OEM arena. Because of its breadth and diversity, it's difficult to generalize how players in specific segments should think about and respond to new unpredictable forces in the market. Even though the journey forward will differ from company to company, we believe leadership teams in OEMs should be focusing on the following growth themes:

- » **New Non-Traditional Growth Opportunities:** sources of new growth are shifting away from just growing with the market or taking market share from peer players. For many

**Exhibit 2: OEM Business Model Characteristics Tied To Sub-Segments**

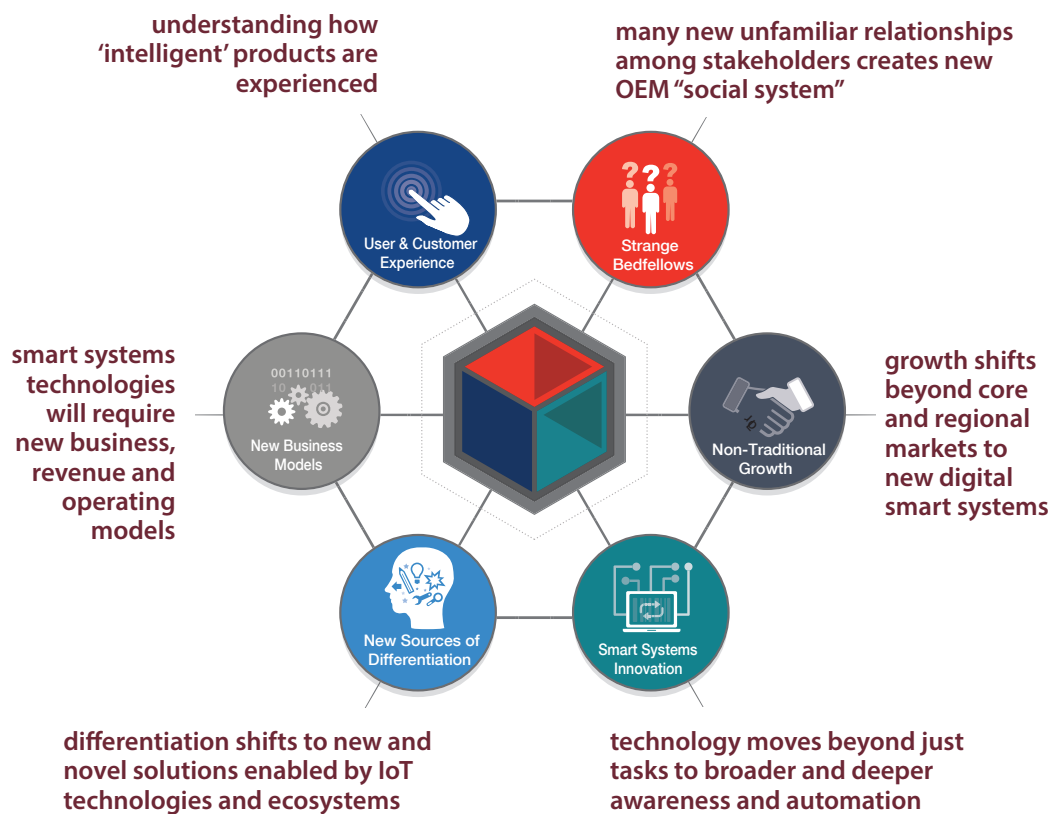


OEMs, growth is rapidly shifting beyond their core business to broader product/system/solutions offerings, integrating new embedded digital capabilities or expanding vertical integration, particularly leveraging new services and value-added customer support.

