smart systems design

Developing New Growth Opportunities at the Intersection of Smart Systems, Services and the Internet of Things
what are smart systems and the internet of things?

Why Is It So Important?
Global expansion; re-engineering; lean practices; mergers and acquisitions. For most companies these strategies for growth and value creation have reached the point of diminishing returns. As networks continue to integrate the physical and virtual worlds, what worked in the past to drive growth is less likely to work now or in the future...

How Should We Think About Framing Opportunities?
The assumption that the role of new business design and development is only about making existing products or services more attractive no longer works. We believe smart systems design needs to transcend discreet product or service innovation. Business developers need to creatively imagine fully developed systems and whole marketplaces.

To discover, design and develop innovative smart systems, organizations will need new and uniquely facilitated processes...

where are the biggest growth opportunities?

What Are The Success Factors?
Diverse collaborative networks will be self-organized by people who are motivated to explore and develop ideas they care deeply about. Business innovation will extend beyond ideas about new products and services to the very manner in which business is conducted.

Building new ventures for the Internet of Things requires new and very different modes of design and development – organizations will need to push the boundaries of collaboration to include many new and unfamiliar participants...

how should our organization respond?

What business design, revenue model and management priorities will help build long term success?

What unrealized technology, system and market leadership opportunities are available in the smart systems and IoT arena?

Which combination of customer value elements will differentiate us? How can we make, partner or acquire those elements?

what are the biggest growth opportunities?
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What exactly are smart systems and the Internet of Things?
What Are Smart Systems and Services

**1. SENSORS & ACTUATORS**

We are giving our world a digital nervous system. Location data using GPS sensors. Eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes.

**2. CONNECTIVITY**

These inputs are digitized and placed onto networks.

**3. PEOPLE & PROCESSES**

These networked inputs can then be combined into bi-directional systems that integrate data, people, processes and systems for better decision making.
The interactions between these entities are creating new types of smart applications and services.

Starting with popular connected devices already on the market

**SMART THERMOSTATS**

*nest*

Save resources and money on your heating bills by adapting to your usage patterns and turning the temperature down when you’re away from home.

**CONNECTED CARS**

*Car2Go*

Tracked and rented using a smartphone. Car2Go also handles billing, parking and insurance automatically.

**ACTIVITY TRACKERS**

*BASIS*

Continuously capture heart rate patterns, activity levels, calorie expenditure and skin temperature on your wrist 24/7.

**SMART OUTLETS**

*belkin*

Remotely turn any device or appliance on or off. Track a device's energy usage and receive personalized notifications from your smartphone.

**PARKING SENSORS**

*STREETLINE*

Using embedded street sensors, users can identify real-time availability of parking spaces on their phone. City officials can manage and price their resources based on actual use.
And quickly advancing

TO DIVERSE APPLICATIONS

HOME
CONSUMER

- Light bulbs
- Security
- Pet Feeding
- Irrigation Controller
- Smoke Alarm
- Refrigerator
- Infotainment
- Washer / Dryer
- Stove
- Energy Monitoring

TRANSPORT
MOBILITY

- Traffic routing
- Telematics
- Package Monitoring
- Smart Parking
- Insurance Adjustments
- Supply Chain
- Shipping
- Public Transport
- Airlines
- Trains

HEALTH
BODY

- Patient Care
- Elderly Monitoring
- Remote Diagnostic
- Equipment Monitoring
- Hospital Hygiene
- Bio Wearables
- Food sensors

BUILDINGS
INFRASTRUCTURE

- HVAC
- Security
- Lighting
- Electrical
- Transit
- Emergency Alerts
- Structural Integrity
- Occupancy
- Energy Credits

CITIES
INDUSTRY

- Electrical Distribution
- Maintenance
- Surveillance
- Signage
- Utilities / Smart Grid
- Emergency Services
- Waste Management
things get really interesting when connected devices start creating compound applications

Simple Applications:
- Alerts & Alarms
- Location Services
- Monitoring & Diagnostics
- Maintenance Dispatch

Compound Applications:
- Asset Management
- Multi-Vendor Equipment Support
- Automation

Complex Applications:
- Smart Cities
- Smart Transportation Systems
- Diverse Data Fusions

Applications involving simple remote monitoring, location services and product support for maintenance or upgrades.

Applications that involve multiple (peer-to-peer) devices and machines with significant interactions between systems and equipment in multi-vendor environment such as factories, hospitals and related environments characterized by diverse vendors, users and stakeholders.

Applications driven by diverse interactions involving sensors, actuators, machines, people and systems that enable extending/expanding values from collaboration and analytics supported by data fusion between and among disparate and diverse sources.

Value

Time

SIMPLE:

COMPOUND:
- Smart Cities
- Smart Transportation Systems
- Diverse Data Fusions

COMPLEX:
Compound applications enable unique new use cases

**Smart Buildings + Mobility**

Anna is being pressured to reduce her company’s expenses for their new corporate office.

Energy used by commercial and industrial buildings in the US creates nearly 50% of our national emissions of greenhouse gases. (United States Environmental Protection Agency)

**Transportation + Smart Cities**

Sofia and her son Luis are on their way Downtown for an appointment.

Wireless sensors embedded in the parking lot help direct the car to an open spot in the city while also initiating the parking fees.

In Downtown San Francisco 20-30% of all traffic congestion is caused by people hunting for a parking spot. (San Francisco Municipal Transportation Agency [SFMTA])

**Healthcare + Smart Home**

Aging uncle Earl is still living isolated at his home and you are concerned about his safety.

Wireless sensors throughout his house help measure healthy activity levels, sleeping patterns and medication schedules.

Alerts are automatically sent to health care services and authorized family members if any abnormal activity is detected.

**For example**

40 million adults age 65 and over will be living alone in the U.S., Canada and Europe. (U.S. Department of Health and Human Services, Administration for Community Living [Aging] 2012)
What Are Smart Systems and Services

REAL-TIME SERVICE NETWORKS

Appliance Monitoring
Predictive Maintenance
Service Technician / CRM
Waste Management / Recycling

R Hotel Denver,
Industrial Washer #GH540-2608

Location ID: FC-RM #00243
Manufacturer: Appliance Park
Louisville, KY ID: #45205343
Materials: FC/SUS
Sensor: Vibration
Connectivity: Wireless LAN

Connor, the Lead Maintenance Manager at the R Hotel in Denver, receives a sensor notification that the pump body O-ring #6 on washing machine #230243 is starting to fail in the housekeeping laundry room.

On his mobile, Connor prompts the machine to order a new part. This action triggers a bidding opportunity for local service technicians within the product’s authorized maintenance network.

The request lays out:
- Pricing parameters
- Timing requirements
- Machine history
- Part specs
- Predictive sensor measurements & alerts

Tom from IA Appliances bids on the service request and receives a notification a few moments later that his bid was accepted.

Within 1.5 hours, a service technician from IA Appliances is on site (Using a temporary facility access code for the wireless door lock) to replace the water pump. Connor sends a brief note on the service quality and IA Appliances releases a bid request for the part’s raw materials to local recycling centers.
What Are Smart Systems and Services

DIGITAL FARM TO TABLE

- Farm & Livestock ID & Sensors
- Food packaging sensors
- Retail Supply Chain Monitoring
- Health Services

Cattle
AIN: 840 003 123 456 789
Location: ID: Braymeadow Farm FR #00285653543
Slaughterhouse ID: #45203343
Sensor: Temperature, Accelerometer
Connectivity: RFID, NFC, WAN

Maria and her daughter are picking up groceries for the week. Using packaging with printed sensors, the two can make sure the ground beef they are purchasing has never reached unsafe temperature levels while on the shelf or being transported.

The packaging also contains a QR code which they can use to query the cow’s RFID tag and bring up its history:
- Where it was raised
- Where it was slaughtered
- Where it was packaged
- What it was fed
- How it was transported
- The last time it was inspected

A week later the U.S. Department of Agriculture’s Food Safety Service determines ground beef from originating from a regional packing company and sold at a neighboring store is contaminated with E. coli 0157:H7. All packages from this distributor change their alert color and notification messages are sent to those shoppers that may have been impacted.
connected machines and devices are rapidly proliferating

In 2017 over 3 billion connected devices were shipped

This number will grow to nearly 10 billion devices by 2022

- Home (Consumer): 4 billion
- Transport (Mobility): 500 million
- Body (Health): 600 million
- Buildings (Infrastructure): 2.1 billion
- Cities (Industry): 2.8 billion

*Not including mobile phones

In 2016 nearly 2.7 billion connected devices will be shipped
This number will grow to nearly 8 billion devices for the year 2020
smart systems and services opportunities are enormous in scale and scope ..... 

smart connected systems spending is likely to grow to a scale that is larger than all previous generations of IT and Network spending

By 2022 this opportunity will grow to more than $1 Trillion
framing smart systems growth opportunities
Smart Systems are quickly becoming a massive, global digital nervous system connecting billions of people, tens of billions of devices, and trillions and more data points through a network of unprecedented scale.
As these intersections blend the physical with the digital, they are mediated by ongoing user interactions, business processes, technology architectures, and newly created market forces.