- » **Changing Sources of Competitive Differentiation:** we believe competitive differentiation will shift away from traditional sources such as product/brand position, scale and available capital, low cost manufacturing, product portfolio, channel or customer support capabilities towards a new focus aimed at areas such as IoT enabled product innovations as well as partner and ecosystem development.
- » **User and Customer Experience:** IoT and connected product technologies are enabling radically new user and customer experiences and informing equally disruptive business models (think of Apple, Amazon, Uber, etc.). Understanding user and customer preferences, behaviors, interactions and the technologies that can inform unique user experiences can create new differentiated offerings. This will drive a shift toward understanding how ‘intelligent’ products are experienced and how ‘networked’ products foster diverse interactions between and among manufacturers, users, application developers, technology sourcing partners and channel participants in a networked context.
- » **Smart Systems Innovation and Optimization:** new digital and IoT technologies will drive a multi-year wave of growth based on the convergence of innovations in embedded software, machine intelligence and data and information architectures integrated with more powerful sensors, actuators and client devices connected to higher performance personal, local and wide-area networks. These technologies will work together in unprecedented ways to solve more complex business problems than previous generations of automation, control and computing technologies. These new capabilities will revolve around real-time situational awareness and automated analysis of “states” and operations. As a result, technology moves beyond just proposing task solutions — such as executing a work order or a sales order — to sensing what is happening in the world around it, analyzing that new information for risks and alternatives, and taking actions.
- » **Go-To-Market and Value Delivery Networks Drive Strange Bedfellows:** As the complexity of these systems continues to increase, the number and diversity of stakeholders, users, sellers and supporters interacting with these systems will also rise in a way that creates a “social system” comprised of new unfamiliar relationships - a phenomenon we call “strange bedfellows.” Leveraging new digital data value inherent in connected products and systems will require new infrastructure and enabling technologies that will, in turn, inform the formation of new and different market relationships and alliance networks comprised of complementary equipment and device OEMs as well as third party application developers and services providers. We believe that within this solution delivery social system [or ecosystem] OEMs will need to understand new value adding “roles,” but also make conscious decisions about their evolving position in market delivery alliances and networks.

- » **New Business Models, Skills and Organization Designs:** The technical innovation driven by digital and IoT technologies coupled with diverse and changing relationships between and among complementary players will likely lead to changes in market structure, shifts in the sources of profit and value creation and thus, new business and operating models. Identifying and designing new business models along with developing the new skills, capabilities, systems and organizational relationships they require will be critical to success.

Exhibit 3: Evolving OEM Growth Themes



It is this last growth theme focused on new business models that stands out for us. The influence and disruptiveness of platform companies affect much of the business world these days. Platforms can come in many types, including a de facto standard such as Cisco's network operating system or Microsoft's Windows, or Facebook's immense user base. Platform business models that creatively combine elements of dis-intermediation, shifting profit pools,



new recurring services, customer transparency or other maneuvers are all disrupting existing business and operating models - and it does not stop here - just think about supply chain and freight logistics, travel, order management, customer relationship management software, consumer lending and payments, to name a few. New platform business models are cropping up everywhere leading to the question, how should OEMs respond?

Perhaps the most important perspective we have come to is about the relationship between technology architectures and business models and the “role” platforms and relationships play in enabling a whole new level of differentiation. Our evolving “thesis” points to the complexity of smart connected systems and, as the number and diversity of stakeholders expands (users, sellers, supporters, benefactors, etc.), and the volume and nature of their interactions grows, the systems or “technology architecture” will become more and more tightly coupled to the “business [model] architecture” and, in turn, the so-called platform becomes the central organizing mechanism required to deliver new data and information-driven services. Platform development decisions must be aligned with the corresponding business and revenue models these technologies will inform. These two “architectures” must be viewed in close proximity. Technology architectures and business architectures need to be mutually supportive without inhibiting one or the other.

However, trying to coordinate and leverage the respective roles of technology architecture and business architecture often creates contention. Many of the participants in this emerging arena that we speak with are coming to see the continuously evolving relationship between these two dimensions as fertile ground for innovation. They need to be interwoven and mutually supportive. In fact, from our own direct consulting experiences, we believe success in either - technology architecture and business architecture - increasingly goes to the company that effectively utilizes the combined potential of both.

What’s required is a true shift in thinking about how data from devices, machines, people and physical systems will be integrated and how they will interact. We need an approach that is not about leveraging aging IT, telecom or automation technology into a new context; its about looking forward to a single, unified approach for integrating the many interactions that these systems will foster. What are the major enabling technologies required to overcome these hurdles?

- » Higher performance, higher quality and more reliable mission critical wireless networks that enable new smarter sensors and sensor data fusion tools;
- » More “democratized” distributed data and information architecture standards to inform data sharing and data fusion for analytics and machine learning;
- » Easier and less costly data management, transformation and analytics application development tools; and finally,