### Business
- **Market Delivery**: Direct // Channel // Value Adders
- **Revenue Type**: Subscription // Managed // Indirect
- **Monetization**: Cost + // Value-Based // Disruptive
- **Business Model**: Solo // Cooperative // Collaborative

### Tech
- **System Applications**: Device Management, Connectivity & Device Enablement
- **Value Added Applications**: Analytics & Dashboards, Network Services
- **Software**: Connectivity & Device Enablement
- **Hardware**: Wireline, WPAN, WLAN, WWAN, LPWAN

### Market
- **Industry Segments**: Energy, Industrial, Transportation, Retail, Commercial, Healthcare, Resources, Telecom & IT, Consumer/Professional

### User Experience
- **Context**: Identity // Location // Time
- **Interaction**: Visual // Audio // Tactile
- **User Experience**

### Relationships
- **Investors**: VCs // PE // Corporate Funds
- **Value Added Partners**: Prod Services // Integrators
- **Channel Partners**: VARs // VADs // Retailers
- **Customers**: Early Adopters // Co-Creation
- **Suppliers**: Electronics // Software // Modules
- **Operations**: Outsourced Mfg // Logistics
- **Design**: Design Firms // Incubators
- **Research**: Univ's // Consortia
- **Ecosystem**: Design Firms // Incubators

### Marketing
- **Value Added Partners**: Prof Services // Integrators
- **Channel Partners**: VARs // VADs // Retailers
- **Investors**: VCs // PE // Corporate Funds
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- **Design**: Design Firms // Incubators
- **Research**: Univ's // Consortia
- **Ecosystem**: Design Firms // Incubators
“User Experience” is the sum of our relationship with technology. It encompasses the practical—like which senses, gestures, and inputs we use to interact with our devices and surrounding environment—as well as the emotional: how the interaction makes us feel.
From the design of silicon to the end-user experience, the technologies of the IoT are driven by data. Sensors, software, and networked infrastructure collect, analyze, transmit and present data for the users and devices who need it most.
Some markets adopt new technologies faster than others, but no sector of the economy is immune to the expanding influence of the IoT. While there are similarities that apply across the board, each vertical has its own set of needs and challenges that shape the way networked technologies add value.
Integrating smart systems into business processes requires restructuring long-held assumptions about how products and services are brought to market. Collaboration between and among users, customers, developers and partners will be a minimum requirement for success.
The solutions we are describing here will have much less managerial hierarchy, command and control decisions or proprietary ownership of ideas.

These relationships will be self-organized by people who are motivated to explore and develop ideas they care deeply about.

Collaborative innovation will extend beyond ideas about new products and services to the very manner in which business is conducted.
success will increasingly go to those that effectively utilize the combined potential

Smart Systems and the Internet of Things will be built from complex interrelationships between the stack.

Integrating these layers together are myriad Interactions

A bi-directional link between digital user experiences and the physical world.

the interactions represent the convergence of users, devices, systems, data, and networks
re-thinking things and products as systems

questions to frame your smart systems opportunity

**Your Product / Service**

**INTERACTIONS**

- Connections (People, Processes, External Systems)

  What is the nature of relationships, interactions, requirements and dependencies between and among systems elements?

**BUSINESS**

- Revenue Model
- License & Delivery
- Market Delivery
- Revenue Type

  What is best path to monetization?
  Where used; via what services model?
  What channel partners are required?
  License, transactions or what?

**RELATIONSHIPS**

- Formal
- Informal

  Who are our natural allies?
  Who are we best poised with?

**USER EXPERIENCE**

- Context
- Usage
- Device
- Interaction

  What is the context “in use” for device?
  What are the expected usage needs?
  What is the device form factor?
  What is the nature of interactions?

**TECH**

- Connectivity & Device Enablement
- Network Services
- System Applications
- Value Added Applications
- Security / Data Policies

  What is the native intelligence of device and communications mode?
  How are comms services provided?
  What platform, device management and related functions provided?
  What applications and functions are required?
  How will identity mgmt, access and security work?

**MARKET**

- Sector
- Device Application

  Which industry segments and applications provide best opportunities?
  What specific use cases and apps will need to be addressed?
smart systems growth models and strategies
smart systems and IoT solutions are comprised of complex solutions development and delivery chains

often, multiple parallel "upstream" technology enablers are adopted by "mid'stream" OEMs and/or services providers who, in turn, deploy solutions into "downstream" vertical end use segments

while the business models for developing and delivering core technologies are relatively stable, the rapidly evolving business and revenue models for OEMs and services providers are anything but......
core smart systems technologies will impact all end use segments

<table>
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<tr>
<th>Artificial Intelligence and Machine Learning</th>
<th>Application Development and Developer Tools</th>
<th>Distributed Data and Information Architecture</th>
<th>High-Performance Networks &amp; Infrastructure</th>
<th>Sensors &amp; Sensor Data Fusion</th>
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<td>Fusing patient data sets and AI capable of diagnosing patients</td>
<td>Telehealth and wearables applications for wellness</td>
<td>Information access and data set fusion for disease management</td>
<td>Real-time patient data and medical set fusion for disease management updates</td>
<td>Medical staff and critical asset tracking &amp; monitoring</td>
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<td>Automation of driverless trucking fleets</td>
<td>Ticketing analytics for demand and asset tracking/ scheduling</td>
<td>Internal vehicle information access coordinated with urban systems</td>
<td>Transport systems schedule and resources to fit demand cycles</td>
<td>Fleet tracking and road condition monitoring</td>
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<td>Timeline to completion and sensing faults during production</td>
<td>Predictive maintenance and workflow applications</td>
<td>Analytics on production and individual machines improve efficiencies</td>
<td>Syncing global operations for collaboration and efficient management</td>
<td>Remote machine maintenance, health and diagnostics</td>
</tr>
<tr>
<td>Ability to balance grids, manage demand and provide services</td>
<td>Renewable energy production trends and predictions</td>
<td>Analytics on processes and systems for equipment optimization</td>
<td>Power distribution, automation and control</td>
<td>Substation monitoring and process monitoring</td>
</tr>
<tr>
<td>Ability to optimize energy requirements and resource usage</td>
<td>Building systems that leverage data across lighting, HVAC, alarms, fire detection</td>
<td>Cross-leveraging data from various building and facility sources</td>
<td>Building owners &amp; operators are able to share data across facility</td>
<td>Integrated mechanical and energy sensors for multi-use</td>
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as users and customers have become more familiar with digital and IoT capabilities, they are realizing these technology innovations will push the boundaries of how products, systems and equipment are used and managed within their operations which, in turn, has increased pressure on machine builders and equipment manufacturers to embrace these capabilities. End customers in factories, hospitals, buildings and more are coming to see how these technologies work together in new and novel ways to solve operational and business problems. As a result, specification and adoption of digital and IoT enabled equipment and systems is beginning to shift towards a “shared” set of roles between end customers and their OEMs.
OEMs are uniquely positioned to capture smart systems values

If enabled with the right tools, OEMs can help disseminate these solutions to end customers due to their application expertise and existing relationships.

End customers want to adopt smart services solutions, but are wary of working with tech suppliers who may not have industry expertise—OEMs can fill this role.

End User Specification and Buying Influencers

Core Enabling Technologies

Provide horizontal technologies and tools that must be contextualized for specific industries and customers.
equipment, systems and support is a changing environment

industrial services are increasingly complex and technology enabled to allow coordination and collaboration…

- Growth of higher value engineered / technical services will outpace growth of basic maintenance / repair and installation services
- Growth of professional technical services is driven by customer needs for planning, designing, building, and managing complex, systems
- Shift to open systems will continue to drive increasing demand for multivendor services & support
- Systems integration & support services are offered to satisfy customer need for “knitting” together systems
- Customers will emphasize service providers’ ability to manage their environments rather than just simply service products from different suppliers
- Managed, remote services and support expected to grow considerably
- Continued growth of ‘selective outsourcing’ of non-core or peripheral activities following intense period of downsizing
- Future trend toward “managed” services – SaaS, PaaS and IaaS
- Rapid future growth of asset management services is expected: HW / SW inventory, SW licenses, contracts (lease & maintenance)
customers expect suppliers to improve business outcomes

as automation and production systems become more complex, customers are looking to suppliers to provide broader services scope and are increasingly reducing the number of strategic suppliers they work with.

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<tr>
<th>Performance-Driven Customers</th>
<th>Best-In-Class Control/Systems</th>
<th>Design / deploy unique motion and drive control solutions to achieve best-in-class optimization of process, support and non-process operational assets.</th>
</tr>
</thead>
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<td></td>
<td>Program-Management</td>
<td>Global program / project management services designed to maximize effective implementation of systems, delivering a consistent, quality-based program.</td>
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<td></td>
<td>Measurement &amp; Verification</td>
<td>Monitoring &amp; measurement of specific process, process support and non-process systems variables that improve system performance.</td>
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<td>Systems-Design &amp; Development- Services</td>
<td>Asset Analysis</td>
<td>Collect and analyze information to identify optimization opportunities for process and systems analyzed independently and together as interdependent systems.</td>
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<td></td>
<td>Asset-Benchmarking</td>
<td>Benchmark key performance data for systems performance. Key areas to assess include process, process-support, and process and equipment assets.</td>
</tr>
<tr>
<td>Systems-Management &amp; Optimization Services</td>
<td>Safety &amp; Compliance-Services</td>
<td>Provide solutions that allow customers to manage safety, including integration of new regulations and ongoing testing, certification and verification support.</td>
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<td>Predictive-Maintenance</td>
<td>Provide predictive maintenance and condition-based monitoring for critical assets -- current health, warning status, recommended maintenance actions.</td>
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<td>Reliability-Centered-Maintenance</td>
<td>Optimize maintenance strategies for equipment criticality and failure -- preventive, predictive, pro-active approaches -- optimizing cost and uptime.</td>
</tr>
<tr>
<td>Field-Service &amp; Support</td>
<td>Parts &amp; Parts Management</td>
<td>Spare parts location, availability, rapid delivery and response time. Additional value added requirements include logistics services, repair &amp; re-manufacturing.</td>
</tr>
<tr>
<td></td>
<td>Field Maintenance &amp; Repair Services</td>
<td>Optimize maintenance for repair, upgrades and support, including field engineer and technical support for trouble shooting and services enhancements.</td>
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</table>