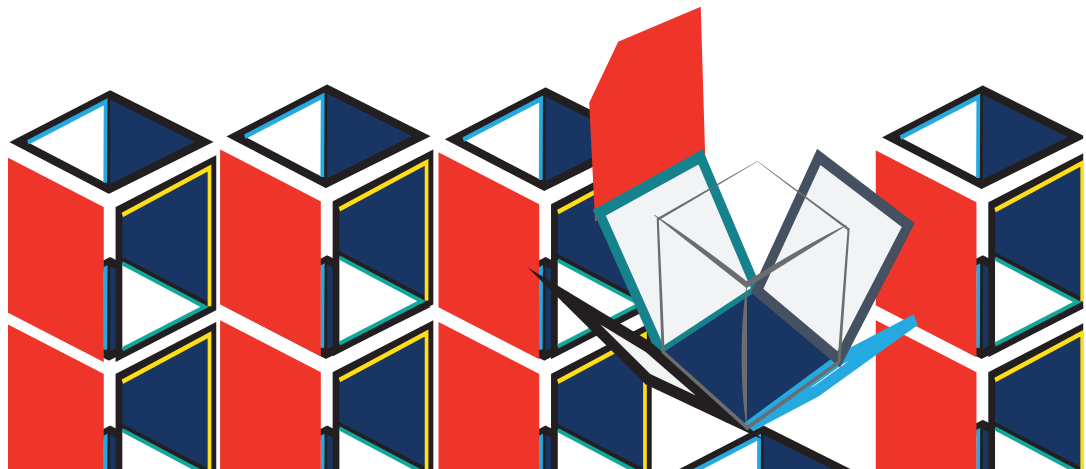
- » A new generation of integration and equipment management platforms that enable free flowing data discovery, data aggregation, integration and fusion and collaborative application development.

While all of the above list of required tools will contribute to OEM and end customer adoption of new Smart Systems and IoT technologies, our analysis also points to several broader market development trends and challenges in realizing the full value of new enabling technology:

- » Challenges in OEMs with adopting new business, revenue and operating models;
- » Complex services delivery ecosystems that require new and different relationships;
- » Anticipation of smart services and systems innovation and new growth venture modes not widely adopted today;
- » Fragmented digital and IoT vendor landscape - particularly the lack of understanding of how these new more “distributed” and “participatory” systems will work on the part of the IT and telecom technology development community; and,
- » Requirements for more vertically-focused solutions developed from “horizontal” enablers.

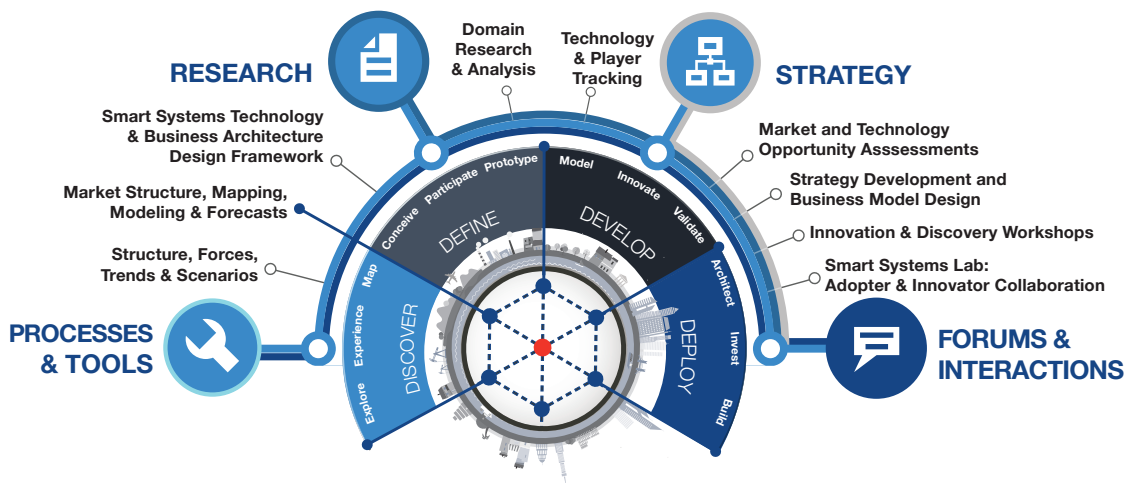
The potential scale of the Smart Systems and IoT opportunities for OEMs is utterly dependent on new technology innovations. While we strongly believe Smart Systems and IoT technologies will play a central role in OEM strategy going forward, we have also observed how difficult it’s been for many OEM’s to integrate new digital and IoT technology into their core business.

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can play is fertile ground for OEM differentiation



## ABOUT HARBOR RESEARCH

An internationally recognized research, technology, and business development consulting firm, Harbor Research has predicted, tracked, and driven the development of the Internet of Things since our inception in 1984. While our history is long, our strategy is simple: capture and create value by combining accurate data discovery and analysis with creative systems-thinking.



It is this mindset that has given us the privilege of working with some of the greatest companies in the world. Today, we continue to work with C-level executives and top management of some of the world's most consistently successful companies and innovative startups. In the same way that the market has flexed and grown over the years, our services and experience have grown to make us the premier service organization you see today. We work with clients in a variety of ways including consulting, advisory, research and content development, thought leadership and workshop facilitation.