- Control systems
- Auxiliary equipment & systems
- Support systems
- Planning/project management
- Contract risk management
- Quality / cost management
- Equipment uptime
- Resource management
- Energy utilization
- Cost per unit of production
- Cost per square footage
- Level of technology
- Safety and performance criteria
- Validation assistance
- Waste monitoring
- Predictive maintenance plans
- Equipment health profiles
- Benchmark to standards
- Right mix of advanced services
- Maintenance master plan
- Lowest cost reliability
- Safety and performance criteria
- Validation assistance
- Waste monitoring
- Right mix of advanced services
- Maintenance master plan
- Lowest cost reliability
- Field service
- Warranty services
- Maintenance planning
Customers need better & more integrated maintenance solutions

By its nature, maintenance is an ad-hoc event. It’s reliant on triggering events that by themselves are relatively straightforward. The complexity of the event and the nature of the work are primary determining factors when deciding how to adopt these technologies, and what business models to implement within them.

**Preventative and Planned**

*Scenario:* Test and measurement is part of their ongoing job duties and regular business operations.

**Corrective and Ad Hoc**

*Scenario:* Data from sensors triggers a notification, alerting facilities manager to take a measurement.

*Scenario:* While completing an unassociated task, the Tech decided to test a machine in the factory (*I was simply passing by*)

*Scenario:* A major piece of machinery has broken down so frontline workers notify the maintenance tech so he can fix it
embedding intelligence and software into products and systems creates new values and services opportunities across the value chain, driving competitive differentiation for products and services.

**Manufacturing Value Chain & Smart Services**

- **Design & Engineer**
- **Build & Integrate**
- **Sell**
- **Operate**
- **Maintain**

**New Sources of Value**

**Product Requirements**
Apply rich new data on how products are used by customers in next generation product designs.

**Pre-Sales Insights**
Understand installed device states – end of support; end of life, etc. to drive more personalized account management, outreach and sales tactics.

**Supply & Distribution Chain**
Track products throughout supply and distribution chains to monitor detours, delivery, compliance, and more.

**Remote Support Services**
Design for [remote] Servicing: diagnostics and preventive and predictive maintenance are conducted remotely to assist field technicians and support resources automatically.

**Asset Tracking**
Efficiently utilize & maintain expensive assets by monitoring status, health, configuration and location.
smart systems is enabling a new range of strategic services for OEMs
new core data services will be a core enabler of new strategic services
OEM current state is one of confusion and excitement

many OEMs provide basic customer support services, but OEMs face open questions in expanding smart systems and services to provide new business values for customers

Challenges

What does service & support mean for me? How will definitions of service & support change in the future?

How do we create valuable services that will incentivize customers to adopt these new solutions?

How should we frame the resistance towards data ownership and security?

What services should be prioritized in development for customers?

How will the future market for services evolve? What steps must we take to support customers?
diverse challenges hindering digital and IoT adoption

although challenges vary among OEMs, the issues fall into the general categories of technology, business and customers

- **Lack of Consensus & Leadership Support**
  Developing a shared understanding of digital and gaining top level support

- **Clear Strategy To Start With...**
  Developing a clear strategy to engage internal support and quickly gain customer adoption by generating tangible value; knowing what to do and how to do it

- **Aligning the Business to Support Services**
  Moving from decades-old cultures resistant to change; becoming a service-driven organization, both structurally and culturally

- **Planning for the Future**
  Understanding and being flexible in technology and solution development today to be prepared for future technology developments

- **Managing Complex Data**
  Collecting, transforming and integrating data from complex machines and processes to enable new application values

- **Data Ownership & Security**
  Customers are increasingly aware of the value and importance of their data, and are concerned about the security of their IP

- **Poor User Experience**
  Industrial suppliers typically do not consider or emphasize user experience in the development of smart systems and services, resulting in diminished value and use of these systems

- **New Business and Revenue Models**

- **New modes of interaction**

- **New work styles and processes**

- **Customer**

- **Technology**

- **Business**

- **Recruiting The Right Talent**
  Finding and hiring leaders and evangelists that can help drive the development and diffusion of digital throughout the company

- **Determining Organization & Relationships**
  Walling off digital initiatives and operating independently from the mothership to drive speed and freedom has advantages, but can also just deprive new ventures of investment, capabilities and resources

- **Finding your Place in the Ecosystem**
  Finding and engaging the right partners to help fill capability gaps and add value to smart solutions, while not creating tension with current partners, channels or customers

- **Fragmented Customer Requirements**
  While equipment may be easy to customize or configure to specific customer scenarios, doing the same for software and services is difficult
OEMs will need to design and develop new business and operating models.
new business models are progressive; open collaboration drives innovation
new business models require new selling skills and channel partners and new go-to-market designs ....
new business models also require new monetization and new revenue models
digital and IoT requires different modes of strategy development

- How do we address systemic issues with our organizations ability to fully address the new opportunity?
- Does our go-to-market system design align well with the opportunity and market?
- Are our products, systems or services correctly spec’d and configured?
- Which value elements should we develop, which obtain by partnering and which by sourcing?
- What formal and informal relationships among allies might exist in the future?
- Which trends, forces and disruptions likely will shape the future competitive environment?
- Which players, events and technologies should we care about?
- Are there new combinations of technologies, products, services and partners that can drive sustained differentiation?
- Does our go-to-market system design align well with the opportunity and market?
- Which value elements will increase and extend the value to the customer of our core offerings?
- Are our products, systems or services correctly spec’d and configured?
new growth and corporate venture development has been challenging for OEMs
OEMs have dominantly relied on acquisitions to drive top line growth
OEMs need to be focused and deliberate in their choice of innovation modes...

**Cooperative Digital "Enabler"**
- Description: Leadership enhances value of synergy between teams and/or units -- the whole is worth more than the some of its parts
- Leadership fosters and encourages interactions through vision development, decision-making processes & structures, policies & guidelines, relationships, or teams/staff
- Synergistic efforts are often cumbersome, inappropriate, or ineffective (benefits of synergistic relationships are often overestimated)

**Distinctive Digital "Accelerator" Skills**
- Description: Leadership creates value by developing a range of distinct digital skills, critical enablers, functions, programs, and services
- Leadership provides investment and the means to drive expertise-based services and architectural enablers for BUs. The best companies align unique skills with BUs and needs
- Leadership provides resources but is not aggressive enough about setting vision, goals and criticality of initiatives

**Focused “Builder” of Digital Ventures**
- Description: Leadership enhances ability to stage and launch new digital business ventures, JVs and collaborative customer innovation
- Leadership sets vision, actively supports and directly influences digital strategies and performance in BUs – could include new venture development, support for JVs and investments in infrastructure
- Leadership is less familiar with each business than unit leaders and can press for wrong targets, misallocate resources, or adopt inappropriate strategies

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**Leadership Role**

**Active**
- Synergistic efforts are often cumbersome, inappropriate, or ineffective (benefits of synergistic relationships are often overestimated)
- Leadership provides resources but is not aggressive enough about setting vision, goals and criticality of initiatives

**Passive**
- Synergistic efforts are often cumbersome, inappropriate, or ineffective (benefits of synergistic relationships are often overestimated)
- Leadership provides resources but is not aggressive enough about setting vision, goals and criticality of initiatives
we believe OEMs need to broaden their options for new growth and innovation
leading OEMs are beginning to shift to multi-modal growth strategies

**Digital “Enabler”**
Act as an “enabler” of new digital and IoT technologies and tools
Develop new business and revenue models
Define reference architecture and development tools
Collaborate with BUs to drive new initiatives
Develop and drive new skills into BUs

**Digital Growth “Accelerator”**
Take more direct control of projects and initiatives in emergent arenas not well addressed by operating BUs
Discover and develop new adjacent business opportunities to existing core businesses
Explore M&A and investment opportunities to accelerate re-positioning and transition to new growth opportunities
Coordinate and collaborate with diverse external organizations to drive new learning, JVs and related strategic business development

**“Builder” of New Ventures**
Become central coordinator and vehicle for establishing and growing new Smart Systems growth ventures
Promising spin-offs from BUs
External partnerships, JVs and ventures
External investors

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Strategic Alliance To Drive Industrial Ethernet technology from Cisco to Rockwell and market access via Rockwell channel for Cisco
Creation of GE Software to converge internal software developments to single platform – equity investment in Pivotal software to speed new platform to market
Reverse merger and acquisition to create new software business unit to drive the unique skills required in industrial software business
OEM growth strategy models and roles

We believe there is a new generation of OEM players that are addressing the need to create new growth modes and growth vehicles. The various approaches to creating new customer value can be grouped into a set of growth models and strategies.

**“Designer”**
Designs unique organizational structures, relationships, and tools to create extraordinary value with digital opportunities.

**“Constructor”**
Acquires to attain new skills &/or businesses (e.g., software); builds new business “platforms” to address growth opportunities.

**“Grower”**
Has competence to organically grow; deliberately nurtures new skills without losing focus or competitive edge; adept at ecosystem development.

**“Planner”**
Charts the company’s future course, fostering opportunities that mark a big shift from the company’s existing businesses (i.e., digital).

**“Operator”**
Aggressively and deliberately focus on the management of internal efficiencies and skills; digital focus is often on driving new efficiencies and services.

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**Digital and Smart Systems Development Mode**

A company will typically adopt this mode when it sees a growth opportunity where existing structures or business models are not well aligned with the new opportunity—examples include clever structuring of combinations of acquisitions, creating internal ventures as separate businesses &/or “spinning-out” new companies to create an innovative culture.

Many companies acquire firms but often these moves are stop-gap measures; in certain cases, a company sees a growth opportunity that cannot be prosecuted by internal growth in the required time frame, or lack the skills. For these, buying becomes a specialization—typically building a new line of business (platform).

Some companies have skills and technology to develop new organic growth opportunities and make a special competence of evolving an organization that can nurture and accommodate the creation and resulting businesses without loss of focus. Special attention focused on developing unique organic growth capabilities.

Leadership takes an active role in charting the company’s future course fostering those opportunities that shift from the OEM’s existing business mix. These often occur in adjacencies or in unexplored apps or technologies. Often these players will create distinct new organization structures to grow new capability.

Operators aggressively manage operational efficiencies such as manufacturing, R&D, sales, M&A, or related business processes based on corporate skill sets. Often, corporate maximizes management expertise and impact by intentionally managing similar business models.

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**Illustrative Examples**

- **“Designer”**
  - Acuity
  - Xylem
  - GE **
  - Bosch

- **“Constructor”**
  - Roper
  - Fortive-Fluke **
  - Schneider Electric
  - Danaher **

- **“Grower”**
  - Rockwell Automation
  - 3M
  - National Instruments

- **“Planner”**
  - ABB
  - Fortive **
  - GE **

- **“Operator”**
  - GE **
  - Emerson
  - Danaher **
  - Honeywell **
  - Eaton
several OEMs are attempting to embrace smart systems and IoT platforms
understanding new business and operating models as well as organizational development levers will be critical to driving new digital growth
OEMs need new ways to interact to create new growth strategies

Most knowledge comes from human experience and expertise. Today, however, knowledge and expertise largely resides in functional silos and systems dispersed across organizations. Acting singularly, functional organizations are constrained by the resources under their control. Legacy processes and habits inhibit any natural ability to communicate and work together to solve big problems or create new solutions.

- Defining a digital and IoT vision and strategy based on understanding new and novel requirements for manufacturing and customers
- Development and acceleration for new smart systems, services and solutions
- Supported by new internal processes, skills and roles required to adopt new tech and capabilities
- Supported by building and sustaining partner and ecosystem values
smart systems design and development process
Smart systems design is a new discipline that lies between the fault lines of existing disciplines. Today, with the emergence of connected products and information-based services, even more complexity has arisen in the design of systems and services as well as in the core of the product. Because networks add yet more complexity to the process and because just about everything will get connected, we strongly believe this environment requires combinations of several disciplines and methods in order to fully address the nature of smart connected business opportunities.

Recognizing the need for new methods and processes is a minimum requirement...

Design, as well as strategy, is concerned with creating values and making them visible, not to mention profitable. Business strategy and design today need to extend to the experience that customers will have with connected products, services, spaces or a mix of these and, therefore must integrate the processes and systems that are behind these experiences with decisions related to both design and strategy.

The convergence of design with strategy and related innovation processes will inevitably lead to a new integrated set of processes, methods and disciplines -- the advent of what we are calling Smart Systems Design.
we need a radically new frame of reference...that leverages the convergence of design, strategy and innovation processes

How can we better understand customer experience through the user’s eyes and through the creativity of multiple parallel participants?

How can we drive empathy, participation and motivation? How can we put human sensibilities and behaviors at the center of the solution?

How can an organization turn its workers, partners, and customers into believers and contributors? How can we solve really big problems or create unique new offerings?

How can we better understand the value of data and information coming from products, systems and people?

How can we deliberately organize to anticipate technologies that are disruptive or sustaining in nature...innovation that creates new (and unexpected) opportunities?

How can we move beyond a conventional view of technology where all tangible and intangible skills and assets including people, brands, technologies, relationships, and processes are fully leveraged?

How can we better understand the value of data and information coming from products, systems and people?
to conceive and design smart systems, organizations need an integrated approach...

SYSTEMS DESIGN
We believe design needs to transcend discrete product or service innovation. Assuming that the role of design is only about making existing products or services more attractive no longer works. Business designers need to creatively imagine fully developed systems and whole marketplaces. Companies need to envision the design role as one that can address product, service and business systems.

RELATIONSHIPS
Problem solving for new Smart Systems opportunities must address tough questions: how can an organization turns its workers, partners, and customers into believers and contributors? How can we make changes that can impact multiple functions and organizations and ultimately solve really big problems or create unique new offerings? We are firm believers in the human element - the community as a manifestation of the system and visa versa. Behaviors of users, customers, teams, functions, leadership, all need to considered. Understanding empathy, participation, motivations - putting human sensibilities and behaviors at the center of the solution is key.

SKILLS
Companies need to move beyond a conventional orientation to technology skills and knowledge. Organizations need a disciplined process focused on optimizing all tangible and intangible skills and assets including people and competencies, brands and positioning, technologies and intellectual property, alliances, relationships and business and operational processes.
business model design and development needs to be truly creative .........

### SMART SYSTEMS and SERVICES OFFERINGS
Organizing customer and user innovations

<table>
<thead>
<tr>
<th>Unique / Distinct Features, Functions and Capabilities</th>
<th>Augmenting Capabilities and Services / Support</th>
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</thead>
<tbody>
<tr>
<td>Customization</td>
<td>Integrated Offerings</td>
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<tr>
<td>Modularity</td>
<td>Direct Add-ons</td>
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<td>Manageability</td>
<td>Third Party Extensions</td>
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<tr>
<td>Best-in-Class Performance</td>
<td>Bundled Functions</td>
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<tr>
<td>Environmental / Sustainability</td>
<td>Incentive Programs</td>
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<td>Employee Incentives (e.g. Incentive)</td>
<td>Guarantee</td>
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<td>Productivity and Efficiency</td>
<td>Financial Incentives (e.g. Incentive)</td>
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<td>Resource Utilization</td>
<td>Loyalty Programs</td>
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<td>Content Elements</td>
<td>Personalization</td>
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<td>Safety</td>
<td>Self-Service</td>
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<td>Service Supplements / Ramps</td>
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<td>User Communities</td>
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<td>Support Systems</td>
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### BUSINESS ORGANIZATION and DESIGN
Configuring core skills and relationships within an OEM are the basis for new innovation models

<table>
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<tr>
<th>Monetization and Ways To Make Money</th>
<th>Value Creating Networks and Relationships</th>
<th>Alignment, Leverage and Development of Resources</th>
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<tbody>
<tr>
<td>Subscriptions</td>
<td>Intellectual Property</td>
<td>Leadership Style / Company Culture</td>
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<td>Flexible Pricing</td>
<td>Knowledge Management</td>
<td>Decentralized</td>
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<td>Freemium</td>
<td>Organizational Design</td>
<td>Incentive Systems</td>
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<td>Installment</td>
<td>IT Sys and Integration</td>
<td>Team Structures</td>
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<td>Licensing</td>
<td>Lean / Flex Production</td>
<td>Process Automation</td>
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<td>Membership</td>
<td>Logistics Systems</td>
<td>Process Efficiency</td>
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### Customer Engagement
Structuring the elements to enable unique user and customer interactions

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### USER and CUSTOMER EXPERIENCE
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### Which value elements in which segments will give us a sustainable advantage?
- What characteristics should we use to describe our user and customer’s needs, how should we segment our world?
- Which actual or potential segments are most attractive, which opportunities should we focus on?
- Are customers measurably pleased with our offerings, do customers speak directly about their interactions with our company, does our brand reflect unique attributes?
- Are there robust partners and communities that enhance users’ experience?

### How Can We Best Use Technological & Market Uncertainty To Our Advantage?
- Do our systems and solutions possess unique features and functionality that captivate customers?
- Does the company deliver its offerings to customers and users in ways that challenge industry norms?
- Do diverse partners help sell or deliver the company’s offerings?
our approach is simple: help clients create and capture value by combining accurate data discovery and analysis with strategy development and creative systems-thinking

We plan and build new businesses and growth opportunities by leveraging deep analysis, thoughtful interactions and unique systems and business model design and development tools

Harbor Research Inc. has nearly 30 years of experience supporting new business creation and development. We continually strive to generate deep insight into what drives value creation and competitive advantage in our clients’ businesses and the economy as a whole. Harbor helps companies outperform their peers and rivals by instilling innovation into the core of their business development processes. We help client’s foster creative thinking, facilitate diverse perspectives and unconventional insight and, most importantly, we directly participate. The result is increased certainty around vital new business decisions.

We work collaboratively to help clients come to confident answers today while also building their capabilities for the future - we are passionate about creating lasting impact. We believe that innovation can be driven from systematic methods and that enduring capabilities and processes can be built to reduce the risks associated with new growth ventures. Every solution we propose is informed by a combination of real world experience and unique processes and methods that are tailored to the dynamics of your organization.

To discover, design and develop innovative smart systems, organizations must consider all the elements involved and the context they fit into. The benefits that will flow from the recognition that traditional strategy and product development protocols will not meet the needs of a connected business are nearly infinite.